

DAUPHIN ISLAND  
WATER & SEWER AUTHORITY  
Dauphin Island, Alabama



Contract Documents  
For The

**ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY**  
ADCNR GRANT #S1P08-ABMS

CONSISTING OF:

BIDDING REQUIREMENTS  
CONTRACT FORMS  
CONDITIONS OF THE CONTRACT  
SPECIFICATIONS

Prepared By:



**ARDURRA**  
COLLABORATE. INNOVATE. CREATE.



Huntsville, Alabama  
Project No. 100200.32

August, 2024

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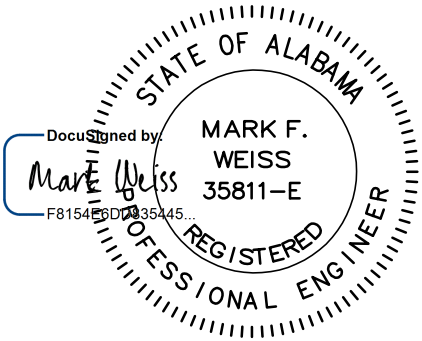
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08/02/24

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The following section(s) were prepared by Walcott Adams Verneuille Architects, Inc.:

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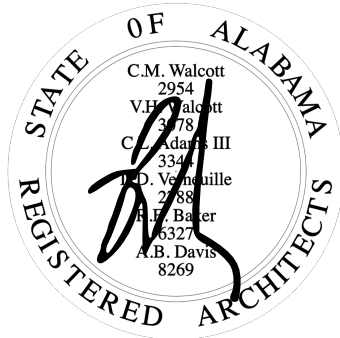
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08/02/2024

## ADVERTISEMENT FOR BIDS

Sealed Bids for the construction of the **Aloe Bay Water Quality Enhancement Wastewater Treatment Facility** will be received by **Dauphin Island Water & Sewer Authority** on or before **2:00 p.m. CDT, September 19, 2024** at the office of **Dauphin Island Water & Sewer Authority, 908 Alabama Avenue, Dauphin Island, AL 36528**, at which time said bids will be publicly opened and read.

The Project consists of the following major components:

Replacement of DIWSA's 1 MGD wastewater treatment plant including: operations building, influent pump station, two (2) wastewater process basins, two (2) secondary clarifiers, tertiary filtration systems, aeration systems, pumping systems, sludge digester, solids handling facility & screw press, UV disinfection system and chlorine contact basin.

Contract Documents may be obtained from Ardurra, 200 Clinton Avenue West, Suite 704, Huntsville, AL 35801, upon payment of **200.00** for each set. All deposits are non-refundable. Contract Documents will also be available for download from the Ardurra website at: [www.ardurra.com/biddocs](http://www.ardurra.com/biddocs) or from [www.questcdn.com](http://www.questcdn.com), eBidDoc#9284040, for a fee of \$22.00.

**A mandatory pre-bid meeting will be at the Dauphin Island Water & Sewer Authority wastewater treatment facility located at, 701 Lemoyne Avenue, Dauphin Island, AL 36528 on September 5, 2024 at 10:00 a.m. CDT.**

All questions and clarification requests must be submitted by 4:00 pm CDT September 12, 2024.

Each Bid must be submitted on the prescribed form and accompanied by security submitted on the prescribed Bid Bond form in an amount not less than five (5%) percent of the amount bid but not more than \$10,000.00.

All Contractors are required to provide certification of compliance with the E-Verify program per Alabama Act 2012-491.

For information concerning the proposed Work, contact Jim Smith, P.E., Ardurra, 200 Clinton Avenue West, Suite 704, Huntsville, AL 35801 at 256.203.9501. To obtain Plans and Specifications contact Michelle Jeffery, 256.203.9501.

The BID SCHEDULE may be examined at the following locations:

**Alabama Department of Economic and Community Affairs  
Office of Minority Business Enterprise  
P. O. Box 5690/401 Adams Avenue, Suite 524  
Montgomery, AL 36103-5690**

Any contract awarded under this Invitation for Bids may be paid for in whole or in part with grant funding from the Gulf Coast Ecosystem Restoration Council ("RESTORE Council", also "Council") and the Alabama Department of Conservation and Natural Resources ("ADCNR") under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act). Any contract resulting from this solicitation will be subject to the terms and conditions of the funding award, the RESTORE Council Financial Assistance Standard Terms and Conditions, including any Special Award Conditions, the Standard Sub-Award Terms and Conditions,



the RESTORE Act, 33 U. S. C. 1321(t) et seq., the U.S. Department of the Treasury Regulations 31 C. F. R. § 34 et seq., including 31 C. F. R. §§ 34, Subpart F, all applicable terms and conditions in 2 C. F. R. Part 200 of the Office of Management and Budget (“OMB”) Uniform Guidance for Grants and Cooperative Agreements, as amended, (including Appendix II to Part 200), and all other OMB circulars, executive orders or other federal laws or regulations, as applicable. Notwithstanding the above, neither ADCNR nor the RESTORE Council, or any of their agents, representatives, or employees, is or will be a party to this Invitation for Bids or any resulting contract. Further, any contractor awarded a contract under this Invitation for Bids shall not be deemed to be an agent, representative, employee or servant of ADCNR or the RESTORE Council.

Minority and women’s business enterprises are solicited to bid on this contract as prime contractors and are encouraged to make inquiries regarding potential subcontracting opportunities and equipment, material and/or supply needs.

All bidders must make positive efforts to use small and minority owned business and women business enterprises.

## INSTRUCTIONS TO BIDDERS

### 1. BID REQUIREMENTS

#### A. SUBMISSION OF PROPOSALS

Each Bid must be submitted in a sealed envelope, addressed to **Dauphin Island Water & Sewer Authority, 908 Alabama Avenue, Dauphin Island, AL 36528**. Each sealed envelope should bear on the outside the Bidder's name, address, and license number and expiration date, license classification of the Contractor bidding the Project, and the name of the Project "Aloe Bay Water Quality Enhancement Wastewater Treatment Facility" for which the Bid is submitted. Any Bid envelope which contains a listing of more than one (1) Contractor in each license classification will not be accepted. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed to the Owner at above address. Any Bid received after the time and date specified shall not be considered.

#### B. PREPARATION OF PROPOSALS

All Bids must be made on the required Bid form. All blank spaces for Bid prices must be filled in, in ink or typewritten, and the Bid form must be fully completed and executed when submitted. Only one (1) copy of the Bid form is required. Any discrepancy in calculation of pay item cost will be resolved by use of the unit cost.

#### C. ACCEPTANCE OF PROPOSALS

The Owner may waive any informalities or minor defects or reject any and all Bids. Any Bid may be withdrawn prior to the above scheduled time for the opening of Bids or authorized postponement thereof. No Bidder may withdraw a Bid within ninety (90) days after the actual date of the opening thereof. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Owner and the Bidder. A conditional or qualified Bid will not be accepted.

#### D. BIDDER'S UNDERSTANDING

Bidders must satisfy themselves of the accuracy of the estimated quantities in the Bid Schedule by examination of the site and a review of the Drawings and Specifications including Addenda. After Bids have been submitted, the Bidder shall not assert that there was a misunderstanding concerning the quantities of Work or of the nature of the Work to be done.

The Owner shall provide to Bidders prior to Bidding, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

Each Bidder is responsible for inspecting the site and for reading and being thoroughly familiar with the Contract Documents. The failure or omission of any Bidder to do any of the foregoing shall in no way relieve any Bidder from any obligation in respect to its Bid.

The Contract Documents contain the provisions required for the construction of the Project. Information obtained from an officer, agent, or employee of the Owner or any other person shall not affect the risks or obligations assumed by the Contractor or relieve the Contractor from fulfilling any of the conditions of the Contract.

Information derived from inspection of logs of test borings, or pits, Geotechnical reports, topographic maps, or from Drawings showing location of utilities and structures will not in any way relieve the Contractor from any risk, or from properly examining the site and making such additional investigations as he may elect, or from properly fulfilling all the terms in the Contract Documents.

Prospective Bidders shall contact Vail Feemster, Manager to schedule inspection trips to the project site.

The Engineer is Ardurra. The Engineer's address is 200 Clinton Avenue West, Suite 704, Huntsville, AL 35801. All questions regarding interpretations of the Contract Documents should be directed to Mr. Jim Smith, P. E. at 256.203.9501, [jsmith@ardurra.com](mailto:jsmith@ardurra.com).

#### E. BID SECURITY

Each Bid must be accompanied by cash, a certified check, a cashier's check drawn on a bank in good standing, or a bid bond payable to the Owner for five (5%) percent of the amount bid. As soon as the Bid prices have been tabulated, the Owner will return the Bid Security of all except the three (3) lowest responsible Bidders. When the Agreement is executed the Bid Security of the two (2) remaining unsuccessful Bidders will be returned. The Bid Security of the successful Bidder will be retained until the Payment Bond and Performance Bond, if applicable, have been executed and approved, after which it will be returned. Bid security shall be valid for 90 days post bid date.

#### F. TYPE OF BID

The type of Bid for the Work specified in these Contract Documents will be lump sum as set forth in the Proposal. A single price based upon a combination of lump sum and unit price shall be submitted as the base bid in the appropriate spaces set forth in the Proposal. The total amount to be paid to the Contractor shall be the amount of the base bid as adjusted for additions or deletions resulting from Owner authorized changes in the Project and Owner selected deductive and additive alternates.

Where the Proposal requires the Bidder to submit prices for Owner selected deductive and additive alternates, the prices shall be submitted in the appropriate places as set forth in the Proposal. The Owner is not obligated to select any of the alternates so proposed.

#### G. FUNDING

This project is funded whole or in part by RESTORE Act Funding and that any contract awarded will be subject to all applicable federal statutes, regulations, executive orders, OMB circulars, the Standard Terms and Conditions, Program-Specific Conditions of this federal

financial assistance award ("Award"), as applicable, in addition to the certificate and assurances required at the time of application.

## **2. AWARD OF CONTRACT**

### **A. BASIS OF AWARD**

Work for this Project will be let under one (1) Contract to the lowest responsive, responsible bidder meeting the bidding requirements. The Owner reserves the following rights: (1) to reject all bids where the Owner deems rejection to be in its best interest; (2) to reject any bid that is not in compliance with the Contract Documents; (3) to waive any informalities and irregularities in said bids; and (4) to accept any combination of sub-totals within any schedule which is determined to be in the Owner's best interest; and (5) to postpone award of the Contract for a period of time, which, however, shall not extend beyond ninety (90) days from the bid opening, unless extended by mutual agreement by the Owner and low responsive, responsible Bidder.

### **B. DETERMINATION OF LOW BIDDER**

Award will be made on the basis of the lowest actual bid amount, which is defined as the base bid less any deductions for "allowed" deductive alternates, plus any additions for "allowed" additive alternates listed in the Proposal and submitted by a responsive and responsible qualified Bidder. Any discrepancy in calculation of pay item cost will be resolved by use of the unit cost.

### **C. QUALIFICATIONS OF BIDDER**

The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the Work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Agreement and to complete the Work contemplated therein.

Bidders are required to register with SAM.gov and provide UEI Number.

The low Bidder shall supply the names and addresses of major material suppliers and Subcontractors when required to do so by the Owner.

MINORITY BUSINESS ENTERPRISE AND WOMEN'S BUSINESS ENTERPRISE (MBE/WBE) REQUIREMENTS: Documentation of compliance with the MBE/WBE requirements is a matter of contractor responsibility. When subcontracting, the contractor must submit documentation of good faith efforts to meet the project's MBE/WBE requirements before contracted work can commence; MBE/WBE requirements and required documentation are outlined in ADCNR Required Attachments Section of the Contract Documents. Failure on the part of the contractor to submit proper documentation may cause the Owner to not execute or to terminate the contract.

DAVIS BACON AND RELATED ACTS: The Davis-Bacon Act and Related Acts are applicable to construction activities under this Contract. The prime contractor, all sub-contractors, and all lower-tier sub-contractors must comply with the Davis-Bacon Act (40 USC. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). The Contract Work Hours and Safety Standards Act (29 CFR §5.5(b)) applies to this contract and the Copeland "Anti-Kickback" Act (40 USC. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States") also applies to all work performed.

Detailed information regarding compliance with the aforementioned labor standards is included in the ADCNR Required Attachments Section of the Contract Documents.

See Section "Labor Standards Supplementary Conditions to the Construction Contract" of the Contract Documents for the applicable prevailing wage determination issued by the Department of Labor. The decision to award a contract or subcontract is conditioned upon the acceptance of this wage determination, which may be superseded by addendum.

### **3. EXECUTION OF THE CONTRACT**

#### **A. CONTRACT BONDS**

A Performance Bond and Payment Bond in the amount of one-hundred (100%) percent of the Contract Amount with a corporate surety approved by the Owner, will be required for the faithful performance of the Contract.

Attorneys-in-fact who sign Bid Bond, or Performance Bond and/or Payment Bond must file with each Bond a certified and effective dated copy of their power of attorney.

#### **B. INSURANCE**

Insurance requirements shall be as specified in Part 3 of the Contract Documents, CONDITIONS OF THE CONTRACT. The successful Bidder shall file with the Owner at the time of delivery of the signed Contract, the insurer's certificate(s) of insurance for each insurance company providing insurance. All evidence of insurance shall be countersigned by a licensed agent residing and engaged in doing business in the State of Alabama. The insurer shall be licensed and authorized to conduct business in the State of Alabama.

#### **C. AGREEMENT**

The successful Bidder will be required to execute the Agreement and obtain the Performance Bond and insurance within ten (10) calendar days from the date when Notice of Award is delivered to the Bidder. The Notice of Award shall be accompanied by the necessary Agreement, Bond Forms and evidence of insurance. In case of failure of the Bidder to execute

the Agreement, the Owner may consider the Bidder in default, in which case the Bid Security accompanying the proposal shall become the property of the Owner.

Upon receipt of acceptable Bonds, Insurance and Agreement signed by the party to whom the Agreement was awarded, Owner shall sign the Agreement and return to such party an executed duplicate of the Agreement.

D. NOTICE TO PROCEED

A written Notice to proceed shall be issued upon execution of the Agreement by the Owner.

**4. CONTRACT DOCUMENTS**

A. FORMAT

The Contract Documents governing the Work proposed herein are divided into parts, divisions, and sections for convenient organization and reference. Generally, there has been no attempt to divide the Specification Sections into Work performed by the various building trades, Work by separate Subcontractors, or Work required for separate facilities in the Project.

The separate Sections contained within these Contract Documents are intended to be mutually cooperative and to provide all details reasonably required for the execution of the proposed Work.

B. OTHER

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout.

## PROPOSAL

Proposal of \_\_\_\_\_ (hereinafter called Bidder"), organized and existing under the laws of the State of \_\_\_\_\_ doing business as \* \_\_\_\_\_, (Individual, Partnership, Corporation)  
**Dauphin Island Water & Sewer Authority**, (hereinafter called "Owner").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all WORK for the construction of the **Aloe Bay Water Quality Enhancement Wastewater Treatment Facility** in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to its own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence the WORK to be performed under this Agreement within seven (7) days from the Agreement start date specified in the Owner's Notice to Proceed, shall substantially complete the Work in all respects within 630 days from the date specified in the Owner's Notice to Proceed and to fully complete the Work, in all respects, within 30 days after substantial completion.

It is mutually agreed between the parties hereto that time is of the essence, and in the event the Work is not substantially completed within the time herein specified it is agreed that the Contractor shall pay liquidated damages in the amount of \$1,500.00 per day for each calendar day of delay to the Owner until the Work is substantially completed, as determined by the project engineer. The Contractor agrees that the amount of liquidated damages fairly and accurately represents the actual damages which the Owner will have sustained per day by reason of the Contractor's failure to substantially complete the Work within the time specified herein. Liquidated damages is not a penalty but is instead intended to compensate the Owner for costs incurred as a result of the Contractor's delay. The Contractor further agrees that this is a bargained for and essential provision of the agreement and that the Contractor freely and voluntarily submitted a bid for the Work.

Bidder further agrees to compensate the OWNER at the rate of \$130.00 per hour for resident observation costs that are a result of:

1. Work performed that requires resident observation services at times other than those considered Normal Work Time as described in the GENERAL CONDITIONS of the contract.

**and/or**

2. Work performed that requires resident observation services after the specified number of days, previously listed in this PROPOSAL, in order to complete the contract work.

BIDDER hereby acknowledges that he has received Addenda Nos. \_\_\_\_\_,  
\_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

BIDDER agrees to perform all the Work described in the CONTRACT DOCUMENTS for the unit prices or lump sum indicated in the Bid Schedule.



## BID SCHEDULE

NOTE: BIDS shall include sales tax, if applicable and all other applicable taxes and fees.

### BASE BID

ITEM NO.	QUANTITY AND UNIT	DESCRIPTION	UNIT PRICE	TOTAL PRICE
1.	1 LS	Mobilization/ Bonds (<5%)	\$ _____	\$ _____
2.	1 LS	Wastewater Treatment Facility complete including but not limited to influent pump station, odor control, north & south process basins, aeration system, pumping systems, headworks, operations building, chlorine contact basin, UV system, tertiary filter, drying bed, digester basin, civil site work, yard piping, electrical systems, plumbing & HVAC systems, temporary systems, landscaping and decommission & demolition of existing structures	\$ _____	\$ _____
3.	1 LS	I&C Integration and Programming Allowance by the Owners System Integrator	\$ 270,000	\$ _____
4.	1 LS	Office and laboratory furnishings allowance	\$ 100,000	\$ _____
5.	1 LS	Power relocation allowance	\$ 100,000	\$ _____
<b>TOTAL BASE BID</b> \$ _____				
Written: _____ DOLLARS and _____ CENTS				

### Alternate Bid Items

1.	1 LS	Dewatering and Maintenance Building PEMB complete including but not limited to: PEMB, foundation, electrical systems, plumbing & HVAC systems; demo of existing maintenance building	\$_____	\$_____
2.	1 LS	Furnish and install screw press, conveyor equipment, sludge pump, grinder, and polymer feed systems	\$_____	\$_____

### Explanation of Base Bid Items

#### **Item 1 - Mobilization and Bonds**

Includes all labor, equipment, and materials required to mobilize to the site and provide project bonding as required in the contract documents. Item 1 shall be less than 5% of the project bid and paid lump sum.

#### **Item 2 - Wastewater Treatment Facility**

Includes all labor, equipment, and materials required to provide a complete operational treatment facility as described in the contract document except for items specifically called for in the bid items below. Payment shall be lump sum based on the contractors approved schedule of values percent complete.

#### **Item 3 - I&C Integration and Programming Allowance by the Owners System Integrator**

This item provides for plant control systems programming integration by Ardurra for new facility control systems. Allowance includes PLC programming, HMI development, drone photography and control systems start-up assistance and troubleshooting. This allowance does not cover any equipment or labor for items specifically called for in the project specifications or design drawings. All control systems instrumentation, hardware, and software included with the new equipment and improvements shall be furnished by the General Contractor. Payment shall be as invoiced from Ardurra to the GC.

#### **Item No. 4 - Office and Laboratory Furnishings Allowance**

This item provides for the new control room/office/conference space furnishings as determined by DIWSA. Item may include materials and labor for the purchase and installation of office furniture, chairs, desks, tables, decorations, laboratory equipment, and glassware. Labor and materials for this item will not be performed or purchased by the General Contractor. DIWSA reserves the right to self-perform or contract with a 3rd party vendor for this work. Payment shall be lump sum as a change order adjustment to the contract.

**Item No. 5 – Power Relocation Allowance**

This item provides for the demolition and relocation of the overhead power lines. Item may include materials and labor for the purchase and installation of overhead electrical lines, any additional equipment necessary to tie in the underground electric lines, and the demolition of the existing electrical infrastructure. Labor and materials for this item will be performed and purchased by the electrical utility.

**Explanation of Alternate Bid Items****Item 1 – Dewatering and Maintenance Building**

Includes all labor, equipment, and materials required to furnish and install a pre-engineered metal building (PEMB) complete as detailed in the contract documents. Item shall include PEMB, foundation, site work, lighting, electrical, plumbing, and HVAC. Does not include the screw press dewatering and sludge conveyance systems described in Alternate Item 2. Payment shall be lump sum based on the contractors approved schedule of values percent complete.

**Item 2 – Screw Press System**

Includes all labor, equipment, and materials required to furnish and install a fully functional screw press dewatering system. This item shall include but not limited to screw press equipment, conveyor equipment, polymer dosing system, sludge pump, booster pump, plumbing connections, electrical control panels, power supply, startup and testing. Payment shall be lump sum based on the contractors approved schedule of values percent complete.

**Non Pay Items**

Items of no specific payment include but are not limited to the following:

1. No specific payment will be made for rock excavation or cushion material.
2. No specific payment will be made for common excavation and back filling.
3. No specific payment will be made for removing spoils and waste.
4. No specific payment will be made for site preparation.
5. No specific payment will be made for plugs, caps, taps, compressors, approved gages and other equipment and labor required for cleaning and testing.
6. No specific payment will be made for the removal and replacing of defective work.
7. No specific payment will be made for unauthorized work and, if directed, it shall be removed without extra compensation.
8. No specific payment will be made for clean up and maintenance of the Work during construction and the twelve (12) months after final acceptance.
9. No specific payment will be made for returning all unused pipe, fittings or other unused materials to the OWNER's warehouse at the completion of the project.
10. No specific payment will be made for repairing telephone, water, sewer, gas, etc. mains damaged or destroyed by the CONTRACTOR. These utilities shall be repaired by the owner of the damaged utility at the expense of the CONTRACTOR.

11. No specific payment will be made for repairing any property damaged by the CONTRACTOR. This includes property owned by the general public, the Town of Dauphin Island, private individuals, commissions, partnerships, LLCs and any other entity.
12. No specific payment will be made for installation of valves, tees, crosses, caps or other fittings unless specifically called out in the Pricing Format (Bid List). This includes any caps welded on to pipe, fittings or valves for the purposes of testing.

## AWARD OF THE CONTRACT

Award of the Contract will be made as stated in the **INSTRUCTIONS TO BIDDERS**. The Owner reserves the right to reject all Proposals where the Owner deems rejection to be in its best interest, or to reject any Proposal not in compliance with the Contract Documents. The Owner reserves the right to waive any informalities and irregularities in said Proposals.

All items required to complete the Work specified but not included in the Proposal shall be considered incidental to the amounts set forth in the Proposal. The total amount paid to the Contractor shall be the amount of the bid as adjusted for Owner selected additives and deductives and as adjusted for Owner authorized changes in the Project.

The Bidder declares that he has carefully examined the Contract Documents for the construction of the Project, that he has personally inspected the site, that he has satisfied himself as to the quantities involved, including materials and equipment, and conditions of Work involved, including the fact that the description of the quantities of Work and materials, as included herein, is brief and is intended only to indicate the general nature of the Work and to identify the said quantities with the detailed requirements of the Contract Documents.

The Bidder further acknowledges that he has satisfied himself as to the nature and location of the Work, the general and local conditions, particularly those bearing upon access to the site; disposal, handling and storage of materials; availability of water, electric power, and roads; and uncertainties of weather, river stages, or similar physical conditions at the site; the conformation and conditions of the ground; the character of equipment and facilities needed preliminary to and during the prosecution of the Work and all other matters which can in any way affect the Work or the cost thereof under this Contract.

Respectfully Submitted:

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Bidder

---

Date

---

Signature

---

Address

---

Title

---

City, State

Zip

---

License No.

---

Telephone

SEAL - (if BID is by a corporation)

## BID BOND

BOND NO. \_\_\_\_\_  
AMOUNT: \$ \_\_\_\_\_

STATE OF ALABAMA

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_ hereinafter called the PRINCIPAL, and \_\_\_\_\_ a corporation duly organized under the laws of the State of \_\_\_\_\_ having its principal place of business at \_\_\_\_\_ in the State of \_\_\_\_\_ and authorized to do business in the State of Alabama, as SURETY, are held and firmly bound unto the **Dauphin Island Water & Sewer Authority**, Dauphin Island, Alabama, as Owner, hereinafter called the OBLIGEE, in the sum of \_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_), for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS BOND IS SUCH THAT:

WHEREAS, the PRINCIPAL is herewith submitting his or its Bid Proposal for the construction of the **Aloe Bay Water Quality Enhancement Wastewater Treatment Facility**, said Bid Proposal, by reference thereto, being hereby made a part hereof.

NOW, THEREFORE, if the Bid Proposal submitted by the PRINCIPAL is accepted, and the Contract awarded to the PRINCIPAL, and if the PRINCIPAL shall execute the proposed Contract, shall provide all insurance required, and shall furnish such Performance Bond, and other bonds as required by the Contract Documents within the time fixed by the Documents, then this obligation shall be void. If the PRINCIPAL shall fail to execute the proposed Contract, provide all insurance required, and furnish these bonds, the SURETY hereby agrees to pay to the OBLIGEE the said sum as noted above.

Signed and sealed this \_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

(SEAL)

\_\_\_\_\_  
PRINCIPAL

By \_\_\_\_\_  
SURETY

By \_\_\_\_\_  
Attorney-In-Fact

(Attach notarized copy of Power-of-Attorney evidencing authority of Attorney-in-Fact to bind the Surety on the date of the execution of the bond.)

## AGREEMENT

THIS AGREEMENT, made and entered into on the \_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_, by and between \_\_\_\_\_ Contractor and **Dauphin Island Water & Sewer Authority** Owner:

WITNESSETH:

That the Contractor, for the consideration hereinafter fully set out, hereby agrees with the Owner as follows:

1. That the Contractor shall furnish all the materials and perform all the work for the Project entitled **Aloe Bay Water Quality Enhancement Wastewater Treatment Facility** in manner and form as provided by the following enumerated Drawings, Specifications, and Documents, which are attached hereto and made a part hereof, as if fully contained herein:

Part 1 - Bidding Requirements  
Part 2 - Contract Forms  
Part 3 - Conditions of the Contract  
Part 4 - Specifications  
Part 5 - Drawings  
Part 6 - Addenda ....., ....., ....

(The foregoing are collectively referred to as the "Contract Documents").

2. That the Contractor shall commence the Work to be performed under this Agreement within seven (7) days from the Agreement start date specified in the Owner's Notice to Proceed, shall substantially complete the Work in all respects within **630** days from the date specified in the Owner's Notice to Proceed and to fully complete the Work, in all respects, within **30** days after substantial completion.
3. It is mutually agreed between the parties hereto that time is of the essence, and in the event the Work is not substantially completed within the time herein specified it is agreed that the Contractor shall pay liquidated damages in the amount of \$ 1,500 per day for each calendar day of delay to the Owner until the Work is substantially completed, as determined by the project engineer. The Contractor agrees that the amount of liquidated damages fairly and accurately represents the actual damages which the Owner will have sustained per day by reason of the Contractor's failure to substantially complete the Work within the time specified herein. Liquidated damages is not a penalty but is instead intended to compensate the Owner for costs incurred as a result of the Contractor's delay. The Contractor further agrees that this is a bargained for and essential provision of the agreement and that the Contractor freely and voluntarily submitted a bid for the Work.



4. That the Owner hereby agrees to pay to the Contractor for the faithful performance of this Agreement, subject to additions and deductions as provided in the Contract Documents in lawful money of the United States, the amount of: \_\_\_\_\_ Dollars (\$\_\_\_\_\_) based on the lump sum amounts contained herein.
5. That upon submission by the Contractor of evidence satisfactory to the Owner that Notice of Completion requirements have been met, and that all payrolls, material bills, and other costs incurred by the Contractor in connection with the construction of the Work have been paid in full, final payment of account of this Agreement shall be made within thirty (30) days after the completion by the Contractor of all Work covered by this Agreement and the acceptance of such Work by the Owner.
6. That the Work completed herein shall be covered by a warranty as provided by the Performance Bond and as provided in the Contract Documents, effective for a period beginning upon the date of substantial completion and ending one (1) year thereafter.
7. It is further mutually agreed between the parties hereto that if, at any time after the execution of this Agreement and the Surety Bonds hereto attached for its faithful performance and payment, the Owner shall deem the Surety or Sureties upon such bond to be unsatisfactory or if, for any reason such bond ceases to be adequate to cover the performance of the Work, the Contractor shall, at its expense, within five (5) days from the receipt of notice from the Owner so to do, furnish an additional bond or bonds in such form and amount and with such Surety or Sureties as shall be satisfactory to the Owner. In such event, no further payment to the Contractor shall be deemed to be due under this Agreement until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the Owner, and if not furnished the Contractor may be terminated at the option of the Owner by giving ten (10) days written notice.
8. No payment for additional Work or extras will be made unless the same shall be duly authorized by appropriate action by the Owner in writing.
9. By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and date first above written, in four (4) counterparts, each of which shall without proof or accounting for the other counterpart be deemed an original Contract.

If Sole Proprietor or Partnership

\_\_\_\_\_  
Signature of Contractor

\_\_\_\_\_  
Title

If Corporation

(SEAL)

\_\_\_\_\_  
Name of Corporation

ATTEST:

By \_\_\_\_\_

\_\_\_\_\_  
Secretary

Title \_\_\_\_\_

ATTEST:

Owner

\_\_\_\_\_  
Secretary

By \_\_\_\_\_  
Chairman

## PERFORMANCE BOND

Bond No. \_\_\_\_\_

Amount: \$ \_\_\_\_\_

STATE OF ALABAMA

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_ of \_\_\_\_\_ hereinafter called the CONTRACTOR (Principal), and \_\_\_\_\_ a corporation duly organized and existing under and by virtue of the laws of the State of \_\_\_\_\_, hereinafter called the SURETY, and authorized to transact business within the State of Alabama, as SURETY, are held and firmly bound unto the **Dauphin Island Water & Sewer Authority**, as OWNER (Obligee), in the sum of: \_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_ ) lawful money of the United States of America, for the payment of which, well and truly be made to the OWNER, the CONTRACTOR and the SURETY bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the CONTRACTOR has executed and entered into a certain Agreement hereto attached, with the OWNER, dated \_\_\_\_\_ 20 \_\_\_\_\_, for the **Aloe Bay Water Quality Enhancement Wastewater Treatment Facility**.

NOW, THEREFORE, if the CONTRACTOR shall in all things perform all the terms and conditions of the within and foregoing Agreement as provided in the Contract Documents to be by such CONTRACTOR performed, and shall honor all claims for defective Work made within the warranty period following completion and acceptance of the Work as established in the Contract Documents and shall pay over, make good and reimburse to the OWNER, all loss or damage which the OWNER may sustain by reason of failure or default on the part of the CONTRACTOR, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

PROVIDED, HOWEVER, that the SURETY, for the value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract Documents or to the Work to be performed, thereunder, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract Documents.

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument  
this \_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

CONTRACTOR

(Seal)

By\_\_\_\_\_

Attest

\_\_\_\_\_

(Seal)

SURETY

By\_\_\_\_\_

Countersigned:

\_\_\_\_\_

Resident Agent

\_\_\_\_\_

Address

\_\_\_\_\_

(Attach notarized copy of Power-of-Attorney evidencing authority of Attorney-in-Fact to bind  
the Surety on the date of the execution of the bond.)

## PAYMENT BOND

Bond No. \_\_\_\_\_

Amount: \$ \_\_\_\_\_

STATE OF ALABAMA

KNOW ALL MEN BY THESE PRESENTS, that \_\_\_\_\_ of \_\_\_\_\_ hereinafter called the CONTRACTOR (Principal), and \_\_\_\_\_ a corporation duly organized and existing under and by virtue of the laws of the State of \_\_\_\_\_, hereinafter called the SURETY, and authorized to transact business within the State of Alabama, as SURETY, are held and firmly bound unto the **Dauphin Island Water & Sewer Authority**, as OWNER (Obligee), in the sum of \_\_\_\_\_ DOLLARS (\$ \_\_\_\_\_) lawful money of the United States of America, for the payment of which, well and truly be made to the OWNER, the CONTRACTOR and the SURETY bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

WHEREAS, the CONTRACTOR has executed and entered into a certain Agreement hereto attached, with the OWNER, dated \_\_\_\_\_ 20\_\_\_\_, for the which Agreement and the Specifications for said Work shall be deemed a part hereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal and all Subcontractors to whom any portion of Work provided for in said Contract is sublet and all assignees of said Principal and of such Subcontractors shall promptly make payments to all persons supplying him or them with labor, materials, or supplies for or in the prosecution of the Work provided for in such Agreement, or in any amendment or extension of or additions to said Agreement, and for the payment of reasonable attorney's fees, incurred by the claimant or claimants in suits on each bond, then the above obligations shall be void; otherwise to remain in full force and effect. PROVIDED, however, that this bond is subject to the following conditions and limitations.

- A. Any person, firm or corporation that has furnished labor, materials, or supplies for or in the prosecution of the Work provided for in said Agreement shall have a direct right of action against the Principal and Surety on this bond, which right of action shall be asserted in a proceeding instituted in the County in which the Work provided for in said Agreement is to be performed or in any County in which said Principal and Surety does business. Such right of action shall be asserted in a proceeding instituted in the name of the claimant or claimants for his or their use and benefit against said Principal and Surety or either of them (but not later than one (1) year after the final settlement of said Agreement) in which action such claim or claims shall be adjudicated and judgment rendered thereon.

B. The Principal and Surety hereby designate and appoint

\_\_\_\_\_  
(To be filled in by Surety Company)

as the agent of each of them to receive and accept service of process or other pleading issued or filed in any proceeding instituted on this bond and hereby consent that such service shall be the same as personal service on the Principal and/or Surety.

C. The Surety shall not be liable hereunder for damage or compensation recoverable under any Worker's Compensation or Employer's Liability Statute.

D. In no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one (1) year after the final settlement of said Agreement.

E. This bond is given pursuant to the terms of Act No. 39, General Laws of Alabama, approved February 8, 1935, entitled "An Act to Further Provide for Bond of Contractors on State and Other Public Works and Suits Thereon."

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument this \_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

CONTRACTOR

(Seal)

By\_\_\_\_\_

Attest

\_\_\_\_\_  
(Seal)

SURETY

By\_\_\_\_\_

Countersigned:

\_\_\_\_\_  
Resident Agent

\_\_\_\_\_  
Address

(Attach notarized copy of Power-of-Attorney evidencing authority of Attorney-in-Fact to bind the Surety on the date of the execution of the bond.)

State of \_\_\_\_\_ )  
County of \_\_\_\_\_ )

CERTIFICATE OF COMPLIANCE WITH THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535, as amended by ACT 2012-491)

DATE: \_\_\_\_\_

RE Contract/Grant/Incentive (describe by number or subject):

\_\_\_\_\_ by and between  
\_\_\_\_\_ (Contractor/Grantee) and  
\_\_\_\_\_ (State Agency, Department or Public Entity)

The undersigned hereby certifies to the State of Alabama as follows:

1. The undersigned holds the position of \_\_\_\_\_ with the Contractor/Grantee named above, and is authorized to provide representations set out in this Certificate as the official and binding act of that entity, and has knowledge of the provisions of THE BEASON-HAMMON ALABAMA TAXPAYER AND CITIZEN PROTECTION ACT (ACT 2011-535 of the Alabama Legislature, as amended by ACT 2012-491) which is described herein as "the Act."
2. Using the following definitions from Section 3 of the Act, select and initial either (a) or (b), below, to describe the Contractor/Grantee's business structure.  

BUSINESS ENTITY. Any person or group of persons employing one or more persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood, whether for profit or not for profit.

a. Self-employed individuals, business entities filing articles of incorporation, partnerships, limited partnerships, limited liability companies, foreign corporations, foreign limited partnerships, and foreign limited liability companies authorized to transact business in this state, business trusts, and any business entity that registers with the Secretary of State.

b. Any business entity that possesses a business license, permit, certificate, approval, registration, charter, or similar form of authorization issued by the state, any business entity that is exempt by law from obtaining such a business license, and any business entity that is operating unlawfully without a business license.

EMPLOYER. Any person, firm, corporation, partnership, joint stock association, agent, manager, representative, foreman, or other person having control or custody of any employment, place of employment, or of any employee, including any person or entity employing any person for hire within the State of Alabama, including a public employer. This term shall not include the occupant of a household contracting with another person to perform casual domestic labor within the household.
- \_\_\_\_\_ (a) The Contractor/Grantee is a business entity or employer as those terms are defined in Section 3 of the Act.  
\_\_\_\_\_ (b) The Contractor/Grantee is not a business entity or employer as those terms are defined in Section 3 of the Act.
3. As of the date of this Certificate, the Contractor/Grantee does not knowingly employ an unauthorized alien within the State of Alabama and hereafter it will not knowingly employ, hire for employment, or continue to employ an unauthorized alien within the State of Alabama;
4. The Contractor/Grantee is enrolled in E-Verify unless it is not eligible to enroll because of the rules of that program or other factors beyond its control.

Certified this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_.

\_\_\_\_\_  
Name of Contractor/Grantee/Recipient

By: \_\_\_\_\_

Its \_\_\_\_\_

The above Certification was signed in my presence by the person whose name appears above, on this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_\_.

WITNESS: \_\_\_\_\_

\_\_\_\_\_  
Printed Name of Witness

## **GENERAL CONDITIONS**

1. Definitions
2. Additional Instructions and Detail Drawings
3. Schedules, Reports, and Records
4. Drawings and Specifications
5. Shop Drawings
6. Materials, Services, and Facilities
7. Inspection and Testing
8. Substitutions
9. Patents
10. Surveys, Permits, Regulations
11. Protection of Work, Property, Persons
12. Supervision by Contractor
13. Changes in the Work
14. Changes in Contract Price
15. Time for Completion and Liquidated Damages
16. Correction of Work
17. Subsurface Conditions
18. Suspension of Work, Termination, and Delay
19. Payments to Contractor
20. Acceptance of Final Payment as Release
21. Insurance
22. Contract Security
23. Assignments
24. Indemnification
25. Separate Contracts
26. Subcontracting
27. Engineer's Authority
28. Land and Rights-of-Way
29. Guarantee
30. Taxes



## **1. DEFINITIONS**

Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated and shall be applicable to both the singular and plural thereof:

A. ADDENDA- Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications, or corrections.

B. BID- The offer or proposal of the BIDDER submitted on the prescribed form setting forth the price for the WORK to be performed.

C. BIDDER- Any person, firm, or corporation submitting a BID for the WORK.

D. BONDS- Bid, Performance, and Payment Bonds and other instruments of surety, furnished by the CONTRACTOR and the CONTRACTOR'S surety in accordance with the CONTRACT DOCUMENTS.

E. CHANGE ORDER- A written order to the CONTRACTOR authorizing an addition, deletion, or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.

F. CONTRACT DOCUMENTS- The Contract, including Advertisement for BIDS, Instructions to BIDDERS, PROPOSAL, BID BOND, Agreement, Payment BOND, Performance BOND, CHANGE ORDER, DRAWINGS, SPECIFICATIONS, and ADDENDA.

G. CONTRACT PRICE- The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

H. CONTRACT TIME- The number of calendar days stated in the CONTRACT DOCUMENTS for the completion of the WORK.

I. CONTRACTOR- The person, firm, or corporation with whom the OWNER has executed the Agreement.

J. DRAWINGS- The parts of the CONTRACT DOCUMENTS which show the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.

K. ENGINEER- The person, firm, or corporation named as such in the CONTRACT DOCUMENTS.

L. FIELD ORDER- A written order effecting a change in the WORK not involving an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, issued by the ENGINEER to the CONTRACTOR during construction.

M. NOTICE OF AWARD- The written notice of the acceptance of the BID from the OWNER to the successful BIDDER.

N. NOTICE TO PROCEED- Written communication issued by the OWNER to the CONTRACTOR authorizing him/her to proceed with the WORK and establishing the date for commencement of the WORK.

O. OWNER- A public or quasi-public body or authority, corporation, association, partnership, or an individual for whom the WORK is to be performed.

P. PROJECT- The undertaking to be performed as provided in the CONTRACT DOCUMENTS.

Q. RESIDENT PROJECT REPRESENTATIVE- The authorized representative of the OWNER who is assigned to the PROJECT site or any part thereof.

R. SHOP DRAWINGS- All Drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, manufacturer, SUPPLIER or distributor, which illustrate how specific portions of the WORK shall be fabricated or installed.

S. SPECIFICATIONS- A part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

T. SUBCONTRACTOR- An individual, firm, or corporation having a direct contract with the CONTRACTOR or with any other SUBCONTRACTOR for the performance of a part of the WORK at the site.

U. SUBSTANTIAL COMPLETION- That date certified by the ENGINEER when the construction of the PROJECT or a specified part thereof is sufficiently completed, in accordance with the CONTRACT DOCUMENTS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended and startup is complete. Startup shall not be complete until the entire treatment facility operates successfully and continuously for seven (7) consecutive days.

V. SUPPLEMENTAL GENERAL CONDITION- Modifications to General Conditions as if included as part of the General Conditions.

W. SUPPLIER- Any person or organization who supplies materials or equipment for the WORK, including that fabricated to a special design, but who does not perform labor at the site.

X. WORK- All labor necessary to produce the construction required by the CONTRACT DOCUMENTS, and all materials and equipment incorporated or to be incorporated in the PROJECT.

Y. WRITTEN NOTICE- Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at their last given address, or delivered in person to said party or their authorized representative on the WORK.

## **2. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS**

A. The CONTRACTOR may be furnished additional instructions and detail Drawings, by the ENGINEER, as necessary to carry out the WORK required by the CONTRACT DOCUMENTS.

B. The additional Drawings and instructions thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail Drawings and instructions.

## **3. SCHEDULE, REPORTS AND RECORDS**

A. The CONTRACTOR shall submit to the OWNER such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the CONTRACT DOCUMENTS for the Work to be performed.

B. Prior to the first partial payment estimate the CONTRACTOR shall submit construction progress schedules showing the order in which the CONTRACTOR proposes to carry on the WORK, including dates at which the various parts of the WORK will be started, estimated date of completing each part and, as applicable:

1. The dates at which special detail Drawings will be required; and
2. Respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

C. The CONTRACTOR shall also submit a schedule of payments that the CONTRACTOR anticipates will be earned during the course of the WORK.

D. NORMAL WORK TIME, for the purpose of this contract, shall be defined as Monday through Friday for 8 hours per day. Unless previously agreed to before commencement of work under this contract by the OWNER and the ENGINEER, all other work times are not considered NORMAL WORK TIME. Holidays observed by the Federal Government are not considered NORMAL WORK TIME.

The CONTRACTOR may perform work that does not require Engineering and/or inspection services outside of NORMAL WORK TIME. For example, clearing, cleanup, grassing, mulching, etc., may be done on weekends.

## **4. DRAWINGS AND SPECIFICATIONS**

A. The intent of the DRAWINGS and SPECIFICATIONS is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the WORK in accordance with the CONTRACT DOCUMENTS and all incidental Work necessary to complete the Project in an acceptable manner, ready for use, occupancy or operation by the OWNER.

B. Any discrepancies or conflicts found between the DRAWINGS and SPECIFICATIONS and site conditions or any inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK performed by the CONTRACTOR after discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR'S risk.

## **5. SHOP DRAWINGS**

A. The CONTRACTOR shall provide SHOP DRAWINGS as may be necessary for the prosecution of the WORK as required by the CONTRACT DOCUMENTS. The ENGINEER shall promptly review all SHOP DRAWINGS. The ENGINEER'S approval of any SHOP DRAWING shall not release the CONTRACTOR from responsibility for deviations from the CONTRACT DOCUMENTS. The approval of any SHOP DRAWING which substantially deviates from the requirement of the CONTRACT DOCUMENTS shall be evidenced by a CHANGE ORDER.

B. When submitted for the ENGINEER'S review, SHOP DRAWINGS shall bear the CONTRACTOR'S certification that he has reviewed, checked and approved the SHOP DRAWINGS and that they are in conformance with the requirements of the CONTRACT DOCUMENTS.

C. Portions of the WORK requiring a SHOP DRAWING or sample submission shall not begin until the SHOP DRAWING or submission has been approved by the ENGINEER. A copy of each approved SHOP DRAWING and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the ENGINEER.

## **6. MATERIALS, SERVICES AND FACILITIES**

A. It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the WORK within the specified time.

B. Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the WORK. Stored materials and equipment to be incorporated in the WORK shall be located so as to facilitate prompt inspection.

C. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

D. Materials, supplies, and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

E. Materials, supplies, or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR or the SUBCONTRACTOR subject to a chattel mortgage or

under a conditional sale contract or other agreement by which an interest is retained by the seller.

## **7. INSPECTION AND TESTING**

A. All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the CONTRACT DOCUMENTS.

B. The CONTRACTOR shall provide all inspection and testing services performed by a third party testing company approved by the OWNER.

C. The CONTRACTOR shall provide at the CONTRACTOR'S expense the testing and inspection services required by the CONTRACT DOCUMENTS.

D. If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER the required certificates of inspection, testing or approval.

E. Inspections, tests, or approvals by the engineer or others shall not relieve the CONTRACTOR from the obligations to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS.

F. The ENGINEER, ENGINEER'S representatives , and authorized OWNER representatives will at all times have access to the WORK. In addition, authorized representatives and agents of any participating Federal or State agency must be permitted to inspect all work, materials, payrolls, records or personnel, invoices of materials, and other relevant data and records. The CONTRACTOR will provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof.

G. If any WORK is covered contrary to the written instructions of the ENGINEER it must, if required by the ENGINEER, be uncovered for the ENGINEER'S observation and replaced at the CONTRACTOR'S expense.

H. If the ENGINEER considers it necessary or advisable that covered WORK be inspected or tested by others, the CONTRACTOR, at the ENGINEER'S request, will uncover, expose or otherwise make available for observation, inspection or testing as the ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such WORK is defective, the CONTRACTOR will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such WORK is not found to be defective, the CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate CHANGE ORDER will be issued.

## **8. SUBSTITUTIONS**

A. Whenever a material, article, or piece of equipment is identified on the DRAWINGS or SPECIFICATIONS by reference to brand name or catalogue numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The CONTRACTOR may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the CONTRACT DOCUMENTS by reference to brand name or catalogue number, and if, in the opinion of the ENGINEER, such material, article, or piece of equipment is of equal substance and function to the specified, the ENGINEER may approve its substitution and use by the CONTRACTOR. Any cost differential shall be deductible from the CONTRACT PRICE and the CONTRACT DOCUMENTS shall be appropriately modified by CHANGE ORDER. The CONTRACTOR warrants that if substitutes are approved, no major changes in the function or general design of the PROJECT will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the CONTRACTOR without a change in the CONTRACT PRICE or CONTRACT TIME.

## **9. PATENTS**

A. The CONTRACTOR shall pay all applicable royalties and license fees, and shall defend all suits or claims for infringement of any patent rights and save the OWNER harmless from loss on account thereof, except that the OWNER shall be responsible for any such loss when a particular process, design or product of a particular manufacturer or manufacturers is specified, however, if the CONTRACTOR has reason to believe that the design, process or product specified is an infringement of a patent, the CONTRACTOR shall be responsible for such loss unless the CONTRACTOR promptly gives such information to the ENGINEER.

## **10. SURVEYS, PERMITS, REGULATIONS**

A. The OWNER shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the WORK together with a suitable number of bench marks adjacent to the WORK as shown in the CONTRACT DOCUMENTS. From the information provided by the OWNER, unless otherwise specified in the CONTRACT DOCUMENTS, the CONTRACTOR shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pipe locations and other working points, lines, elevations and cut sheets.

B. The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, shall be charged with the resulting expense and shall be responsible for any mistake that may be caused by their unnecessary loss or disturbance.

C. Permits and licenses of a temporary nature necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR unless otherwise stated in the Contract Documents. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for the OWNER, unless otherwise specified. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules

and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the CONTRACT DOCUMENTS are at variance therewith, the CONTRACTOR shall promptly notify the ENGINEER in writing, and any necessary changes shall be adjusted in Section 13, CHANGES IN THE WORK.

## **11. PROTECTION OF WORK, PROPERTY, AND PERSONS**

A. The CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to all employees on the WORK and other persons who may be affected thereby, all the WORK and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course on construction.

B. The CONTRACTOR shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The CONTRACTOR shall erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. The CONTRACTOR shall notify owners of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR shall remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or part, by the CONTRACTOR, any SUBCONTRACTOR or anyone directly or indirectly employed by any of them or anyone of whose acts any of or loss attributable to the fault of the CONTRACT DOCUMENTS or to the acts or omissions of the OWNER, of the ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the CONTRACTOR.

C. In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR, without special instructions or authorization from the ENGINEER or OWNER, shall act to prevent threatened damage, injury or loss. The CONTRACTOR shall give the ENGINEER prompt WRITTEN NOTICE of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall thereupon be issued covering the changes and deviations involved.

## **12. SUPERVISION BY CONTRACTOR**

A. The CONTRACTOR shall supervise and direct the WORK. He shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR shall employ and maintain on the WORK a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR'S representative at the site. The supervisor shall have full authority to act on behalf of the CONTRACTOR and all communications given to the supervisor shall be as binding as if given to the CONTRACTOR. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

### **13. CHANGES IN THE WORK**

A. The OWNER may at any time, as the need arises, order changes within the scope of the WORK without invalidating the Agreement. If such changes increase or decrease the amount due under the CONTRACT DOCUMENTS, or in the time required for performance of the WORK, an equitable adjustment shall be authorized by CHANGE ORDER.

B. The ENGINEER, also, may at any time, by issuing a FIELD ORDER, make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER unless the CONTRACTOR believes that such FIELD ORDER entitles the CONTRACTOR to a change in CONTRACT PRICE or TIME, or both, in which event the CONTRACTOR shall give the ENGINEER WRITTEN NOTICE thereof within seven (7) days after the receipt of the ordered change. Thereafter the CONTRACTOR shall document the basis for the change in CONTRACT PRICE or TIME within ten (10) days, unless the ENGINEER agrees in writing to the need for additional time due to no fault of the CONTRACTOR. The CONTRACTOR shall not execute such changes pending the receipt of an executed CHANGE ORDER or further instruction from the OWNER.

### **14. CHANGES IN CONTRACT PRICE**

A. The CONTRACT PRICE may be changed only by a CHANGE ORDER. The value of any WORK covered by a CHANGE ORDER or of any claim for increase or decrease in the CONTRACT PRICE shall be determined by one or more of the following methods in the order of precedence listed below:

1. Unit prices previously approved.
2. An agreed lump sum.

### **15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES**

A. The date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS and the WORK embraced shall be commenced on a date specified in the NOTICE TO PROCEED.

B. The CONTRACTOR shall proceed with the WORK at such rate of progress to insure full completion within the CONTRACT TIME. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the CONTRACT TIME for the completion of the WORK described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the WORK.

C. If the CONTRACTOR shall fail to complete the WORK within the CONTRACT TIME, or extension of the time granted by the OWNER, then the CONTRACTOR shall pay to the OWNER the amount for liquidated damages as specified in the BID for each calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT DOCUMENTS.



D. The CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the WORK is due to the following and the CONTRACTOR has promptly given WRITTEN NOTICE of such delay to the OWNER or ENGINEER.

1. To any preference, priority or allocation order duly issued by the OWNER.
2. To unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of the OWNER, act of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather.
3. To any delays of SUBCONTRACTORS occasioned by any of the causes specified in paragraphs 1. and 2. of this article.

## **16. CORRECTION OF WORK**

A. The CONTRACTOR shall promptly remove from the premises all WORK rejected by the ENGINEER for failure to comply with the CONTRACT DOCUMENTS, whether incorporated in the construction or not, and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the CONTRACT DOCUMENTS and without expense to the OWNER and shall bear the expense of making good all WORK of other CONTRACTORS destroyed or damaged by such removal or replacement.

B. All removal and replacement WORK shall be done at the CONTRACTOR'S expense. If the CONTRACTOR does not take action to remove such rejected WORK within ten (10) days after receipt of WRITTEN NOTICE, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR.

## **17. SUBSURFACE CONDITIONS**

A. The CONTRACTOR shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the OWNER by WRITTEN NOTICE of:

1. Subsurface or latent physical conditions at the site differing materially from those indicated in the CONTRACT DOCUMENTS; or
2. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the CONTRACT DOCUMENTS.

B. The OWNER will promptly investigate the conditions, and if it is found that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the WORK, an equitable adjustment shall be made and the CONTRACT DOCUMENTS shall be modified by a CHANGE ORDER. Any claim of the

CONTRACTOR for adjustment hereunder will not be allowed unless the required WRITTEN NOTICE has been given; provided that the OWNER may, if the OWNER determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

## **18. SUSPENSION OF WORK, TERMINATION, AND DELAY**

A. The OWNER may suspend the WORK or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the CONTRACTOR, by WRITTEN NOTICE to the CONTRACTOR and the ENGINEER which shall fix the date on which WORK shall be resumed. The CONTRACTOR shall resume that WORK on the date so fixed. The CONTRACTOR shall be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to any suspension.

B. If the CONTRACTOR is adjudged bankrupt or insolvent, or makes a general assignment for the benefit of its creditors, or if a trustee or receiver is appointed for the CONTRACTOR or for any of its property, or if CONTRACTOR files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or repeatedly fails to make prompt payments to SUBCONTRACTORS or for labor, materials or equipment, or disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the WORK or disregards the authority of the ENGINEER, or otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER may without prejudice to any other right or remedy and after giving the CONTRACTOR and its surety a minimum of ten (10) days from delivery of a WRITTEN NOTICE, terminate the services of the CONTRACTOR and take possession of the PROJECT and of all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR, and finish the WORK by whatever method the OWNER may deem expedient.

In such case the CONTRACTOR shall not be entitled to receive any further payment until the WORK is finished. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess SHALL BE PAID TO THE CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR shall pay the difference to the OWNER. Such costs incurred by the OWNER will be determined by the ENGINEER and incorporated in a CHANGE ORDER.

C. Where the CONTRACTOR'S services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

D. After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR and the ENGINEER, the OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the PROJECT and terminate the CONTRACT. In such case the CONTRACTOR will be paid for all WORK executed and any expense sustained plus reasonable profit.

E. If, through no act or fault of the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) days by the OWNER or under an order of court or other public authority, or the ENGINEER fails to act on any request for payment within thirty (30) days after it is submitted, or the OWNER fails to pay the CONTRACTOR substantially the sum approved by the ENGINEER within thirty (30) days of its approval and presentation, then the CONTRACTOR may, after ten (10) days from delivery of a WRITTEN NOTICE to the OWNER and the ENGINEER terminate the CONTRACT and recover from the OWNER payment for all WORK until paid all amounts then due, in which event and upon resumption of the WORK CHANGE ORDERS shall be issued for adjusting the CONTRACT PRICE or extending the CONTRACT TIME or both to compensate for the costs and delays attributable to the stoppage of the WORK.

F. If the performance of all or any portion of the WORK is suspended, delayed, or interrupted as a result of a failure of the OWNER or ENGINEER to act within the time specified in the CONTRACT DOCUMENTS, or if no time is specified, within a reasonable time, an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, will be made by CHANGE ORDER to compensate the CONTRACTOR for the costs and delays necessarily caused by the failure of the OWNER or ENGINEER.

## **19. PAYMENT TO CONTRACTOR**

A. At least ten (10) days before each progress payment falls due (but not more often than once a month), the CONTRACTOR shall submit to the ENGINEER a partial payment estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by partial payment estimate and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the OWNER'S title to the material and equipment and protect the OWNER'S interest therein, including applicable insurance.

The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing approval of payment, and present the partial payment estimate to the OWNER, or return the partial payment estimate to the CONTRACTOR indicating in writing the reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the partial payment estimate. The OWNER will, within ten (10) days of presentation of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate less the retainage. The retainage shall be an amount equal to five (5%) percent of said estimate until fifty (50%) percent of the Work has been completed.

At fifty (50%) percent completion, further partial payments will be made in full to the CONTRACTOR and no additional amounts may be retained unless the ENGINEER certifies that the job is not proceeding satisfactorily but amounts previously retained will not be paid to the CONTRACTOR. At fifty (50%) percent completion or any time thereafter when the progress of the Work is not proceeding satisfactory, additional amounts may be retained but in no event will the total retainage be more than ten (10%) percent of the value of the Work completed. Upon substantial completion of the Work, any amount retained may be paid to the

CONTRACTOR. When the Work has been substantially completed except for WORK which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgment of the OWNER are valid reasons for noncompletion, the OWNER may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the WORK still to be completed.

B. The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.

C. Prior to SUBSTANTIAL COMPLETION, the OWNER, with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any completed or substantially completed portions of the WORK. Such use will not constitute an acceptance of such portions of the WORK.

D. The OWNER will have the right to enter the premises for the purpose of doing Work not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

E. Upon completion and acceptance of the WORK, the ENGINEER will issue a certificate attached to the final payment request that the WORK has been accepted under the conditions of the CONTRACT DOCUMENTS. The entire balance found to be due the CONTRACTOR, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, will be paid to the CONTRACTOR within thirty (30) days of completion and acceptance of the WORK and receipt of an Affidavit for advertising final completion.

F. The CONTRACTOR shall indemnify and save the OWNER or the OWNER'S agents harmless from all claims growing out of the lawful demand of SUBCONTRACTORS, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. After completion of all Work, the CONTRACTOR shall publish a Notice of Completion in a newspaper of general circulation in the area where the Work was done. Such notice shall be published once per week for period of four (4) successive weeks. Proof of publication of such notice shall consist of an Affidavit of publisher and a printed copy of the notice. The CONTRACTOR shall, at the OWNER'S request, furnish additional satisfactory evidence that all obligations of the nature designated above have been paid, discarded, or waived. If the CONTRACTOR fails to do so the OWNER may, after having notified the CONTRACTOR, either pay unpaid bills or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the CONTRACTOR will be resumed in accordance with the terms of the CONTRACT DOCUMENTS, but in no event shall the provisions of this sentence be construed to impose any obligations upon the OWNER to either the CONTRACTOR, the CONTRACTOR'S Surety, or any third party. In paying any unpaid bills of the CONTRACTOR, and any payment so made by the OWNER shall be considered as a payment made under the CONTRACT DOCUMENTS

by the OWNER to the CONTRACTOR and the OWNER shall not be liable to the CONTRACTOR for any such payments made in good faith.

G. If the OWNER fails to make payment thirty (30) days after the CONTRACTOR has completed fulfillment of advertisement and waived all claims after approval by the ENGINEER, in addition to other remedies available to the CONTRACTOR, there will be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the CONTRACTOR.

H. The CONTRACTOR shall include with each monthly Payment Estimate, a letter stating any delays incurred during that pay period as provided for under Article "Time for Completion and Liquidated Damages" as stated hereinbefore.

I. An updated construction Work Progress Schedule, outlining ALL PHASES OF THE CONTRACTOR'S PORTION of Work to be performed shall be submitted with each Payment Estimate.

## **20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE**

A. The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the CONTRACTOR other than claims in stated amounts as may be specifically excepted by the CONTRACTOR for all things done or furnished in connection with this WORK and for every act and neglect of the OWNER and others relating to or arising out of this WORK. Any payment, however, final or otherwise, shall not release the CONTRACTOR or its sureties from any obligations under the CONTRACT DOCUMENTS or the Performance and Payment BONDS.

## **21. INSURANCE**

A. The CONTRACTOR shall purchase and maintain such insurance as will protect it from claims set forth below which may arise out of, or result from, the CONTRACTOR'S execution of the WORK, whether such execution be by the CONTRACTOR, any SUBCONTRACTOR, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

1. Claims under workmen's compensation, disability benefit and other similar employee benefit acts;
2. Claims for damages because of bodily injury, occupational sickness or disease, or death of employees;
3. Claims for damages because of bodily injury, occupational sickness or disease, or death of any person other than employees;
4. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) any other person; and

5. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

B. Certificates of Insurance acceptable to the OWNER shall be filed with the OWNER prior to commencement of the WORK. These Certificates shall contain a provision that coverage's afforded under the policies will not be canceled unless at least thirty (30) days prior WRITTEN NOTICE has been given to the OWNER. Each insurance certificate shall name the OWNER and the ENGINEER as additional insured.

C. The CONTRACTOR shall procure and maintain, at the CONTRACTOR'S own expense, during the CONTRACT TIME, Liability insurance as hereinafter specified:

1. Exhibit B – Insurance Requirements
2. Additional umbrella excess liability coverage for the General Liability and Automobile Liability insurance shall be not less than \$5,000,000 per occurrence in excess of the above stated primary limits.
3. The CONTRACTOR shall acquire and maintain, if applicable, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear.

This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

D. The CONTRACTOR shall procure and maintain, at the CONTRACTOR'S own expense, during the CONTRACT TIME, in accordance with the provisions of the laws of the state in which the WORK is performed, Workmen's Compensation Insurance, including occupational disease provisions, for all of the CONTRACTOR'S employees at the site of the PROJECT and in case any WORK is sublet, the CONTRACTOR shall require such SUBCONTRACTOR similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all of latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous Work under this contract at the site of the PROJECT is not protected under Workmen's Compensation statue, the CONTRACTOR shall provide, and shall cause each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of its employees not otherwise protected.

E. The CONTRACTOR shall secure, if applicable, "All Risk" type Builder's Risk Insurance for WORK to be performed. Unless specifically authorized by the OWNER, the amount of such insurance shall not be less than the CONTRACT PRICE totaled in the BID. The policy shall cover not less than the losses due to fire, explosion, hail, lightning, vandalism, malicious mischief, wind, collapse, riot, aircraft, and smoke during the CONTRACT TIME, and until the WORK is accepted by the OWNER. The policy shall name as the insured the CONTRACTOR and the OWNER.

## **22. CONTRACT SECURITY**

A. If required by the Instructions to Bidders, the CONTRACTOR shall within ten (10) days after the receipt of the NOTICE OF AWARD furnish the OWNER with a Performance BOND and a Payment BOND in penal sums equal to the amount of the CONTRACT PRICE, conditioned upon the performance by the CONTRACTOR of all undertakings, covenants, terms, conditions and agreements of the CONTRACT DOCUMENTS, and upon the prompt payment by the CONTRACTOR to all persons supplying labor and materials in the prosecution of the WORK provided by the CONTRACT DOCUMENTS. Such BONDS shall be executed by the CONTRACTOR and a corporate bonding company licensed to transact such business in the state in which the WORK is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these BONDS shall be borne by the CONTRACTOR. If at any time a surety on any such BOND is declared bankrupt or loses its right to do business in the state in which the WORK is to be performed or is removed from the list of Surety Companies accepted on Federal Bonds, CONTRACTOR shall within ten (10) days after notice from the OWNER to do so, substitute an acceptable BOND (or BONDS) in such form and sum and signed by such other surety or sureties as may be satisfactory to the OWNER. The premiums on such BOND shall be paid by the CONTRACTOR. No further payment shall be deemed due nor shall be made until the new surety or sureties have furnished an acceptable BOND to the OWNER.

## **23. ASSIGNMENTS**

A. Neither the CONTRACTOR nor the OWNER shall sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof, or of any right, title or interest therein, or any obligation thereunder, without written consent of the other party.

## **24. INDEMNIFICATION**

A. The CONTRACTOR shall indemnify and hold harmless the OWNER and the ENGINEER and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

B. In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by any employee of the CONTRACTOR, any SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose act any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen's compensation acts, disability benefit acts or other employee benefits acts.

C. The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, its agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, designs or SPECIFICATIONS.

## **25. SEPARATE CONTRACTS**

A. The OWNER reserves the right to let other contracts in connection with this PROJECT. The CONTRACTOR shall afford other CONTRACTORS reasonable opportunity for the introduction and storage of their materials and the execution of their WORK, and shall properly connect and coordinate the WORK with theirs. If the proper execution or results of any part of the CONTRACTOR'S WORK depends upon the WORK of any other CONTRACTOR, the CONTRACTOR shall inspect and promptly report to the ENGINEER any defects in such WORK that render it unsuitable for such proper execution and results.

B. The OWNER may perform additional WORK related to the PROJECT or the OWNER may let other contracts containing provisions similar to these. The CONTRACTOR will afford the other CONTRACTORS who are parties to such Contracts (or the OWNER, if the OWNER is performing the additional WORK) reasonable opportunity for the introduction and storage of materials and equipment and the execution of WORK, and shall properly connect and coordinate the WORK with theirs.

C. If the performance of additional WORK by other CONTRACTORS or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, written notice thereof shall be given to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves it in additional expense or entitles it to an extension of the CONTRACT TIME, the CONTRACTOR may make a claim thereof as provided in Sections 14 and 15.

## **26. SUBCONTRACTING**

A. The CONTRACTOR may utilize the services of specialty SUBCONTRACTS on those parts of the WORK which, under normal contracting practices, are performed by specialty SUBCONTRACTORS.

B. The CONTRACTOR shall not award WORK to SUBCONTRACTOR(s), in excess of fifty (50%) percent of the CONTRACT PRICE, without prior written approval of the OWNER.

C. The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of its SUBCONTRACTORS, and of persons either directly or indirectly employed by them, as the CONTRACTOR is for the acts and omissions of persons directly employed by the CONTRACTOR.

D. The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORS to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS insofar as applicable to the WORK of



SUBCONTRACTORS and to give the CONTRACTOR the same power as regards terminating any subcontract that the OWNER may exercise over the CONTRACTOR under any provision of the CONTRACT DOCUMENTS.

E. Nothing contained in this CONTRACT shall create any contractual relationship between any SUBCONTRACTOR and the OWNER.

F. Any SUBCONTRACTOR added after award of the bid must be procured in accordance with 2 CFR 200.321

## **27. ENGINEER'S AUTHORITY**

A. The ENGINEER will act as the OWNER'S representative during the construction period, shall decide questions which may arise as to quality and acceptability of materials furnished and WORK performed, and shall interpret the intent of the CONTRACT DOCUMENTS in a fair and unbiased manner. The ENGINEER will make visits to the site and determine if the WORK is proceeding in accordance with the CONTRACT DOCUMENTS.

B. The CONTRACTOR will be held strictly to the intent of the CONTRACT DOCUMENTS in regard to the quality of materials, workmanship, and execution of the WORK. Inspections may be made at the factory or fabrication plant of the source of material supply.

C. The ENGINEER will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

D. The ENGINEER will promptly make decisions relative to interpretation of the CONTRACT DOCUMENTS.

## **28. LAND AND RIGHTS-OF-WAY**

A. PRIOR to issuance of NOTICE TO PROCEED, the OWNER will obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.

B. The OWNER will provide to the CONTRACTOR information which delineates and describes the lands owned and rights-of-way acquired.

C. The CONTRACTOR will provide at its own expense and without liability to the OWNER any additional land and access thereto that the CONTRACTOR may desire for temporary construction facilities, or for storage of materials.

## **29. GUARANTEE**

A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION. The CONTRACTOR warrants and guarantees for a period of one (1) year from the date of SUBSTANTIAL COMPLETION of the system that the completed system is free from all defects due to faulty materials or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage

to other parts of the system resulting from such defects. The OWNER will give notice of observed defects with reasonable promptness. In the event that the CONTRACTOR should fail to make such repairs, adjustments, or other WORK that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance BOND shall remain in full force and effect through the guarantee period.

**30. TAXES**

A. The CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required by the laws of the place where the WORK is performed.

**END OF SECTION**

## **EXHIBIT B**

### **INSURANCE REQUIREMENTS**

Each contractor, and their subcontractors, will maintain such insurance as will protect them, the **Dauphin Island Water & Sewer Authority** (hereinafter "**Owner**") and other applicable parties at limits and coverages specified herein, or, at the existing limits and coverages of contractor or subcontractors, whichever is greater. The limits and coverages specified are not intended to represent the correct insurance needed to fully and adequately protect the subcontractor.

All insurance will be provided by insurers licensed to conduct business in the state where the work is to be performed. Each insurer shall have a minimum A.M. Best rating of A-(VII) and must be acceptable to the **Owner**. Self-insured plans and/or group funds not having an A.M. Best rating must be submitted to the **Owner** for prior approval.

If requested by **Owner**, contractor shall provide a copy of all insurance policy contracts provided by contractor to meet these requirements within 10 days of written request.

No work is to be performed until a Certificate of Insurance complying with these specifications has been filed and accepted by the **Owner**.

#### **I. Workers Compensation and Employers Liability**

Part One: Workers Compensation	Statutory Limits as required by applicable jurisdiction
Part Two: Employers Liability	
Bodily Injury by Accident	\$1,000,000 Each Accident
Bodily Injury by Disease	\$1,000,000 Each Employee
Bodily Injury by Disease	\$1,000,000 Policy Limit

#### **II. Commercial General Liability**

Each Occurrence	\$1,000,000
Personal and Advertising Injury	\$1,000,000
Products/Completed Operation Aggregate	\$1,000,000
General Aggregate	\$1,000,000

- Coverage to be on an Occurrence Form
- Aggregate Limit provided "Per Project"
- Coverage to include
  - Premises and operations
  - Personal Injury and Advertising Injury
  - Products/Completed Operations
  - Independent Contractors
  - Contractual Liability
  - "XCU" hazards
  - Broad Form Property Damage

- Products/Completed Operations to remain in effect for 36 months beyond completion and acceptance by **Owner**.

### III. **Automobile Liability**

- Covering all Owned, Non-Owned, and Hired auto, trucks, and trailers.
- Combined Single Limit (each Accident) \$1,000,000

### IV. **Excess Liability Coverage**

- Coverage to be on an Occurrence form and provide the following limits in excess of the limits required for Employers Liability, Commercial General Liability and Automobile Liability.

Each Occurrence	\$5,000,000
Aggregate	\$5,000,000

#### **Requirements applicable to ALL policies.**

- Each policy shall be endorsed to provide 30 Day prior written notice of cancellation.
- The Commercial General Liability policy and Excess Liability providing Completed Operations coverage shall be maintained for 3 years after completion of project.
- The Commercial General Liability policy and Excess Liability shall name the **Owner** as Additional Insured for claims arising out of the Contractors and/or any Subcontractors work. The ISO Forms CG 20 07 04 and CG 20 37007 04 or a comparable form that is no more restrictive shall be required. The additional Insured form MUST include the current Operations and Products/Completed Operations of each contractor. The naming of the additional insured does not obligate the additional insured to pay any premiums due.
- All policies, except the Workers Compensation, shall be primary and non-contributory with any other coverage available to the Additional Insured.
- Contractor and their subcontractors shall waive all subrogation rights against the **Owner**, and their respective employees, agents, and subcontractors for any claims arising out of the work performed at this project. This applies to the Workers compensation, Automobile, General Liability, Umbrella and any and all property policies covering tools, equipment, and/or materials and supplies to become a part of the project.

### **CERTIFICATE OF INSURANCE**

Contractor shall provide an acceptable certificate of Insurance.

Each policy shall be endorsed to provide 30 Day prior written notice of cancellation to owner

- The Description Section of the Certificate will contain reference to
  - Project name
  - Additional Insureds
  - Waiver of Subrogation
  - 30 day prior notice of cancellation

## **PROPERTY INSURANCE**

### **I. Project**

- Contractor shall purchase and maintain property insurance for the full replacement Cost of the Work. The property insurance shall be maintained until final payment has been made, unless otherwise specified. The coverage shall be written on the "All Risk" or "Special" coverage form including theft.
- Property policy shall be written in the name of Owner, Contractor and sub-contractor(s) as their interest may appear.
- Policy shall be endorsed to allow occupancy by Owner prior to completion.



**Required Attachments for  
RESTORE Spill Impact Component  
(Bucket 3)  
Construction Contracts**

*Non-State and State Agency – Template version 4.1.2024*

The “Required Attachments for RESTORE Spill Impact Component Construction Contracts” is not intended to represent all requirements and obligations that may be applicable to contracts resulting from this solicitation. Any contract resulting from this solicitation will be subject to the terms and conditions of the Sub-Award Agreement between the Alabama Department of Conservation and Natural Resources (“ADCNR”) and the Project Owner, the terms and conditions of the Federal Award from the Gulf Coast Ecosystem Restoration Council (“RESTORE Council”), including any Special Award Conditions, the ADCNR Sub-Award Terms and Conditions, the RESTORE Act Financial Assistance Standard Terms and Condition and Program-Specific Terms and Conditions under the “Spill Impact Component,” as amended, the RESTORE Act, 33 USC § 1321(t) et seq., the U.S. Department of Treasury Regulations governing the RESTORE Act, 31 CFR § 34 et seq., all applicable terms and conditions in 2 CFR Part 200 of the Office of Management and Budget (“OMB”) Uniform Guidance for Grants and Cooperative Agreements, as amended on August 13, 2020, including Appendix II to 2 CFR Part 200, and all other OMB circulars, executive orders or other federal laws or regulations applicable to the services provided under this contract. All of these terms and conditions apply to the Subrecipient and its Contractors, as well as any covered subcontractors or vendors whose work is funded as a result of this solicitation.

IT IS THE PRIME CONTRACTOR’S RESPONSIBILITY TO ENSURE THAT THESE TERMS AND CONDITIONS ARE INCORPORATED INTO EACH SUBCONTRACT WHOSE WORK IS FUNDED AS A RESULT OF THIS SOLICITATION.

Requirements applicable to any contract and/or subcontract issued as a result of this solicitation include, but are not limited to:

- CERTIFICATIONS RELATED TO RESTORE ACT SPILL IMPACT COMPONENT FUNDING
- RESTORE ACT FINANCIAL ASSISTANCE STANDARD TERMS AND CONDITIONS AND PROGRAM-SPECIFIC TERMS AND CONDITIONS
- ADCNR SUBAWARD GRANT AGREEMENT
- APPENDIX II TO 2 CFR PART 200: CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS
- LABOR STANDARDS SUPPLEMENTARY CONDITIONS TO THE CONSTRUCTION CONTRACT (*Davis Bacon and Related Acts*)
- PROCUREMENT OF RECOVERED MATERIALS
- PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OF EQUIPMENT
- DOMESTIC PREFERENCES FOR PROCUREMENTS
- CONTRACTING WITH SMALL AND MINORITY BUSINESSES, WOMEN’S BUSINESS ENTERPRISES, AND LABOR SURPLUS AREA FIRMS

- SAMPLE LETTER FROM CONTRACTOR TO MBE/WBE FIRMS
- 41 CFR §60-1.4(b) EQUAL OPPORTUNITY CLAUSE (*for Federally Assisted Construction Contracts*)
- 41 CFR §60-4.2(d) NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (Executive Order 11246)
- 41 CFR §60-4.3(a) STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (Executive Order 11246)
- SUBCONTRACTOR LISTING FORM (*The Lowest Responsive and Responsible Bidder MUST submit with required MBE/WBE documentation.*)
- FORM SF-LLL (*The Lowest Responsive and Responsible Bidder MUST submit this form prior to Award; the Prime Contractor will be required to submit this form for each subcontract exceeding \$100,000 upon subcontract execution.*)



## **CERTIFICATIONS RELATED TO RESTORE ACT SPILL IMPACT COMPONENT FUNDING**

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**By submitting a bid for this contract, bidders expressly acknowledge that:**

- 1) This project is funded in whole or in part with grant funding from the Gulf Coast Ecosystem Restoration (RESTORE) Council and the Alabama Department of Conservation and Natural Resources under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act);
- 2) Any contract resulting from this bid (including subcontracts) will be subject to the terms and conditions of said funding award, the RESTORE Act Financial Assistance Standard Terms and Conditions and Program-Specific Terms and Conditions, the ADCNR Sub-Award Terms and Conditions, the RESTORE Act, 33 USC 1321(t), Treasury Regulations 31 CFR § 34 et seq., including 31 CFR §§ 34, Subpart D, all applicable terms and conditions in 2 CFR Part 200 (including Appendix II to Part 200), and all other OMB circulars, executive orders or other federal laws or regulations, as applicable.;
- 3) Any contract awarded (including subcontracts) will be subject to 31 CFR Part 19 – Governmentwide Debarment and Suspension (Nonprocurement); and,
- 4) Any contract awarded (including subcontracts) is subject to Treasury Title VI regulations, 31 CFR Part 22, for the implementation of Title VI of the Civil Rights Act of 1964, as amended (42 USC 2000d, et seq.).
- 5) Any contract awarded (including subcontracts) will be subject to the laws and regulations of the United States and the State of Alabama.

**The owner will not enter into a contract with a bidder, or the bidder's principals, if the bidder or its principals appear on the federal government's Excluded Parties List. Bidders hereby certify, by submission of a proposal, that neither it nor its principals are presently debarred, suspended, proposed for disbarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.**

**Bidders must verify that any subcontractor (or the subcontractor's principals) does not appear on the federal government's Excluded Parties List prior to executing a subcontract with that entity. The Excluded Parties List is accessible at <http://www.sam.gov>.**

**Bidders must register with SAM.gov and obtain and activate a Unique Entity Identifier (UEI) prior to submitting a bid for this project. Each subcontractor will also be required to register with SAM.gov and obtain and activate a UEI prior to beginning work on the project. Active Sam.gov registration must be maintained throughout the project period of performance.**

**The bidder must include a term or condition in all lower-tier covered transactions (i.e., subcontracts) that the transaction is subject to 31 CFR Part 19 - Governmentwide Debarment and Suspension (Nonprocurement).**

**RESTORE ACT**  
**FINANCIAL ASSISTANCE STANDARD TERMS AND CONDITIONS AND**  
**PROGRAM-SPECIFIC TERMS AND CONDITIONS**

# **RESTORE COUNCIL FINANCIAL ASSISTANCE STANDARD TERMS AND CONDITIONS**

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*Gulf Coast Ecosystem Restoration Council  
August 2015*

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# **RESTORE COUNCIL** **FINANCIAL ASSISTANCE STANDARD TERMS AND CONDITIONS**

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THESE RESTORE COUNCIL FINANCIAL ASSISTANCE STANDARD TERMS AND CONDITIONS (ST&Cs) ARE INCORPORATED INTO AND MADE A PART OF THE GRANT AWARD TO WHICH THEY ARE ATTACHED.

## A. STATUTORY AND NATIONAL POLICY REQUIREMENTS

The non-Federal entity<sup>1</sup> (also referred to as “recipient” or “grantee”) and any subrecipients must, in addition to the assurances made as part of the application, comply and require each of its contractors and subcontractors employed in the completion of the project to comply with all applicable statutes, regulations, executive orders (EOs), Office of Management and Budget (OMB) circulars, terms and conditions, and approved applications. This document provides the Gulf Coast Ecosystem Restoration Council (“Council”) standard terms and conditions (ST&Cs) for all Council awards. 2 CFR § 5900.101 provides the Council’s adoption of 2 CFR Part 200, giving regulatory effect to the OMB guidance.

This award is subject to the laws and regulations of the United States. Any inconsistency or conflict in terms and conditions specified in the award will be resolved according to the following order of precedence: public laws, regulations, applicable notices published in the *Federal Register*, EOs, OMB circulars, the Council ST&Cs, and special award conditions. Special award conditions may amend or take precedence over the ST&Cs if and when so provided by the ST&Cs.

Certain of the ST&Cs contain, by reference or substance, a summary of the pertinent statutes or regulations published in the *Federal Register* or Code of Federal Regulations (C.F.R.), EOs, OMB circulars, or the assurances (Forms SF-424B and SF-424D). No such provision will be construed so as to be in derogation of, or an amendment to, any such statute, regulation, EO, OMB circular, or assurance.

## B. PROGRAMMATIC REQUIREMENTS

The recipient must use funds only for the purposes identified in the grant award agreement in accordance with the requirements in 31 C.F.R. § 34.803(d). All activities under the award must meet the eligibility requirements of the Gulf RESTORE Program as defined in 31 C.F.R. §§ 34.201, 34.202 or 34.203, according to component.

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<sup>1</sup> The OMB *Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards* located at 2 C.F.R. part 200 uses the term “non-Federal entity” to generally refer to an entity that carries out a Federal award as a recipient or subrecipient. Because certain of the provisions of these ST&Cs apply to recipients rather than subrecipients, or vice versa, for clarity, these ST&Cs use the terms “non-Federal entity”, “recipient”, and “subrecipient.” In addition, the OMB Uniform Guidance uses the term “pass-through entity” to refer to a non-Federal entity that makes a subaward.

“Non-Federal entity” is defined at 2 C.F.R. § 200.69 as “a State, local government, Indian tribe, institution of higher education (IHE), or nonprofit organization that carries out a Federal award as a recipient or subrecipient.”

“Recipient” is defined at 2 C.F.R. § 200.86 as “a non-Federal entity that receives a Federal award directly from a Federal awarding agency to carry out an activity under a Federal program. The term recipient does not include subrecipients.”

“Subrecipient” is defined at 2 C.F.R. § 200.93 as “a non-Federal entity that receives a subaward from a pass-through entity to carry out part of a Federal program; but does not include an individual that is a beneficiary of such program. A subrecipient may also be a recipient of other Federal awards directly from a Federal awarding agency.”

“Pass-through entity” is defined as 2 C.F.R. § 200.74 as “a non-Federal entity that provides a subaward to a subrecipient to carry out part of a Federal program.”

## **.01 Performance (Technical) Reports**

- a. Non-Federal entities must use OMB-approved governmentwide standard information collections when providing financial and performance information and, as appropriate and in accordance with such information collections, are required to relate financial data to the performance accomplishments of the Federal award. When applicable, recipients must also provide cost information to demonstrate cost effective practices (e.g., through unit cost data). The Non-Federal entity's performance will be measured in a way that will help the Council and other non-Federal entities to improve program outcomes, share lessons learned and spread the adoption of promising practices. Recipients will be provided with clear performance goals, indicators and milestones as described in 2 C.F.R. § 200.210 "Information contained in a Federal award."
- b. Recipients must submit performance (technical) reports, which may be Form SF-PPR "Performance Progress Report" or any successor form, or another format as required by the Council, to the Council-designated grants officer (Grants Officer). Performance reports should be submitted electronically, unless the recipient makes an arrangement with the Grants Officer for submission in hard copy (no more than one original and two copies) in accordance with the award conditions.
- c. Performance Reports must be submitted with the same frequency as the Federal Financial Report (Form SF-425), unless otherwise authorized by the Grants Officer. If events occur between scheduled performance reporting dates that have significant impact upon the activity, project or program, the recipient must notify the Grants Officer as soon as possible.
- d. Performance (technical) reports shall contain brief information as prescribed in the *Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards* (2 C.F.R. part 200, specifically 2 C.F.R. § 200.328) incorporated into the award, unless otherwise specified in the award provisions. Specifically, in the "performance narrative" (item 10 on the SF-PPR), the recipient must provide the following information.
  1. Activities and Accomplishments:
    - i. Summarize activities undertaken during the reporting period;
    - ii. Summarize any key accomplishments, including milestones and metrics completed for the period;
    - iii. List any contracts awarded during the reporting period, along with the name of the contractor and its principal, the DUNS number of the contractor, the value of the contract, the date of award, a brief description of the services to be provided, and whether or not local preference was used in the selection of the contractor; and
    - iv. If the recipient is authorized to make subawards, list any subawards executed during the reporting period, along with the name of the entity and its principal, the DUNS number of the entity, the value of the agreement, the date of award, and a brief description of the scope of work.
  2. Adaptive Management:
    - i. Indicate if any operational, legal, regulatory, budgetary, and/or ecological risks, and/or any public controversies, have materialized; if so, indicate what mitigation strategies have been undertaken to attenuate these risks or controversies; and
    - ii. Summarize any challenges that have impeded the recipient's ability to accomplish the approved scope of work on schedule and on budget.

3. Findings/Events: Summarize any significant findings or events, if applicable.
4. Dissemination Activities: Describe any activities to disseminate or publicize results of the activity, project, or program, if applicable.
5. Monitoring:
  - i. Describe all efforts taken to monitor contractor and/or subrecipient performance, to include site visits, during the reporting period. For subawards, indicate whether the subrecipient submitted an audit to the recipient, and if so, whether the recipient issued a management decision on any findings; and
  - ii. Describe any other activities or relevant information not already provided.
6. Planned Activities: Summarize the activities planned for the next reporting period.
7. Attachments: List and attach any deliverables completed during the performance period or other materials to be submitted with the report.

## **.02 Reporting on Real Property**

In accordance with 2 C.F.R. § 200.329, the Federal awarding agency or pass-through entity must require a non-Federal entity to submit reports at least annually on the status of real property in which the Federal government retains an interest, unless the Federal interest in the real property extends 15 years or longer. If the attached Federal interest is for a period of 15 years or longer, the Council or pass-through entity may, at its option, require the non-Federal entity to report at various multi-year frequencies as specified in the terms of the award (e.g., every two years or every three years, not to exceed a five-year reporting period; or the Council or pass-through entity may require annual reporting for the first three years of a Federal award and thereafter require reporting every five years).

## **.03 Unsatisfactory Performance**

Failure to perform the work in accordance with the terms of the award and maintain at least a satisfactory performance as determined by the Council may result in designation of the non-Federal entity as high risk and the assignment of special award conditions or other further action as provided in Section B.06, “Non-Compliance with Award Provisions” below.

## **.04 Programmatic Changes**

The non-Federal entity shall report programmatic changes to the Grants Officer in accordance with 2 C.F.R. § 200.308, and shall request prior approvals in accordance with 2 C.F.R. § 200.407.

## **.05 Other Federal Awards with Similar Programmatic Activities**

The non-Federal entity shall immediately provide written notification to the Grants Officer in the event that, subsequent to receipt of the Council award, other financial assistance is received to support or fund any portion of the scope of work incorporated into the Council award. The Council will not pay for any costs that are funded by other sources.

## **.06 Non-Compliance with Award Provisions**

Failure to comply with any or all of the provisions of the award may have a negative impact on future funding by the Council and may be considered grounds for any or all of the following actions: withholding of payments pending correction of the deficiency by the non-Federal entity and/or more severe enforcement action by the Council or pass-through entity in accordance with 2 C.F.R. § 200.338; disallowance of (that is, denial of both use of funds and any applicable matching credit for) all or part of the cost of the activity or action not in compliance; suspension or termination of all or any portion of the award; initiation of suspension or debarment proceedings as authorized under 2 C.F.R. part 180 and any Council regulations and policies promulgated pursuant to its authority (or in the case of a pass-through entity, recommendation that such a proceeding be initiated by the Council); withholding of further awards for the project or program; or enforcement of other remedies that may be legally available. *See also* 2 C.F.R. §§ 200.339 through 200.342.

## **.07 Prohibition against Assignment by the Non-Federal Entity**

The non-Federal entity shall not transfer, pledge, hypothecate, mortgage, or otherwise assign the award, or any interest therein, or any claim arising thereunder, to any party or parties, including without limitation any bank, trust company or other financing or financial institution, without the express written approval of the Grants Officer.

## **.08 Disclaimer Provisions**

- a. The United States expressly disclaims any and all responsibility or liability to the non-Federal entity or third persons for any actions of the non-Federal entity or third persons resulting in death, bodily injury, personal or property damage, or any other damage, loss or liability in connection with or resulting in any way from the performance of this award or any subaward or subcontract under this award.
- b. Acceptance of this award by the non-Federal entity does not in any way establish or constitute an agency relationship between the United States and the non-Federal entity.

# **C. FINANCIAL REQUIREMENTS**

## **.01 Financial Reports**

- a. In accordance with 2 C.F.R. § 200.327, the recipient shall submit a “Federal Financial Report” (Form SF-425 or any successor form, or another format as required by the Council) on a semi-annual basis. Semi-annual reporting periods will be specified in the grant award for either the periods ending March 31 and September 30, or any portion thereof, or June 30 and December 31, or any portion thereof, unless otherwise specified in a special award condition. Reports are due no later than 30 days following the end of each reporting period. A final Form SF-425 shall be submitted within 90 days after the expiration of the project period.
- b. The report should be submitted to the Grants Officer electronically, unless the recipient makes an arrangement with the Grants Officer for submission in hard copy (no more than one original and two copies), in accordance with the award conditions.

- c. The recipient must report to the Council at the conclusion of the grant period, or other period specified by the Council, on the use of funds pursuant to the award in accordance with the requirements in 31 C.F.R. § 34.803(e).
- d. The recipient must forecast cash requirements/draws semi-annually, for the periods October 1 to March 31 and April 1 to September 30, throughout the life of the grant. Forecasted cash requirements must be updated with the submission of each “Federal Financial Report.”

## **.02 Financial Management**

- a. In accordance with 2 C.F.R. § 200.302(a), each State, including a state’s administrative agents and the Gulf Consortium of Florida counties, must expend and account for the Federal award in accordance with state laws and procedures for expending and accounting for the state’s own funds. In addition, the state’s and other non-Federal entities’ financial management systems, including records documenting compliance with Federal statutes, regulations, and the terms and conditions of the Federal award, must be sufficient to permit the preparation of reports required by general and program-specific terms and conditions – including preparation of accurate, current and complete SF-425, Performance (Technical) Report, reporting on subawards, and any additional reports required by any additional award conditions. The financial management system also must be sufficient to trace funds to a level of expenditures adequate to establish that such funds have been used according to the Federal statutes, regulations – including without limitation the Resources and Ecosystem Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act), Council and Treasury RESTORE Act regulations – and the terms and conditions of the Federal award. *See also* 2 C.F.R. § 200.450 “Lobbying.”
- b. The financial management system of each non-Federal entity must provide all information required by 2 C.F.R. § 200.302(b) and maintain detailed records sufficient to account for the receipt, obligation and expenditure of grant funds in accordance with the requirements in 31 C.F.R. § 34.803(b). *See also* 2 C.F.R. §§ 200.333 “Retention requirements for records”; 200.334 “Requests for transfer of records”; 200.335 “Methods for collection, transmission and storage of information”; 200.336 “Access to records”; and 200.337 “Restrictions on public access to records.” Specifically, the financial management system must provide for:
  - 1. Identification and tracking of all Council awards received and expended by the Catalog of Federal Domestic Assistance (CFDA) title and number, Federal award identification number and year, name of the Federal agency, and name of the pass-through entity, if any;
  - 2. Records that adequately identify the source and application of all funds for Federally-funded activities, including information pertaining to Federal awards, authorizations, obligations, unobligated balances, assets, expenditures, income and interest, and are supported by source documentation; and
  - 3. Effective control over, and accountability for, all Federal funds, and all property and assets acquired with Federal funds. The recipient must adequately safeguard all assets and ensure that they are used solely for authorized purposes.
- c. The recipient must establish written procedures to implement the requirements set forth in Subsection, C.03 “Award Payments,” below, as well as written procedures to determine the allowability of costs in accordance with 2 C.F.R. Part 200, subpart E “Cost Principles,” and the terms and conditions of this award.

### .03 Award Payments

- a. The reimbursement method of payment will be used under this award, unless otherwise specified in a special award condition. The Grants Officer will determine the appropriate method of payment. Payments are made through electronic funds transfers directly to the non-Federal entity's bank account and in accordance with the requirements of the Debt Collection Improvement Act of 1996 (31 U.S.C. § 3701 *et. seq.*) and the Cash Management Improvement Act (31 U.S.C. § 6501 *et. seq.*).
  1. Consistent with 2 C.F.R. § 200.305(a), for States, payments are governed by the Treasury-State Cash Management Improvement Act (CMIA) agreements and default procedures codified at 31 C.F.R. Part 205 "Rules and Procedures for Efficient Federal-State Funds Transfers" and Treasury Financial Manual Volume I, 4A-2000 "Overall Disbursing Rules for All Federal Agencies."
  2. Consistent with 2 C.F.R. § 200.305(b), for non-Federal entities other than States, payment methods must minimize the amount of time elapsing between the transfer of funds from the U.S. Treasury or the pass-through entity and the disbursement by the non-Federal entity.
- b. The Council Award Number must be included on all payment-related correspondence, information, and forms.
- c. Unless otherwise provided for in the award terms, payments under this award will be made using the Department of Treasury's Automated Standard Application for Payment ([ASAP](#))<sup>2</sup> system. Under the ASAP system, payments will be made through preauthorized electronic funds transfers in accordance with the requirements of the Debt Collection Improvement Act of 1996. Awards paid under the ASAP system will contain a special award condition, clause or provision describing enrollment requirements and any controls or withdrawal limits set in the ASAP system. Recipients enrolled in the ASAP system are not required to submit a "Request for Advance or Reimbursement" (Form SF-270 or successor form), in order to receive payments relating to their award. Pre-approval prior to requesting payments may be required for recipients that are determined by the Council to be in a high risk category or noncompliant (*see* 2 C.F.R. § 200.205 "Federal awarding agency review of risk posed by applicants," and *see* section M "Remedies for Noncompliance" below).
  1. In order to receive payments under ASAP, recipients are required to enroll with the Department of Treasury, Financial Management Service, Regional Financial Centers, which enables them to use the on-line and Voice Response System (VRS) method of withdrawing funds from their ASAP established accounts.
  2. The following information will be required to make withdrawals under ASAP: (i) ASAP account number, i.e., the Federal award number found on the cover sheet of the award; (ii) Agency Location Code (ALC); and (iii) Region Code.
- d. When expressly allowed through a special award condition, advances shall be limited to the minimum amounts necessary to meet immediate disbursement needs, but in no event shall advances exceed the amount of cash required for a 30-day period. Funds advanced but not disbursed in a timely manner and any accrued interest thereon must be promptly returned to the Council. The Grants Officer may periodically request documentation from the non-Federal entity verifying that the elapsed time between the transfer of funds and disbursement has been minimized. If a non-Federal entity demonstrates an unwillingness or inability to establish procedures that will minimize time elapsing

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<sup>2</sup> Department of Treasury's Automated Standard Application for Payment (ASAP) system - [https://www.fiscal.treasury.gov/fsservices/gov/pmt/asap/asap\\_home.htm](https://www.fiscal.treasury.gov/fsservices/gov/pmt/asap/asap_home.htm), verified on 8/18/2015.



between transfer of funds and disbursement or if the non-Federal entity otherwise fails to continue to qualify for the advance payment method, the Grants Officer may change the method of payment to reimbursement only.

- e. Where the use of an alternative system other than ASAP is provided for in the award terms, requests for payment will be submitted to the Grants Officer.
  - 1. Form SF-3881, “ACH Vendor/Miscellaneous Payment Enrollment Form,” must be completed before the first award payment can be made via the “Request for Advance or Reimbursement” (Form SF-270) request.
  - 2. When advance payment is expressly allowed for by special award condition, the non-Federal entity must submit the request no more frequently than monthly, and advances will be approved for periods to cover only expenses anticipated over the following 30 days. The non-Federal entity must complete the “ACH Vendor Miscellaneous Payment Enrollment Form” (Form SF-3881 or successor form), and Form SF-270, and submit those forms to the Grants Officer.

#### **.04 Federal and Non-Federal Sharing**

- a. Awards that include Federal and non-Federal sharing incorporate a budget consisting of shared allowable costs. If actual allowable costs are less than the total approved budget, the Federal and non-Federal cost shares shall be calculated by applying the approved Federal and non-Federal cost share ratios to actual allowable costs. If actual allowable costs are greater than the total approved budget, the Federal share shall not exceed the total Federal dollar amount authorized by the award.
- b. The non-Federal share, whether in cash or in-kind, is to be paid out at the same general rate as the Federal share. Exceptions to this requirement may be granted by the Grants Officer based on sufficient documentation demonstrating previously determined plans for, or later commitment of, cash or in-kind contributions. In any case the non-Federal entity must meet its cost share commitment over the life of the award. The non-Federal entity must create and maintain sufficient records sufficient to justify all non-Federal sharing requirements and to facilitate questions and audits. *See* Section I “Audits” below for audit requirements, and *see* 2 C.F.R. § 200.306 for additional requirements regarding cost sharing.

#### **.05 Program Income**

- a. Non-Federal entities are encouraged to earn income to defray program costs where appropriate. Any program income shall be earned and applied consistent with the requirements of 2 C.F.R. § 200.307.
- b. The recipient must maintain detailed records sufficient to account for the receipt, obligation, and expenditure of grant funds including the tracking of program income. Program income must be included in the non-Federal entity’s approved budget and tracked in accordance with the requirements in 31 C.F.R. § 34.803(b).
- c. All program income must be documented in the Federal financial report submitted to the Council for the period in which the income was earned.

## **.06 Budget Changes and Transfer of Funds among Categories**

- a. Requests for changes to the approved budget must be made in accordance with 2 C.F.R. § 200.308 “Revision of budget and program plans” and submitted in writing to the Grants Officer who will make the final determination on such requests and notify the non-Federal entity in writing thereof.
  1. Construction Awards. For construction Federal awards, the non-Federal entity must request prior written approval promptly from the Grants Officer for budget revisions whenever one or more of the following applies:
    - i. The revision results from changes in the scope or the objective of the project or program;
    - ii. The need arises for additional Federal funds to complete the project; or
    - iii. A revision is desired which involves specific costs for which prior written approval requirements may be imposed consistent with applicable OMB cost principles listed in 2 C.F.R. part 200, Subpart E—“Cost Principles.”
  2. Non-Construction Awards. For non-construction Federal awards, recipients must request prior written approval promptly from the Grants Officer for budget revisions whenever one or more of the following applies:
    - i. Change in the scope or the objective of the project or program;
    - ii. Change in a key person specified in the application or the Federal award;
    - iii. The disengagement from the project for more than three months, or a 25 percent reduction in time devoted to the project, by the approved project director or principal investigator;
    - iv. The inclusion, unless waived by the Council, of costs that require prior approval in accordance with 2 C.F.R. part 200 Subpart E—“Cost Principles” or 45 C.F.R. Part 75 Appendix IX “Principles for Determining Costs Applicable to Research and Development under Awards and Contracts with Hospitals,” or 48 C.F.R. Part 31 “Contract Cost Principles and Procedures,” as applicable;
    - v. The transfer of funds budgeted for participant support costs as defined in 2 C.F.R. § 200.75 “Participant support costs to other categories of expense”;
    - vi. The subawarding, transferring or contracting out of any work under a Federal award unless (a) described in the application and funded in the approved Federal award, or (b) applicable to the acquisition of supplies, material, equipment or general support services only; or
    - vii. Changes in the amount of approved cost-sharing or matching provided by the non-Federal entity. No other prior approval requirements for specific items may be imposed unless a deviation has been approved by OMB. *See also* 2 C.F.R. §§ 200.102 “Exceptions” and 200.407 “Prior written approval.”
  3. Both Construction and Non-Construction Activities in Award. If a single award provides support for construction and non-construction work, the recipient must request prior written approval from the Grants Officer before making any fund or budget transfers between the two types of work supported.
- b. In accordance with 2 C.F.R. § 200.308(e), transfers of funds by the recipient among direct cost categories are permitted for awards in which the Federal share of the project is the Simplified Acquisition Threshold (\$150,000 as of 12/26/2013) or less. For awards in which the Federal share of the project exceeds the Simplified Acquisition Threshold, the recipient must request prior written approval from the Grants Officer for transfers of funds among direct cost categories when the



cumulative amount of such direct cost transfers exceeds ten percent of the total budget<sup>3</sup> as last approved by the Grants Officer. The 10% threshold applies to the total Federal funds authorized by the Grants Officer at the time of the transfer request. The same requirements apply to the cumulative amount of transfer of funds among programs, functions, and activities. This transfer authority does not authorize the recipient to create new budget categories within an approved budget without the prior written approval of the Grants Officer. No transfer that enables any Federal appropriation, or part thereof, to be used for an unauthorized purpose will be permitted. The foregoing provision does not prohibit the recipient from requesting Grants Officer approval for revisions to the budget. *See* 2 C.F.R. § 200.308 (as applicable) for specific requirements concerning budget revisions and transfer of funds between budget categories.

- c. The recipient is not authorized at any time to transfer amounts budgeted for direct costs to the indirect costs line item or vice versa without the prior written approval of the Grants Officer.

## **.07 Indirect (Facilities and Administrative [F&A]) Costs**

- a. Indirect (facilities and administrative [F&A]) costs will not be allowable charges against an award unless permitted under the award, specifically included as a line item in the award's approved budget and consistent with 2 C.F.R. §§ 200.414 "Indirect (F&A) costs" and Subpart E "Cost Principles."
- b. Indirect costs of recipients are subject to the three percent (3%) cap on administrative expenses stated in 33 U.S.C. § 1321(t)(1)(B)(iii) and 31 C.F.R. § 34.204. The three percent cap on administrative expenses applies only to recipients and does not flow down to subrecipients.
- c. Excess indirect costs may not be used to offset unallowable direct costs.
- d. Indirect costs charged must be consistent with the indirect cost rate agreement negotiated between the non-Federal entity and its cognizant agency (defined as the Federal agency that is responsible for reviewing, negotiating, and approving cost allocation plans or indirect cost proposals, *see* 2 C.F.R. § 200.19) and must be included in the recipient's budget. The Council will accept approved indirect cost rates unless otherwise authorized by a Federal statute or regulation, or requirements at 2 C.F.R. § 200.414(c) are met.
  - 1. If indirect costs are permitted and the non-Federal entity wishes to include indirect costs in its budget, but the non-Federal entity has not previously established an indirect cost rate with a Federal agency, the requirements for determining the relevant cognizant agency and developing and submitting indirect (F&A) cost rate proposals and cost allocation plans are contained in Appendices III – VII to 2 C.F.R. Part 200 as follows:
    - Appendix III to 2 C.F.R. Part 200 – Indirect (F&A) Costs Identification and Assignment, and Rate Determination for Institutions of Higher Education (IHEs);
    - Appendix IV to 2 C.F.R. Part 200 – Indirect (F&A) Costs Identification and Assignment, and Rate Determination for Nonprofit Organizations;
    - Appendix V to 2 C.F.R. Part 200 – State/Local Governmentwide Central Service Cost Allocation Plans;

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<sup>3</sup> The cumulative amount of direct cost transfers is calculated by summing the negative variances between the approved and proposed budgets. Variance is calculated by subtracting the proposed budget amount for each cost category from the approved budget amount for the category. Only variances less than zero are totaled. The cumulative negative variance is then divided by the total grant award budget to determine the percentage transferred, i.e., cumulative % of transfer(s) =  $\{[\Sigma (\text{negative variances})] / \text{total award budget}\} \times 100$ .

- Appendix VI to 2 C.F.R. Part 200 – Public Assistance Cost Allocation Plans; and
- Appendix VII to 2 C.F.R. Part 200 – States and Local Government and Indian Tribe Indirect Cost Proposals.

The cognizant agency for governmental units or agencies not specifically identified by OMB will be determined based on the Federal agency providing the largest amount of Federal funds. *See* 2 C.F.R. §200.416 “Cost allocation plans and indirect cost proposals.” When the Council is not the oversight or cognizant Federal agency, the non-Federal entity shall provide the Grants Officer with a copy of a negotiated rate agreement or a copy of the transmittal letter submitted to the cognizant or oversight Federal agency requesting a negotiated rate agreement.

2. For those organizations for which the Council is cognizant or has oversight, the Council or its designee will either negotiate a fixed rate with carry-forward provisions for the non-Federal entity or, in some instances, will limit its review to evaluating the procedures described in the non-Federal entity’s cost allocation plan. Indirect cost rates and cost allocation methodology reviews are subject to future audits to determine actual indirect costs.
3. Within 90 days after the award start date, the non-Federal entity shall submit to the address listed below documentation (indirect cost proposal, cost allocation plan, etc.) necessary to perform the review. The non-Federal entity shall provide the Grants Officer with a copy of the transmittal letter.

Gulf Coast Ecosystem Restoration Council Office  
Attn: Senior Grants Management Officer  
500 Poydras Street, Suite 1117  
New Orleans, LA 70130

If the non-Federal entity fails to submit the required documentation to the Council within 90 days of the award start date, the Grants Officer may amend the award to preclude the recovery of any indirect costs under the award. If the Council, oversight or cognizant Federal agency determines there is a finding of good and sufficient cause to excuse the non-Federal entity’s delay in submitting the documentation, an extension of the 90-day due date may be approved by the Grants Officer.

4. The non-Federal entity may use the fixed rate proposed in the indirect cost plan until such time as the Council provides a response to the submitted plan. Actual indirect costs must be calculated annually and adjustments made through the carry-forward provision used in calculating the following year’s rate. This calculation of actual indirect costs and the carry-forward provision is subject to audit. Indirect cost rate proposals must be submitted annually. Organizations that have previously established indirect cost rates must submit a new indirect cost proposal to the cognizant agency within six months after the close of each of the recipients’ fiscal years.
- e. The maximum dollar amount of allocable indirect costs for which the Council will reimburse the non-Federal entity shall be the lesser of:
1. The line item amount for the Federal share of indirect costs contained in the approved award budget, including all budget revisions approved in writing by the Grants Officer; or
  2. The Federal share of the total indirect costs allocable to the award based on the indirect cost rate approved by a cognizant or oversight Federal Agency for indirect costs and applicable to the period in which the cost was incurred, provided that the rate is approved in writing on or before

the award end date, subject to the three percent (3%) cap on administrative expenses provided in 33 U.S.C. § 1321(t)(1)(B)(iii) and 31 C.F.R. § 34.204.

- f. In addition, a non-Federal entity that is a State, local government, Indian tribe, institution of higher education, or nonprofit organization and has never received a negotiated indirect cost rate may elect to charge a *de minimis* rate of 10% of modified total direct costs. *See also* 2 C.F.R. § 200.414(f).

## **.08 Incurring Costs or Obligating Federal Funds Outside of the Period of Performance**

- a. The non-Federal entity shall not incur costs or obligate funds for any purpose pertaining to the operation of the project, program, or activities beyond the period of performance, i.e., the time during which the non-Federal entity may incur new obligations to carry out the work authorized under the Federal award. *See* 2 C.F.R. §§ 200.77 and 200.309.
  - 1. The Council or pass-through entity must include start and end dates of the period of performance in the Federal award.
  - 2. All activities supported through an award must occur and be completed during the approved period of performance, whether funded directly or through a subaward or subcontract, and all obligated costs must be liquidated within 90 days following the end date of the period of performance.
  - 3. The only costs which may be authorized for a period of not to exceed 90 days following the end of the project period are those solely associated with close-out activities. Close-out activities are limited to the preparation of final progress, financial, and required project audit reports unless otherwise approved in writing by the Grants Officer. The Grants Officer may approve extensions of the 90-day closeout period upon a request by the non-Federal entity as provided in 2 C.F.R. § 200.343.
- b. Unless otherwise authorized in 2 C.F.R. § 200.343 or a special award condition, any extension of the project period can only be authorized by the Grants Officer in writing. Verbal or written assurances of funding from anyone other than the Grants Officer shall not constitute authority to obligate funds for programmatic activities beyond the end of the project period.
- c. Pre-Award Costs. Pre-award costs are those incurred prior to the effective date of the Federal award directly pursuant to the negotiation and in anticipation of the Federal award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are allowable only to the extent that they would have been allowable if incurred after the date of the Federal award and only with the written approval of the Grants Officer. The recipient must use funds obligated and disbursed under the award only during the period of performance specified in the award document. *See* 2 C.F.R. § 200.458.
- d. The Council has no obligation to provide any additional prospective funding. Any amendment of the award to increase funding and to extend the project period is at the sole discretion of the Council.

## **.09 Tax Refunds**

Refunds of Federal Insurance Contributions Act (FICA) (26 U.S.C. §§ 3101-3128) or Federal Unemployment Tax Act (FUTA) (26 U.S.C. §§ 3301-3311) taxes received by the non-Federal entity

during or after the period of performance must be refunded or credited to the Council whenever the benefits were financed with Federal funds under the award. The non-Federal entity shall contact the Grants Officer immediately upon receipt of these refunds. The non-Federal entity shall in addition refund portions of FICA/FUTA taxes determined to belong to the Federal Government, including refunds received after the period of performance ends.

## **D. INTERNAL CONTROLS**

Consistent with 2 C.F.R. § 200.303, each non-Federal entity:

- a. Must establish and maintain effective internal control over the Federal award that provides reasonable assurance that the non-Federal entity is managing the Federal award in compliance with Federal statutes, regulations, and the terms and conditions of the Federal award. These internal controls must be in compliance with guidance in “[Standards for Internal Control in the Federal Government](#)”<sup>4</sup> issued by the Comptroller General of the United States or the “[Internal Control Integrated Framework](#),”<sup>5</sup> issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).
- b. Must comply with Federal statutes, regulations, and the terms and conditions of the Federal award.
- c. Must evaluate and monitor the non-Federal entity’s compliance with statute, regulations and the terms and conditions of Federal award.
- d. Must take prompt action when instances of noncompliance are identified including noncompliance identified in audit findings.
- e. Must take reasonable measures to safeguard protected personally identifiable information and other information the Council or pass-through entity designates as sensitive or the non-Federal entity considers sensitive consistent with applicable Federal, state and local laws regarding privacy and obligations of confidentiality.

## **E. PROPERTY STANDARDS**

### **.01 Standards**

The non-Federal entity must comply with the property standards as stipulated in 2 C.F.R. §§ 200.310 to 200.316.

### **.02 Insurance coverage**

Recipients must provide insurance coverage for real property and equipment acquired or improved with Federal funds equivalent to that provided for property owned by the non-Federal entity. Federally-owned

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<sup>4</sup> “Standards for Internal Control in the Federal Government” issued by the Comptroller General of the United States - <http://www.gao.gov/assets/80/76455.pdf>, verified on 8/18/2015.

<sup>5</sup> “Internal Control Integrated Framework,” issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO), Executive Summary - <http://www.coso.org/documents/Internal%20Control-Integrated%20Framework.pdf>, verified on 8/18/2015.

property need not be insured unless required by the terms and conditions of the Federal award. *See* 2 C.F.R. § 200.310.

### **.03 Real Property**

- a. Real property or an interest in real property may not be acquired under an award without prior written approval of the Grants Officer.
- b. Title of real property. Subject to the obligations and conditions set forth in this section, title to real property acquired or improved under a Federal award will vest upon acquisition in the non-Federal entity.
- c. Use. Except as otherwise provided by Federal statutes or by the Council, real property must be used for the originally authorized purpose as long as needed for that purpose, during which time the non-Federal entity must not dispose of or encumber its title or any other interest therein.
- d. Willing Sellers. Land or interest in land may only be acquired by purchase, exchange or donation from a willing seller in accordance with the requirements in 31 C.F.R. § 34.803(f).
- e. Federal Acquisitions. Funds may not be used to acquire land in fee title by the Federal Government unless the exceptions in 31 C.F.R. § 34.803(g) are met.
- f. Disposition. When real property is no longer needed for the originally authorized purpose, the non-Federal entity must obtain disposition instructions from the Council or pass-through entity. The instructions will provide that the non-Federal entity do one of the following:
  - 1. Retain title after compensating the Council. The amount paid to Council will be computed by applying the Council's percentage of participation in the cost of the original purchase (and costs of any improvements) to the fair market value of the property. However, if the non-Federal entity is disposing of real property acquired or improved with a Federal award and acquiring replacement real property under the same Federal award, the net proceeds from the disposition may be used as an offset to the cost of the replacement property.
  - 2. Sell the property and compensate the Council. The amount due to the Council will be calculated by applying the Council's percentage of participation in the cost of the original purchase (and cost of any improvements) to the proceeds of the sale after deduction of any actual and reasonable selling and fixing-up expenses. If the Federal award has not been closed out, the net proceeds from sale may be offset against the original cost of the property. When the non-Federal entity is directed to sell property, it must utilize sales procedures that provide for competition to the extent practicable and result in the highest possible return.
  - 3. Transfer title to the Council or to a third party designated or approved by the Council. The non-Federal entity is entitled to be paid an amount calculated by applying the non-Federal entity's percentage of participation in the purchase of the real property (and cost of any improvements) to the current fair market value of the property.
- g. The Grants Officer may require the non-Federal entity to submit the Tangible Personal Property Report (Form SF-428 or successor form), and/or Real Property Status Report (Form SF-429 or successor form), including applicable attachments to each form, in connection with the reporting of tangible personal property or of real property acquired or improved, in whole or in part, under a Council financial assistance award. The Grants Officer may also require the non-Federal entity to

submit Form SF-428 and/or Form SF-429, or successor forms, in connection with a non-Federal entity's request to acquire, encumber, dispose of, or take any other action pertaining to tangible personal property or to real property acquired or improved, in whole or in part, under a Council financial assistance award.

## **.04 Federally-owned and Exempt Federally-owned Property**

- a. Title to Federally-owned property<sup>6</sup> remains vested in the Federal government. The non-Federal entity must submit annually an inventory listing of Federally-owned property in its custody to the Grants Officer. Upon completion of the Federal award or when the property is no longer needed, the non-Federal entity must report the property to the Grants Officer for further Council utilization. If the Council has no further need for the property, it must declare the property excess and report it for disposal to the appropriate Federal disposal authority, unless the Council has statutory authority to dispose of the property by alternative methods (e.g., the authority provided by the Federal Technology Transfer Act (15 U.S.C. § 3710 (i)) to donate research equipment to educational and non-profit organizations in accordance with Executive Order 12999, "Educational Technology: Ensuring Opportunity for All Children in the Next Century."). The Council will issue appropriate instructions to the non-Federal entity. The Council may exercise this option when statutory authority exists.
- b. Absent statutory authority and specific terms and conditions of the Federal award, title to exempt Federally-owned property acquired under the Federal award remains with the Federal government.
- c. The Grants Officer may require the non-Federal entity to submit the Tangible Personal Property Report (Form SF-428 or successor form), and/or Real Property Status Report (Form SF-429 or successor form), including applicable attachments to each form, in connection with the reporting of Federally-owned property that is in the non-Federal entity's custody pursuant to a Council financial assistance award or with a non-Federal entity's request to acquire, encumber, dispose of, or take any other action pertaining to Federally-owned property.

## **.05 Equipment**

- a. Recipients must comply with the equipment standards provided in 2 C.F.R. §§ 200.313 "Equipment" and 200.439 "Equipment and other capital expenditures."
- b. American-Made Equipment and Products. Recipients are hereby notified that they are encouraged, to the greatest extent practicable, to purchase American-made equipment and products with funding provided under this award.
- c. Use, management, and disposition of equipment acquired.
  1. For recipients that are States: The recipient must use, manage and dispose of equipment acquired under this award in accordance with state laws and procedures.
  2. For recipients that are not States: Equipment must be used by the recipient in the program or project for which it was acquired as long as needed, whether or not the project or program

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<sup>6</sup> Federally-owned property as defined in 2 C.F.R. § 200.312 means property acquired under a Federal award where the title vests with the Federal government. Exempt Federally-owned property means property acquired under a Federal award where the Federal awarding agency has chosen to vest title to the property to the non-Federal entity without further obligation to the Federal Government, based upon the explicit terms and conditions of the Federal award.



continues to be supported by the Federal award. Before disposing of equipment during the period of performance, the recipient must seek disposition instructions from the Grants Officer for equipment acquired under this award if the current fair market value of the equipment is greater than \$5,000 per unit. Disposition instructions must be requested by submitting a completed “Tangible Personal Property Report” (SF-428 or any successor form) and the “Disposition Request/Report” (SF-428-C or any successor form). In addition, not later than 60 days after the end of the period of performance, the recipient must submit to the Grants Officer a completed SF-428 and “Final Report Form” (SF-428-B or any successor form) if the recipient retains any equipment with a current fair market value greater than \$5,000 per unit.

## **.06 Supplies**

- a. Title to supplies vests in the non-Federal entity upon acquisition. If residual inventory of unused supplies exceeds \$5,000 in total aggregate value upon termination or completion of the project or program and the supplies are not needed for any other Federal award, then the non-Federal entity may retain the supplies for use on other activities or sell them, but must, in either case, compensate the Federal government for its share. The amount of compensation must be computed in the same manner as for equipment as prescribed in 2 C.F.R. § 200.313 “Equipment”; *see* 200.313(e)(2) for the calculation methodology. *See also* 2 C.F.R. § 200.453 “Materials and supplies costs, including costs of computing devices.” The recipient must report the value and the retention or sale of such supplies by submitting to the Grants Officer a completed “Tangible Personal Property Report” (SF-428 or any successor form) and “Final Report Form” (SF-428-B or any successor form) no later than 60 days after the end of the period of performance.
- b. As long as the Federal government retains an interest in the supplies, the non-Federal entity must not use supplies acquired under a Federal award to provide services to other organizations for a fee that is less than private companies charge for equivalent services, unless specifically authorized by Federal statute.

## **.07 Intangible Property**

- a. Title to intangible<sup>7</sup> property acquired under a Federal award vests upon acquisition in the non-Federal entity.
- b. The non-Federal entity must use intangible property for the originally-authorized purpose, and must not encumber the property without the prior written approval of the Council. When no longer needed for the originally authorized purpose, disposition of the intangible property must occur in accordance with the provisions in 2 C.F.R. § 200.313(e).
- c. The non-Federal entity may copyright any work that is subject to copyright and was developed, or for which ownership was acquired, under a Federal award. The Council reserves a royalty-free, perpetual, nonexclusive and irrevocable license to reproduce, publish, distribute, exhibit, and/or otherwise use and exploit the work throughout the world in all media now known or hereafter devised, and to authorize others to do so for Federal purposes.

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<sup>7</sup> Intangible property as defined by 2 C.F.R. § 200.59 means property having no physical existence, such as trademarks, copyrights, patents and patent applications and property, such as loans, notes and other debt instruments, lease agreements, stock and other instruments of property ownership (whether the property is tangible or intangible).

- d. The non-Federal entity is subject to applicable regulations governing patents and inventions, including governmentwide regulations issued by the Department of Commerce at 37 C.F.R. part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Awards, Contracts and Cooperative Agreements.”
- e. The Federal government has the right, perpetually throughout the world in all media now known or hereafter devised, to:
  - 1. Obtain, reproduce, publish, distribute, exhibit, and/or otherwise use and exploit the data produced under a Federal award; and
  - 2. Authorize others to do so for Federal purposes.
- f. Freedom of Information Act (FOIA). Pursuant to 2 C.F.R. § 200.315(e), in response to a FOIA request for research data relating to published research findings<sup>8</sup> produced under a Federal award that were used by the Federal government in developing an agency action that has the force and effect of law, the Council will request, and the non-Federal entity must provide, within a reasonable time, the research data<sup>9</sup> so that such data can be made available to the public through the procedures established under the FOIA. If the Council obtains the research data solely in response to a FOIA request, the Council may charge the requester a reasonable fee equal to the full incremental cost of obtaining the research data that reflects the costs incurred by the Council and the non-Federal entity. Pursuant to 5 U.S.C. § 552(a)(4)(A), this fee is in addition to any fees the Council may assess under the FOIA.

## **.08 Property Trust Relationship**

Real property, equipment and intangible property acquired or improved with a Federal award must be held in trust by the non-Federal entity as trustee for the beneficiaries of the project or program under which the property was acquired or improved. The Council may require the non-Federal entity to record liens or other appropriate notices of record to indicate that personal or real property has been acquired or improved with a Federal award and that use and disposition conditions apply to the property.

## **F. PROCUREMENT STANDARDS**

Pursuant to 2 C.F.R. § 200.317, when procuring property and services under this Federal award, a State must follow the same policies and procedures it uses for procurements from its non-Federal funds. The

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<sup>8</sup> Published research findings (as defined by 2 C.F.R. § 200.315(e)(2)) means findings are published in a peer-reviewed scientific or technical journal; or a Federal agency publicly and officially cites the research findings in support of an agency action that has the force and effect of law. Used by the Federal government in developing an “agency action that has the force and effect of law” is defined as when an agency publicly and officially cites the research findings in support of an agency action that has the force and effect of law.

<sup>9</sup> As defined by 2 C.F.R. § 200.315(e)(3), research data means the recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues. This “recorded” material excludes physical objects (e.g., laboratory samples). Research data also do not include: trade secrets, commercial information, materials necessary to be held confidential by a researcher until they are published, or similar information which is protected under law; and personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy, such as information that could be used to identify a particular person in a research study.



State will comply with 2 C.F.R. § 200.322 “Procurement of recovered materials,” and the State must ensure that every purchase order or other contract includes any clauses required by section 2 C.F.R. § 200.326 “Contract provisions.” All other non-Federal entities, including subrecipients of a State, will follow the requirements of 2 C.F.R. §§ 200.318 “General procurement standards” through 200.326 “Contract provisions.”

- a. For recipients that are States: When executing procurement actions under the award, the recipient must follow the same policies and procedures it uses for procurements from its non-Federal funds. The recipient must ensure that every purchase order or other contract contains any clauses required by federal statutes and EOs and their implementing regulations, including all of the provisions listed in Appendix II to 2 C.F.R. Part 200 “Contract Provisions for Non-Federal Entity Contracts under Federal Awards,” as well as any other provisions required by law or regulations.
- b. For recipients that are not States: The recipient must follow all procurement requirements set forth in 2 C.F.R. §§ 200.318, 200.319, 200.320, 200.321, 200.323, 200.324, and 200.325. In addition, all contracts executed by the recipient to accomplish the approved scope of work must contain any clauses required by federal statutes and EOs and their implementing regulations, including all of the provisions listed in Appendix II to 2 C.F.R. Part 200 “Contract Provisions for Non-Federal Entity Contracts under Federal Awards.”

## **G. NON-DISCRIMINATION REQUIREMENTS**

No person in the United States shall, on the ground of race, color, national origin, handicap, age, religion, or sex, be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving Federal financial assistance. The non-Federal entity shall comply with the non-discrimination requirements below:

### **.01 Statutory Provisions**

- a. Title VI of the Civil Rights Act of 1964 (42 U.S.C. §§ 2000d *et seq.*) and any Council regulations and policies promulgated pursuant to its authority prohibit discrimination on the grounds of race, color, or national origin under programs or activities receiving Federal financial assistance;
- b. Title IX of the Education Amendments of 1972 (20 U.S.C. §§ 1681 *et seq.*) prohibits discrimination on the basis of sex under Federally assisted education programs or activities;
- c. The Americans with Disabilities Act of 1990 (ADA) (42 U.S.C. §§ 12101 *et seq.*) prohibits discrimination on the basis of disability under programs, activities, and services provided or made available by state and local governments or instrumentalities or agencies thereto, as well as public or private entities that provide public transportation;
- d. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794), and any Council regulations and policies promulgated pursuant to its authority prohibit discrimination on the basis of handicap under any program or activity receiving or benefiting from Federal assistance.
- e. Revised ADA Standards for Accessible Design for Construction Awards revised regulations implementing Title II of the Americans with Disabilities Act (ADA) (28 C.F.R. part 35; 75 FR 56164, as amended by 76 FR 13285) and Title III of the ADA (28 C.F.R. part 36; 75 FR 56164, as amended by 76 FR 13286) which adopted new enforceable accessibility standards called the “2010 ADA

Standards for Accessible Design” (2010 Standards). All new construction and alteration projects shall comply with the 2010 Standards.

- f. The Age Discrimination Act of 1975, as amended (42 U.S.C. §§ 6101 *et seq.*), and any Council regulations and policies promulgated pursuant to its authority prohibit discrimination on the basis of age in programs or activities receiving Federal financial assistance;
- g. Any other applicable non-discrimination law(s).

## **.02 Other Provisions**

- a. Parts II and III of EO 11246, “Equal Employment Opportunity,” (30 FR 12319, 1965), as amended by EO 11375 (32 FR 14303, 1967) and EO 12086 (43 FR 46501, 1978), requiring Federally-assisted construction contracts to include the nondiscrimination provisions of §§ 202 and 203 of that EO and Department of Labor regulations implementing EO 11246 (41 C.F.R. § 60-1.4(b), 1991).
- b. EO 13166 (August 11, 2000), “Improving Access to Services for Persons With Limited English Proficiency,” requiring Federal agencies to examine the services provided, identify any need for services to those with limited English proficiency (LEP), and develop and implement a system to provide those services so LEP persons can have meaningful access to them.
- c. Pilot Program for Enhancement of Employee Whistleblower Protections. The National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2013 (Pub. L. No. 112-239, enacted January 2, 2013 and codified at 41 U.S.C. § 4712) includes a pilot program of whistleblower protection. It applies to all Council awards, subawards, or contracts under awards issued beginning July 1, 2013 through January 1, 2017. The following provision implements that law:

In accordance with 41 U.S.C. § 4712, an employee of a non-Federal entity or contractor under a Federal award or subaward may not be discharged, demoted, or otherwise discriminated against as a reprisal for disclosing to a person or body information that the employee reasonably believes is evidence of gross mismanagement of a Federal award, subaward, or a contract under a Federal award or subaward, a gross waste of Federal funds, an abuse of authority relating to a Federal award or subaward or contract under a Federal award or subaward, a substantial and specific danger to public health or safety, or a violation of law, rule, or regulation related to a Federal award, subaward, or contract under a Federal award or subaward. These persons or bodies include:

1. A Member of Congress or a representative of a committee of Congress.
2. An Inspector General.
3. The Government Accountability Office.
4. A Federal employee responsible for contract or grant oversight or management at the relevant agency.
5. An authorized official of the Department of Justice or other law enforcement agency.
6. A court or grand jury.
7. A management official or other employee of the contractor, subcontractor, or grantee who has the responsibility to investigate, discover, or address misconduct.

Non-Federal entities shall inform their employees in writing of the rights and remedies provided under 41 U.S.C. § 4712, in the predominant native language of the workforce.

### **.03 Title VII Exemption for Religious Organizations**

Generally, Title VII of the Civil Rights Act of 1964, 42 U.S.C. § 2000e *et seq.*, provides that it shall be an unlawful employment practice for an employer to discharge any individual or otherwise to discriminate against an individual with respect to compensation, terms, conditions, or privileges of employment because of such individual's race, color, religion, sex, or national origin. However, Title VII, 42 U.S.C. § 2000e-1(a), expressly exempts from the prohibition against discrimination on the basis of religion, a religious corporation, association, educational institution, or society with respect to the employment of individuals of a particular religion to perform work connected with the carrying on by such corporation, association, educational institution, or society of its activities.

## **H. RECORDS RETENTION**

- a. The recipient must retain all records pertinent to this award for a period of no less than three years, beginning on a date as described in 2 C.F.R. § 200.333. While electronic storage of records (backed up as appropriate) is preferable, the recipient has the option to store records in hardcopy (paper) format. For the purposes of this section, the term "records" includes but is not limited to:
  1. Copies of all contracts and all documents related to a contract, including the Request for Proposal (RFP), all proposals/bids received, all meeting minutes or other documentation of the evaluation and selection of contractors, any disclosed conflicts of interest regarding a contract, all signed conflict of interest forms (if applicable), all conflict of interest and other procurement rules governing a particular contract, and any bid protests;
  2. Copies of all subawards, including the funding opportunity announcement or equivalent, all applications received, all meeting minutes or other documentation of the evaluation and selection of subrecipients, any disclosed conflicts of interest regarding a subaward, and all signed conflict of interest forms (if applicable);
  3. All documentation of site visits, reports, audits, and other monitoring of contractors (vendors) and subrecipients (if applicable);
  4. All financial and accounting records, including records of disbursements to contractors (vendors) and subrecipients, and documentation of the allowability of Administrative Costs charged to this award;
  5. All supporting documentation for the performance outcome and other information reported on the recipient's Financial Reports and Performance (Technical) Reports; and
  6. Any reports, publications, and data sets from any research conducted under this award.
- b. If any litigation, claim, investigation, or audit relating to this award or an activity funded with award funds is started before the expiration of the three year period, the records must be retained until all litigation, claims, investigations, or audit findings involving the records have been resolved and final action taken.

## I. AUDITS

- a. Under the Government Accounting Office's authorities (5 U.S.C. § 701 et seq.) and the Inspector General Act of 1978, as amended, 5 U.S.C. App. 3, § 1 *et seq.*, an audit of the award may be conducted at any time. The Treasury Office of Inspector General (OIG), Government Accounting Office (GAO) and the Council are authorized to audit Council awards. *See* Section 1608 of the RESTORE Act; and *see* 31 C.F.R. §§ 34.205, 34.406, 34.508 and 34.805.
- b. The Treasury OIG (as specified in the RESTORE Act), or any of his or her duly authorized representatives, the GAO and the Council shall have timely and unrestricted access to any pertinent books, documents, papers, and records of the non-Federal entity, whether written, printed, recorded, produced, or reproduced by any electronic, mechanical, magnetic, or other process or medium, in order to make audits, inspections, excerpts, transcripts, or other examinations as authorized by law.
- c. If the Treasury OIG requires a program audit on a Council award, the OIG will usually make the arrangements to audit the award, whether the audit is performed by OIG personnel, an independent accountant under contract with the Council, or any other Federal, state, or local audit entity.
- d. The Treasury OIG, the GAO, and the Council shall have the right during normal business hours to conduct announced and unannounced onsite and offsite physical visits of recipients and their subrecipients and contractors corresponding to the duration of their records retention obligation for this award.

### .01 Organization-Wide, Program-Specific, and Project Audits

- a. Organization-wide or program-specific audits must be performed in accordance with the Single Audit Act Amendments of 1996, as implemented by 2 C.F.R. part 200, Subpart F, "Audit Requirements." Recipients that are subject to the provisions of 2 C.F.R. part 200, Subpart F and that expend \$750,000 or more in a year in Federal awards must have an audit conducted for that year in accordance with the requirements contained in 2 C.F.R. part 200, Subpart F. A copy of the audit shall be submitted to the Bureau of the Census, which has been designated by OMB as a central clearinghouse, by electronic submission to the Federal Audit Clearinghouse [website](http://harvester.census.gov/sac/).<sup>10</sup> If it is necessary to submit by paper, the address for submission is:

Federal Audit Clearinghouse  
Bureau of the Census  
1201 E. 10th Street  
Jeffersonville, IN 47132

- b. Except for the provisions for biennial audits provided in paragraphs (1) and (2) of this section, audits required must be performed annually. Any biennial audit must cover both years within the biennial period.
  1. A State, local government, or Indian tribe that is required by constitution or statute, in effect on January 1, 1987, to undergo its audits less frequently than annually, is permitted to undergo its audits pursuant to this part biennially. This requirement must still be in effect for the biennial period.

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<sup>10</sup> Federal Audit Clearinghouse website - <http://harvester.census.gov/sac/>, verified on 6/5/2015.

2. Any nonprofit organization that had biennial audits for all biennial periods ending between July 1, 1992, and January 1, 1995, is permitted to undergo its audits pursuant to this part biennially.
- c. Council programs may have specific audit guidelines that will be incorporated into the award. When the Council does not have a program-specific audit guide available for the program, the auditor will follow the requirements for a program-specific audit as described in 2 C.F.R. § 200.507. The non-Federal entity may include a line item in the budget for the cost of the audit for approval. A copy of the program-specific audit shall be submitted to the Grants Officer and to the OIG at [OIGCounsel@oig.treas.gov](mailto:OIGCounsel@oig.treas.gov) or if e-mail is unavailable, submission to the OIG can be made at the following address:

Treasury Office of Inspector General  
1500 Pennsylvania Ave. NW  
Washington, DC 20220

## **.02 Audit Resolution Process**

- a. An audit of the award may result in the disallowance of costs incurred by the non-Federal entity and the establishment of a debt (account receivable) due the Council. For this reason, the non-Federal entity should take seriously its responsibility to respond to all audit findings and recommendations with adequate explanations and supporting evidence whenever audit results are disputed.
- b. A non-Federal entity whose award is audited has the following opportunities to dispute the proposed disallowance of costs and the establishment of a debt:
  1. Unless the Inspector General determines otherwise, the non-Federal entity has 30 days after the date of the transmittal of the draft audit report to submit written comments and documentary evidence.
  2. The non-Federal entity has 30 days after the date of the transmittal of the final audit report to submit written comments and documentary evidence. There will be no extension of this deadline.
  3. The Council will review the documentary evidence submitted by the non-Federal entity and notify the non-Federal entity of the results in an *Audit Resolution Determination Letter*. The non-Federal entity has 30 days after the date of receipt of the *Audit Resolution Determination Letter* to submit a written appeal. There will be no extension of this deadline. The appeal is the last opportunity for the non-Federal entity to submit written comments and documentary evidence that dispute the validity of the audit resolution determination.
  4. An appeal of the Audit Resolution Determination does not prevent the establishment of the audit-related debt nor does it prevent the accrual of interest on the debt. If the Audit Resolution Determination is overruled or modified on appeal, appropriate corrective action will be taken retroactively. An appeal will stay the offset of funds owed by the auditee against funds due to the auditee.
  5. The Council will review the non-Federal entity's appeal and notify the non-Federal entity of the results in an *Appeal Determination Letter*. After the opportunity to appeal has expired or after the appeal determination has been rendered, the Council will not accept any further documentary evidence from the non-Federal entity. No other administrative appeals to the Council are available.

## J. DEBTS

### .01 Payment of Debts Owed the Federal Government

- a. The non-Federal entity must promptly pay any debts determined to be owed the Federal Government. Council debt collection procedures are set out in 2 C.F.R. part 200, Subpart D. In accordance with 2 C.F.R. § 200.345, delinquent debt includes any funds paid to the non-Federal entity in excess of the amount to which the non-Federal entity is finally determined to be entitled under the terms of the Federal award, constituting a debt to the Federal government (this includes a post-delinquency payment agreement) unless other satisfactory payment arrangements have been made. In accordance with 2 C.F.R. § 200.345, failure to pay a debt by the due date, or if there is no due date, within 90 calendar days after demand, shall result in the assessment of interest, penalties and administrative costs in accordance with the provisions of 31 U.S.C. § 3717 and 31 C.F.R. parts 900 through 999. The Council will transfer any debt that is more than 180 days delinquent to the Bureau of the Fiscal Service for debt collection services, a process known as “cross-servicing,” pursuant to 31 U.S.C. § 3711(g), 31 C.F.R. § 285.12 and any Council regulations and policies promulgated pursuant to its authority, and may result in the Council taking further action as specified in Section B.06 “Non-Compliance With Award Provisions” Above. Funds for payment of a debt shall not come from other Federally-sponsored programs. Verification that other Federal funds have not been used will be made (e.g., during on-site visits and audits).
- b. If a non-Federal entity fails to repay a debt within 90 calendar days after the demand, the Council may reduce the debt by: (1) Making an administrative offset against other requests for reimbursements; (2) Withholding advance payments otherwise due to the non-Federal entity; or (3) Other action permitted by Federal statute. *See* 2 C.F.R. § 200.345(a).

### .02 Late Payment Charges

- a. Interest shall be assessed on the delinquent debt in accordance with section 3717(a) of the Debt Collection Act of 1982, as amended (31 U.S.C. § 3701 *et seq.*). The minimum annual interest rate to be assessed is the [Department of the Treasury’s Current Value of Funds Rate \(CVFR\)](#).<sup>11</sup> The CVFR is published by the Department of the Treasury in the [Federal Register](#)<sup>12</sup> and in the [Treasury Financial Manual Bulletin](#).<sup>13</sup> The assessed rate shall remain fixed for the duration of the indebtedness.
- b. Penalties shall accrue at a rate of not more than six percent (6%) per year or such higher rate as authorized by law.
- c. Administrative charges, that is, the costs of processing and handling a delinquent debt, are determined by the Council.

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<sup>11</sup> Department of the Treasury’s Current Value of Funds Rate (CVFR) webpage - [https://www.fiscal.treasury.gov/fsreports/rpt/cvfr/cvfr\\_home.htm](https://www.fiscal.treasury.gov/fsreports/rpt/cvfr/cvfr_home.htm), verified 8/18/2015.

<sup>12</sup> Federal Register website - <http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=FR> and <http://www.federalregister.gov/>, verified 8/18/2015.

<sup>13</sup> Treasury Financial Manual Bulletin website - <http://tfm.fiscal.treasury.gov/v1/bull.html>, verified 8/18/2015.



### **.03 Effect of Judgment Lien on Eligibility for Federal Grants, Loans, or Programs**

Pursuant to 28 U.S.C. § 3201(e), unless waived by the Council a debtor who has a judgment lien against the debtor's property for a debt to the United States shall not be eligible to receive any grant or loan that is made, insured, guaranteed, or financed directly or indirectly by the United States or to receive funds directly from the Federal Government in any program, except funds to which the debtor is entitled as beneficiary, until the judgment is paid in full or otherwise satisfied.

## **K. GOVERNMENTWIDE DEBARMENT AND SUSPENSION**

The non-Federal entity shall comply with the provisions of 2 C.F.R. Part 180, "OMB Guidelines To Agencies on Governmentwide Debarment and Suspension (Nonprocurement)," which generally prohibit entities, and their principals, that have been debarred, suspended, or voluntarily excluded from participating in Federal nonprocurement transactions either through primary or lower tier covered transactions, and which sets forth the responsibilities of recipients of Federal financial assistance regarding transactions with other persons, including subrecipients and contractors.

## **L. LOBBYING RESTRICTIONS**

### **.01 Statutory Provisions**

The non-Federal entity shall comply with 2 C.F.R. § 200.450 ("Lobbying"), which incorporates the provisions of 31 U.S.C. § 1352, the "New Restrictions on Lobbying" published at 55 FR 6736 (February 26, 1990), and OMB guidance and notices on lobbying restrictions. In addition, non-Federal entities must comply with any Council regulations and policies promulgated pursuant to its authority. These provisions prohibit the use of Federal funds for lobbying the executive or legislative branches of the Federal Government in connection with the award, and require the disclosure of the use of non-Federal funds for lobbying. Executive lobbying costs, i.e., costs incurred in attempting to improperly influence<sup>14</sup> either directly or indirectly an employee or officer of the executive branch of the Federal government to give consideration or to act regarding a Federal award or a regulatory matter, are unallowable costs. *See* 2 C.F.R. § 200.450(b) and (c).

### **.02 Disclosure of Lobbying Activities**

The non-Federal entity receiving in excess of \$100,000 in Federal funding shall submit a completed Form SF-LLL or any successor form, "Disclosure of Lobbying Activities," regarding the use of non-Federal funds for lobbying. The Form SF-LLL shall be submitted within 30 days following the end of the calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed. The non-Federal entity must submit any required Forms SF-LLL, including those received from subrecipients, contractors, and subcontractors, to the Grants Officer. *See* 31 U.S.C. § 1352.

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<sup>14</sup> To improperly influence means any influence that induces or tends to induce a Federal employee or officer to give consideration or to act regarding a Federal award or regulatory matter on any basis other than the merits of the matter.

## M. REMEDIES FOR NONCOMPLIANCE

- a. If a non-Federal entity fails to comply with Federal statutes, regulations or the terms and conditions of a Federal award, the Council or pass-through entity may impose additional conditions, as described in 2 C.F.R. § 200.207 “Specific conditions” (e.g., requiring additional reporting or more frequent submission of the Financial or Performance (Technical) Reports; requiring additional activity, project, or program monitoring; requiring the recipient or one or more of its subrecipients to obtain technical or management assistance; or establishing additional actions that require prior approval). If the Council or pass-through entity determines that noncompliance cannot be remedied by imposing additional conditions, pursuant to 2 C.F.R. § 200.338, the Council or pass-through entity may take one or more of the following actions, as appropriate in the circumstances:
  1. Temporarily withhold cash payments pending correction of the deficiency by the non-Federal entity or more severe enforcement action by the Council or pass-through entity.
  2. Disallow (that is, deny both use of funds and any applicable matching credit for) all or part of the cost of the activity or action not in compliance.
  3. Wholly or partly suspend or terminate the Federal award.
  4. Initiate suspension or debarment proceedings as authorized under 2 C.F.R. part 180 and Council regulations (or in the case of a pass-through entity, recommend such a proceeding be initiated by the Council).
  5. Withhold further Federal awards for the project or program.
  6. Take other remedies that may be legally available.

The Council will notify the recipient in writing of the Council’s proposed determination that an instance of non-compliance has occurred, provide details regarding the instance of noncompliance, and indicate the remedy that the Council proposes to pursue. The recipient will then have 30 calendar days to respond and provide information and documentation contesting the Council’s proposed determination or suggesting an alternative remedy. The Council will consider information provided by the recipient and issue a final determination in writing, which will state the Council’s final findings regarding noncompliance and the remedy to be imposed.

- b. RESTORE Act-Specific Remedy for Non-compliance
  1. If the Council determines that the recipient has expended funds to cover the cost of any ineligible activities, in addition to the remedies available in this section, the Council, in coordination with the U.S. Department of Treasury (“Treasury”), will make no additional payments to the recipient from the RESTORE Trust Fund, including no payments from the RESTORE Trust Fund for activities, projects, or programs under any other RESTORE Act Component until the recipient has either (a) deposited an amount equal to the amount expended for the ineligible activities in the RESTORE Trust Fund, or (b) the Council, in coordination with Treasury, has authorized the recipient to expend an equal amount from the recipient’s own funds for an activity that meets the requirements of the RESTORE Act. *See* 33 U.S.C. § 1321(t)(1)(G) and (H), and *see* 31 C.F.R. § 34.804 “Noncompliance.”



2. If the Council determines that the recipient has materially violated the terms of the award, the Council, in coordination with Treasury, will make no additional funds available to the recipient from any part of the RESTORE Trust Fund until the recipient corrects the violation.
  - c. In extraordinary circumstances, the Council may require that any of the remedies above take effect immediately upon notice in writing to the recipient. In such cases, the recipient may contest the Council's determination or suggest an alternative remedy in writing to the Council, and the Council will issue a final determination.
  - d. Instead of, or in addition to, the remedies listed above, the Council may refer the noncompliance to the Treasury OIG for investigation or audit, pursuant to 31 C.F.R. § 34.805 "Treasury Inspector General." The Council will refer all allegations of fraud, waste, or abuse to the Treasury OIG.
  - e. Termination. In accordance with 2 C.F.R. § 200.339, when a Federal award is terminated or partially terminated, both the Council or pass-through entity and the non-Federal entity remain responsible for compliance with the requirements in 2 C.F.R. §§ 200.343 "Closeout" and 200.344 "Post-closeout adjustments and continuing responsibilities."
1. The Federal award may be terminated in whole or in part as follows:
    - i. By the Council or pass-through entity, if a non-Federal entity fails to comply with the terms and conditions of a Federal award;
    - ii. By the Council or pass-through entity for cause;
    - iii. By the Council or pass-through entity with the consent of the non-Federal entity, in which case the two parties will agree upon the termination conditions, including the effective date and, in the case of partial termination, the portion to be terminated; or
    - iv. By the non-Federal entity upon sending to the Council or pass-through entity written notification setting forth the reasons for such termination, the effective date, and, in the case of partial termination, the portion to be terminated. However, if the Council or pass-through entity determines in the case of partial termination that the reduced or modified portion of the Federal award or subaward will not accomplish the purposes for which the Federal award was made, the Council or pass-through entity may terminate the Federal award in its entirety.
  2. The Council or pass-through entity is required to provide a notice of termination to the non-federal entity, pursuant to 2 C.F.R. § 200.340:
    - i. If the Federal award is terminated for the non-Federal entity's failure to comply with the Federal statutes, regulations, or terms and conditions of the Federal award, the notification must state that the termination decision may be considered in evaluating future applications received from the non-Federal entity.
    - ii. Upon termination of a Federal award, the Council will provide the information required under FFATA to the Federal Web site established to fulfill the requirements of FFATA, and update or notify any other relevant governmentwide systems or entities of any indications of poor performance as required by 41 U.S.C. § 417b and 31 U.S.C. § 3321 and implementing guidance at 2 C.F.R. part 77. See also 2 C.F.R. part 180 for the requirements for Suspension and Debarment.

## **N. CODES OF CONDUCT AND SUBAWARD, CONTRACT, AND SUBCONTRACT PROVISIONS**

### **.01 Code of Conduct for Recipients**

- a. The non-Federal entity must immediately report any indication of fraud, waste, abuse or potential criminal activity pertaining to grant funds to the Council, Treasury and the Treasury Inspector General in accordance with the requirements in 31 C.F.R. § 34.803(a).
- b. Pursuant to the certification in Form SF-424B, paragraph 3, or equivalent, the non-Federal entity must maintain written standards of conduct to establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain in the administration of this award.
- c. Non-Federal entities must comply with the requirements of 2 C.F.R. § 200.318 “General procurement standards,” including maintaining written standards of conduct covering conflicts of interest and governing the performance of its employees engaged in the selection, award and administration of contracts. No employee, officer or agent shall participate in the selection, award or administration of a contract supported by a Federal award if he or she has a real or apparent conflict of interest. Such a conflict of interest would arise when the employee, officer or agent, any member of his or her immediate family, his or her partner, or an organization which employs or is about to or planning to employ any of the foregoing parties, has a financial or other interest in or a tangible personal benefit from a firm considered for a contract. The officers, employees and agents of the non-Federal entity must neither solicit nor accept any gratuities, favors or anything of monetary value from contractors or parties to subcontracts. However, non-Federal entities may set written standards of conduct for circumstances in which the financial interest is not substantial or the gift is an unsolicited item of nominal value. Such standards must provide for disciplinary actions to be taken for violations of the standards of conduct by officers, employees or agents of the non-Federal entity.

### **.02 Applicability of Award Provisions to Subrecipients**

- a. The non-Federal entity shall require all subrecipients, including lower tier subrecipients, under the award to comply with the provisions of the award, including applicable cost principles, administrative provisions, audit requirements, and all associated terms and conditions. *See* 2 C.F.R. part 200, Subpart D, “Subrecipient Monitoring and Management” *and see* 2 C.F.R. § 200.101(b)(1). Additionally, the non-Federal entity must perform all responsibilities required of a pass-through entity, as specified in 2 C.F.R. Part 200, including evaluating and documenting a subrecipient’s risk of noncompliance; providing training and technical assistance necessary to complete the subaward activities; monitoring the performance of the subrecipient; and taking any necessary enforcement actions against a noncompliant subrecipient. *See* 2 C.F.R. § 200.331 “Requirements for pass through entities.”
- b. Prior to dispersing funds to a subrecipient, the recipient must execute a legally-binding written agreement with the entity receiving the subaward in accordance with the requirements in 31 C.F.R. § 34.803(c). The written agreement shall extend all applicable program requirements to the subrecipient. The written agreement must include a requirement that the contractor or subrecipient retain all records in compliance with 2 C.F.R. § 200.333.
- c. A non-Federal entity is responsible for subrecipient monitoring, including the following:

1. Federal Award Identification. The non-Federal entity must ensure that each subaward includes the following information and applicable compliance requirements at the time of the subaward. If any of these data elements change, the pass through entity must include the changes in a subsequent subaward modification. When some of this information is not available, the pass-through entity must provide the best information available to describe the Federal award and subaward.
  - i. Subrecipient name (which must match the registered name in DUNS);
  - ii. Subrecipient's DUNS number (*see* 2 C.F.R. § 200.32 "Data Universal Numbering System (DUNS) number");
  - iii. Federal Award Identification Number (FAIN);
  - iv. Federal Award Date (*see* 2 C.F.R. § 200.39 "Federal award date");
  - v. Subaward Period of Performance Start and End Date;
  - vi. Amount of Federal Funds Obligated by this action;
  - vii. Total Amount of Federal Funds Obligated to the subrecipient;
  - viii. Total Amount of the Federal Award;
  - ix. Federal award project description, as required to be responsive to the Federal Funding Accountability and Transparency Act (FFATA);
  - x. Name of Federal awarding agency, pass-through entity and contact information for awarding official;
  - xi. CFDA Number and Name; the pass-through entity must identify the dollar amount made available under each Federal award and the CFDA number at time of disbursement;
  - xii. Identification of whether the award is for research and development (R&D); and
  - xiii. Indirect cost rate for the Federal award (including whether the *de minimis* rate is charged per 2 C.F.R. § 200.414 "Indirect (F&A) costs").
2. Award Monitoring. The non-Federal entity is responsible for oversight of the operations of the Federal award supported activities. The non-Federal entity must monitor its activities under Federal awards to assure that compliance with applicable Federal requirements and performance expectations are being achieved. Monitoring by the non-Federal entity must cover each program, function or activity. *See* 2 C.F.R. §§ 200.328 "Monitoring and reporting program performance," and 200.331 "Requirements for pass-through entities." The non-Federal entity shall monitor activities of the subrecipient through reporting, site visits, regular contact, or other means, as necessary to ensure that the subaward is used solely for authorized purposes, in compliance with Federal statutes, regulations and the terms and conditions of the subaward; and that subaward performance goals are achieved. Pass-through entity monitoring of the subrecipient must include:
  - i. Reviewing financial and programmatic reports required by the pass-through entity.
  - ii. Following-up and ensuring that the subrecipient takes timely and appropriate action on all deficiencies pertaining to the Federal award provided to the subrecipient from the pass-through entity detected through audits, on-site reviews, and other means.
  - iii. Issuing a management decision for audit findings pertaining to the Federal award provided to the subrecipient from the pass-through entity as required by 2 C.F.R. § 200.521 "Management decision."
3. Subrecipient Audits. The non-Federal entity is responsible for ensuring that subrecipients expending \$750,000 or more in Federal awards during the subrecipient's fiscal year have met the audit requirements of 2 C.F.R. part 200, Subpart F, "Audit Requirements," and that the required audits are completed within nine (9) months after the end of the subrecipient's audit period. In addition, the non-Federal entity is required to issue a management decision on audit findings within six (6) months after receipt of the subrecipient's audit report, and to ensure that the

subrecipient takes timely and appropriate corrective action on all audit findings. Pursuant to 2 C.F.R. § 200.505, in cases of continued inability or unwillingness to have an audit conducted in accordance with this part, Federal agencies and pass-through entities must take appropriate action as provided in 2 C.F.R. § 200.338 “Remedies for noncompliance.”

### **.03 Competition and Codes of Conduct for Subawards**

- a. Unless otherwise approved in writing in advance by the Grants Officer, all subawards will be made in a manner to provide, to the maximum extent practicable, open and free competition in accordance with the requirements of 2 C.F.R. §§ 200.317 through 200.326 “Procurement Standards.” The non-Federal entity must be alert to organizational conflicts of interest as well as other practices among subrecipients that may restrict or eliminate competition. In order to ensure objective subrecipient performance and eliminate unfair competitive advantage, subrecipients that develop or draft work requirements, statements of work, or requests for proposals shall be excluded from competing for such subawards.
- b. The non-Federal entity must maintain written standards of conduct covering conflicts of interest and governing the performance of its employees engaged in the selection, award and administration of contracts. No employee, officer, or agent must participate in the selection, award, or administration of a contract supported by a Federal award if he or she has a real or apparent conflict of interest. Such a conflict of interest would arise when the employee, officer, or agent, any member of his or her immediate family, his or her partner, or an organization which employs or is about to or planning to employ any of the foregoing parties, has a financial or other interest in or a tangible personal benefit from a firm considered for a contract. The officers, employees, and agents of the non-Federal entity shall neither solicit nor accept gratuities, favors or anything of monetary value from contractors or parties to subcontracts. However, non-Federal entities may set standards of conduct for circumstances in which the financial interest is not substantial or the gift is an unsolicited item of nominal value. Such standards must provide for disciplinary actions to be taken for violations of the standards of conduct by officers, employees or agents of the non-Federal entity.
- c. If the non-Federal entity has a parent, affiliate or subsidiary organization that is not a State, local government or Indian tribe, the non-Federal entity must also maintain written standards of conduct covering organizational conflicts of interest, wherein relationships with a parent company, affiliate or subsidiary organization cause the non-Federal entity to be or appear to be unable to be impartial in conducting a procurement action involving such related organization.
- d. A financial interest may include employment, stock ownership, a creditor or debtor relationship, or prospective employment with the organization selected or to be selected for a subaward. An appearance of impairment of objectivity may result from an organizational conflict where, because of other activities or relationships with other persons or entities, a person is unable or potentially unable to render impartial assistance or advice. It may also result from non-financial gain to the individual, such as benefit to reputation or prestige in a professional field.

### **.04 Applicability of Provisions to Subawards, Contracts, and Subcontracts**

- a. The non-Federal entity shall include the following notice in each request for applications or bids for a subaward, contract, or subcontract, as applicable:

*Applicants or bidders for a lower tier covered transaction (except procurement contracts for goods and services under \$25,000 not requiring the consent of a Council official) are subject to 2 C.F.R. Part 180, “OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement).” In addition, applicants or bidders for a lower tier covered transaction for a subaward, contract, or subcontract greater than \$100,000 of Federal funds at any tier are subject to relevant statutes, including among others, the provisions of 31 U.S.C. 1352, as well as the common rule, “New Restrictions on Lobbying,” published at 55 FR 6736 (February 26, 1990), including definitions, and the Office of Management and Budget “Governmentwide Guidance for New Restrictions on Lobbying,” and notices published at 54 FR 52306 (December 20, 1989), 55 FR 24540 (June 15, 1990), 57 FR 1772 (January 15, 1992), and 61 FR 1412 (January 19, 1996).*

When the recipient makes a subaward to a subrecipient that is authorized to enter into contracts for the purpose of completing the subaward scope of work, the recipient must require the subrecipient to comply with the requirements contained in this section.

- b. Pursuant to 2 C.F.R. Appendix II to part 200, “Contract Provisions for Non-Federal Entity Contracts Under Federal Awards,” and in addition to other provisions required by the Federal agency or non-Federal entity, all contracts made by the non-Federal entity under the Federal award must contain provisions covering the following, as applicable:
  1. Contracts for more than the Simplified Acquisition Threshold (\$150,000 as of 12-26-2013), which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. § 1908, must address administrative, contractual or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.
  2. All contracts in excess of \$10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be effected and the basis for settlement.
  3. Equal Employment Opportunity. Except as otherwise provided under 41 C.F.R. part 60, all contracts that meet the definition of “Federally assisted construction contract” in 41 C.F.R. part 60-1.3 must include the equal opportunity clause provided under 41 C.F.R. 60-1.4(b), in accordance with EO 11246, “Equal Employment Opportunity” (30 F.R. 12319, 12935, 3 C.F.R. part, 1964-1965 Comp., p. 339), as amended by EO 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and implementing regulations at 41 C.F.R. part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”
  4. Davis-Bacon Act. When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. §§ 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 C.F.R. part 5, “Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction”). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Council. The contracts must also include a provision for compliance with the Copeland “Anti-Kickback” Act (40 U.S.C. § 3145), as supplemented by Department of



Labor regulations (29 C.F.R. part 3, “Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States”). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Council.

5. Contract Work Hours and Safety Standards Act (40 U.S.C. §§ 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704, as supplemented by Department of Labor regulations (29 C.F.R. part 5). Under 40 U.S.C. § 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. § 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.
6. Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of “funding agreement” under 37 C.F.R. § 401.2(a) and the non-Federal entity or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that “funding agreement,” the non-Federal entity or subrecipient must comply with the requirements of 37 C.F.R. part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.
7. Mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201).
8. Debarment and Suspension (Executive Orders 12549 and 12689). A contract award (*see* 2 C.F.R. § 180.220) must not be made to parties listed on the governmentwide Excluded Parties List System in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. part 180 that implement Executive Orders 12549 (3 C.F.R. part 1986 Comp., p. 189) and 12689 (3 C.F.R. part 1989 Comp., p. 235), “Debarment and Suspension.” The Excluded Parties List System in [SAM](#)<sup>15</sup> contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.
9. Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352). Contractors that apply or bid for an award of \$100,000 or more must file the required certification, a “Disclosure of Lobbying Activities” (Form SF-LLL or successor form). Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal

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<sup>15</sup> System for Award Management (SAM) website - <https://www.sam.gov>, verified 8/18/2015.

contract, grant or any other award covered by 31 U.S.C. § 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier-to-tier up to the Federal award recipient. The Form SF-LLL must be submitted within 15 days following the end of the calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed. The non-Federal entity must submit all disclosure forms received, including those that report lobbying activity on its own behalf, to the Grants Officer within 30 days following the end of the calendar quarter.

10. Procurement of recovered materials (section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act). A state agency or agency of a political subdivision of a State and its contractors must comply with requirements of Section 6002 including procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 C.F.R. part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired by the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.
  11. Pilot Program for Enhancement of Employee Whistleblower Protections. The National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2013 (Pub. L. No. 112-239, enacted January 2, 2013 and codified at 41 U.S.C. § 4712) includes a pilot program of whistleblower protection. It applies to all Council awards, subawards, or contracts under awards issued beginning July 1, 2013 through January 1, 2017. Non-Federal entities and contractors under Federal awards and subawards shall inform their employees in writing of the rights and remedies provided under 41 U.S.C. § 4712, in the predominant native language of the workforce. *See* section G.02 (c) of this document.
- c. The recipient must include in its legal agreement or contract with the subrecipient a requirement that the subrecipient make available to the Council, the Treasury OIG, and the GAO any documents, papers or other records, including electronic records, of the subrecipient, that are pertinent to this award, in order to make audits, investigations, examinations, excerpts, transcripts, and copies of such documents. This right also includes timely and reasonable access to the subrecipient's personnel for the purpose of interview and discussion related to such documents. This right of access shall continue as long as records are required to be retained.
  - d. The recipient and any subrecipients, contractors, or subcontractors must comply with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328), as applicable, which limit the political activities of employees whose principal employment activities are funded in whole or in part with federal funds.
  - e. When contracting, the non-Federal entity must take all necessary affirmative steps, as prescribed in 2 C.F.R. § 200.321(b), to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible.

## **.05 Subaward and/or Contract to a Federal Agency**

- a. The non-Federal entity, subrecipient, contractor, and/or subcontractor shall not sub-grant or sub-contract any part of the approved project to any agency or employee of the Council and/or other

Federal department, agency, or instrumentality without the prior written approval of the Grants Officer.

- b. Requests for approval of such action must be submitted in writing to the Grants Officer. The Grants Officer will notify the non-Federal entity in writing of the final determination.

## **O. AMENDMENTS AND CLOSEOUT**

- a. Amendments to an award must be requested in writing and require the written approval of the Grants Officer. The recipient must provide an explanation for the reason an amendment is requested. The Council reserves the right to amend the terms of the award when required by law or regulation.
- b. The non-Federal entity must comply with the closeout requirements as stipulated in 2 C.F.R. § 200.343. Closeout of the award does not affect any of the post-closeout adjustments and continuing responsibilities under 2 C.F.R. § 200.344.

## **P. ENVIRONMENTAL COMPLIANCE**

Environmental impacts must be considered by Federal decision-makers in deciding whether or not to approve: (1) a proposal for Federal assistance; (2) such proposal with mitigation; or (3) a different proposal having less adverse environmental impacts. Federal environmental laws require that the funding agency initiate an early planning process that considers potential impacts that projects funded with Federal assistance may have on the environment. Non-Federal entities must comply with all applicable environmental laws, regulations and policies. Additionally, recipients may be required to assist the Council in complying with laws, regulations and policies applicable to Council actions. Laws, regulations, and policies potentially applicable to Council actions and/or recipients may include but are not limited to the statutes and EOs listed below. The Council does not make independent determinations of compliance with laws such as the Clean Water Act. Rather, the Council may require a recipient to provide information to the Council to demonstrate that the recipient has complied with or will comply with all such requirements. In some cases, if additional information is required after an application is selected, funds may be withheld by the Grants Officer under a special award condition requiring the recipient to submit additional information sufficient to enable the Council to make an assessment regarding compliance with applicable environmental laws, regulations and policies.

If a recipient is permitted to make any subawards, the recipient must include all of the environmental statutes, regulations and EOs listed below in any agreement or contract with a subrecipient, and require the subrecipient to comply with all of these and to notify the recipient if the subrecipient becomes aware of any impact on the environment that was not noted in the recipient's approved application package.

### **.01 The National Environmental Policy Act (42 U.S.C. § 4321 *et seq.*)**

Council approval of financial assistance awards may be subject to the environmental review requirements of the National Environmental Policy Act (NEPA). In such cases, recipients of financial assistance awards may be required to assist the Council in complying with NEPA. For example, applicants may be required to assist the Council by providing information on a proposal's potential environmental impacts, or drafting or supplementing an environmental assessment or environmental impact statement if the Council determines such documentation is required. Independent of the Council's responsibility to comply with



NEPA, where appropriate, projects or programs funded by the Council may trigger Federal agency NEPA compliance duties involving a separate Federal action, such as the issuance of a Federal permit.

## **.02 The Endangered Species Act (16 U.S.C. § 1531 *et seq.*)**

Council approval of financial assistance for project implementation is subject to compliance with section 7 of the Endangered Species Act (ESA). Recipients must identify any impact or activities that may involve a Federally-listed threatened or endangered species, or their designated critical habitat. Section 7 of the ESA requires every Federal agency to ensure that any action it authorizes, funds or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. Federal agencies have the responsibility for ensuring that a protected species or habitat does not incur adverse effects from actions taken under Federal assistance awards, and for conducting the required consultations with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service under the Endangered Species Act, as applicable.

## **.03 Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 *et seq.*)**

Recipients of financial assistance awards must identify to the Council any effects the award may have on essential fish habitat (EFH). Federal agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding the potential effects of their actions, and respond in writing to NMFS recommendations. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH. In addition, NMFS is required to comment on any state agency activities that would impact EFH. Provided the specifications outlined in the regulations are met, EFH consultations will be incorporated into interagency procedures previously established under NEPA, the Endangered Species Act, Clean Water Act, Fish and Wildlife Coordination Act, or other applicable statutes.

## **.04 Clean Water Act Section 404 (33 U.S.C. § 1344 *et seq.*)**

Clean Water Act (CWA) Section 404 regulates the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as levees and some coastal restoration activities), and infrastructure development (such as highways and airports). CWA Section 404 requires a permit from the U.S. Army Corps of Engineers before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from Section 404 regulation (e.g., certain farming and forestry activities).

## **.05 The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712), Bald and Golden Eagle Protection Act (16 U.S.C. § 668 *et seq.*), and Executive Order No. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds**

A number of prohibitions and limitations apply to projects that adversely impact migratory birds and bald and golden eagles. Executive Order 13186 directs Federal agencies to enter a Memorandum of Understanding with the U.S. Fish and Wildlife Service to promote conservation of migratory bird populations when a Federal action will have a measurable negative impact on migratory birds.

## **.06 National Historic Preservation Act (16 U.S.C. § 470 *et seq.*)**

Council approval of financial assistance awards may be subject to Section 106 of the National Historic Preservation Act (NHPA). In such cases, recipients of financial assistance awards may be requested to assist the Council in identifying any adverse effects the award may have on properties included on or eligible for inclusion on the National Register of Historic Places. Pursuant to 36 C.F.R. § 800.2(c)(4), applicants and recipients may also be requested to assist the Council in initiating consultation with State or Tribal Historic Preservation Officers, Indian tribes, Native Hawaiian Organizations or other applicable interested parties as necessary to the Council's responsibilities to identify historic properties, assess adverse effects to them, and determine ways to avoid, minimize or mitigate adverse effects on historic properties.

Pursuant to guidelines issued by the National Park Service under the Abandoned Shipwreck Act (43 U.S.C. §§ 2101-2106), state and Federal agencies whose activities may disturb, alter, damage, or destroy State-owned shipwrecks must take into account the effect of the proposed activity on any state-owned shipwreck and afford the state agencies assigned management responsibility for state-owned shipwrecks a reasonable opportunity to comment on the proposed activity.

## **.07 Clean Air Act (42 U.S.C. § 7401 *et seq.*), Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq.*) (Clean Water Act), and Executive Order 11738 ("Providing for administration of the Clean Air Act and the Federal Water Pollution Control Act with respect to Federal contracts, grants or loans")**

Recipients must comply with the provisions of the Clean Air Act (42 U.S.C. §§ 7401 *et seq.*), Clean Water Act (33 U.S.C. §§ 1251 *et seq.*), and Executive Order 11738. Recipients shall not use a facility that the Environmental Protection Agency (EPA) has placed on EPA's List of Violating Facilities (this list is incorporated into the Excluded Parties List System which is part of SAM) in performing any award that is nonexempt under subpart J of 2 C.F.R. part 1532.

## **.08 The Flood Disaster Protection Act (42 U.S.C. § 4002 *et seq.*)**

Flood insurance, when available, is required for Federally-assisted construction or acquisition in areas having special flood hazards and flood-prone areas. When required, recipients will ensure that flood insurance is secured for their project(s).

## **.09 Executive Order 11988 ("Floodplain Management"), Executive Order 13690 ("Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input"), and Executive Order 11990 ("Protection of Wetlands")**

Recipients must identify proposed actions located in a floodplain and/or wetlands to enable the Council to determine whether there is an alternative to minimize any potential harm. Floodplains are identified through a climate-informed science approach, adding 2-3 feet of elevation to the 100-year floodplain, or using the 500-year floodplain.

## **.10 Executive Order 13112 (“Invasive Species”)**

Federal agencies must identify actions that may affect the status of invasive species and use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them. In addition, an agency may not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere.

## **.11 The Coastal Zone Management Act (16 U.S.C. § 1451 *et seq.*)**

Federally funded projects must be consistent with a coastal state’s approved management program for the coastal zone.

## **.12 The Coastal Barriers Resources Act (16 U.S.C. § 3501 *et seq.*)**

Only in certain circumstances may Federal funding be provided for actions within a Coastal Barrier System. The Coastal Barriers Resources Act generally prohibits new Federal expenditures, including Federal grants, within specific units of the Coastal Barrier Resources System (CBRS). Although the Act restricts Federal expenditures for coastal barrier development, Section 6(a)(6)(A) contains an exemption for projects relating to the study, management, protection, or enhancement of fish and wildlife resources and habitats, including recreational projects. Section 6(a)(6)(G) also exempts nonstructural projects for shoreline stabilization that are designed to mimic, enhance or restore natural stabilization systems. However, care must be taken when interpreting any exemptions described, as they are limited to projects that are consistent with the purpose of this Act as interpreted by the lead agency, Department of Interior. Applicants should work with the U.S. Fish and Wildlife Service, which reviews proposals to determine whether a project falls within a protected unit and if so, whether an exception applies. Maps of the CBRS are available through the interactive U.S. Fish and Wildlife Service [Coastal Barrier Resources System Mapper](http://www.fws.gov/cbra/Maps/Mapper.html).<sup>16</sup>

## **.13 The Wild and Scenic Rivers Act (16 U.S.C. § 1271 *et seq.*)**

This Act applies to awards that may affect existing or proposed components of the National Wild and Scenic Rivers system. Funded projects in the National Wild and Scenic Rivers system must be consistent with Wild and Scenic Rivers Act requirements.

## **.14 The Safe Drinking Water Act (42 U.S.C. § 300 *et seq.*)**

The Sole Source Aquifer program under this statute precludes Federal financial assistance for any project that the EPA determines may contaminate a designated sole source aquifer through a recharge zone so as to create a significant hazard to public health.

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<sup>16</sup> U.S. Fish and Wildlife Service Interactive Coastal Barrier Resources System Mapper - <http://www.fws.gov/cbra/Maps/Mapper.html>, verified 8/18/2015.

### **.15 The Resource Conservation and Recovery Act (42 U.S.C. § 6901 et seq.)**

This act regulates the generation, transportation, treatment, and disposal of hazardous wastes, and also provides that recipients of Federal funds that are state agencies or political subdivisions of states give preference in their procurement programs to the purchase of recycled products pursuant to EPA guidelines.

### **.16 The Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) (42 U.S.C. § 9601 et seq.)**

The Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) (42 U.S.C. § 9601 et seq.), as amended by the Community Environmental Response Facilitation Act, provides the President with broad, discretionary response authorities to address actual and threatened releases of hazardous substances, as well as pollutants and contaminants where there is an imminent and substantial danger to public health and the environment. Section 103 of this Act contains specific reporting requirements and responsibilities and section 117 of the Act contains specific provisions designed to ensure meaningful public participation in the response process.

### **.17 Executive Order 12898 (“Environmental Justice in Minority Populations and Low Income Populations”)**

This Order identifies and addresses adverse human health or environmental effects of programs, policies and activities on low income and minority populations. Consistent with EO 12898, recipients may be requested to help identify and address, as appropriate, disproportionate impacts to low income and minority populations which could result from their project.

### **.18 Rivers and Harbors Act (33 U.S.C. 407)**

A permit may be required from the U.S. Army Corps of Engineers if the proposed activity involves any work in, over or under navigable waters of the United States. Recipients must identify any work (including structures) that will occur in, over or under navigable waters of the United States and obtain the appropriate permit, if applicable.

### **.19 Marine Protection, Research and Sanctuaries Act (Pub. L. 92-532, as amended), National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.), and Executive Order 13089 (“Coral Reef Protection”)**

The Marine Protection, Research and Sanctuaries Act prohibits dumping of material into ocean waters beyond the territorial limit without a permit. Recipients must identify any potential ocean dumping of materials, obtain the appropriate permit, if applicable, and notify the Council. Under the National Marine Sanctuaries Act, Federal agencies are required to protect National Marine Sanctuary resources. Recipients must identify actions that are in or may affect a National Marine Sanctuary and notify the Council. EO 13089 requires that any actions authorized or funded by Federal agencies not degrade the condition of coral reef ecosystems. Recipients must identify any action that might affect a coral reef ecosystem and notify the Council.

## **.20 Executive Order 13653 (“Preparing the United States for the Impacts of Climate Change”)**

This EO requires Federal agencies to identify and support smarter, more climate-resilient investments by States, local communities and tribes, including by providing incentives through agency guidance and grants. Recipients must identify and describe any project elements that promote climate resilience.

## **.21 Farmland Protection Policy Act (7 U.S.C. 4201 et seq.)**

This act requires agency programs, to the extent possible, be compatible with state, local and private programs and policies to protect farmland from irreversible conversion to nonagricultural uses. Recipients must identify any irreversible conversion of farmland to nonagricultural uses as a result of their project.

## **.22 Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)**

During the planning of water resource development projects, agencies are required to give fish and wildlife resources equal consideration with other values. Additionally, the Fish and Wildlife Service and fish and wildlife agencies of States must be consulted whenever waters of any stream or other body of water are “proposed or authorized, permitted or licensed to be impounded, diverted... or otherwise controlled or modified” by any agency under a Federal permit or license.

# **Q. MISCELLANEOUS REQUIREMENTS**

## **.01 Criminal and Prohibited Activities**

- a. The Program Fraud Civil Remedies Act (31 U.S.C. § 3801 *et seq.*), provides for the imposition of civil penalties against persons who make false, fictitious or fraudulent claims to the Federal Government for money (including money representing grants, loans or other benefits).
- b. The False Claims Amendments Act and the False Statements Act (18 U.S.C. §§ 287 and 1001, respectively), provide that whoever makes or presents any false, fictitious or fraudulent statement, representation or claim against the United States shall be subject to imprisonment of not more than five years and shall be subject to a fine in the amount provided by 18 U.S.C. § 287.
- c. The Civil False Claims Act (31 U.S.C. § 3729 *et seq.*), provides that suits can be brought by the government, or a person on behalf of the government, for false claims made under Federal assistance programs.
- d. The Copeland “Anti-Kickback” Act (18 U.S.C. § 874), prohibits a person or organization engaged in a Federally-supported project from enticing an employee working on the project from giving up a part of his compensation under an employment contract. The Copeland “Anti-Kickback” Act also applies to contractors and subcontractors pursuant to 40 U.S.C. § 3145.

## **.02 Political Activities**

The non-Federal entity must comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

### **.03 Drug-Free Workplace**

The non-Federal entity shall comply with the provisions of the Drug-Free Workplace Act of 1988 (Pub. L. No. 100-690, Title V, Sec. 5153, as amended by Pub. L. No. 105-85, Div. A, Title VIII, Sec. 809, as codified at 41 U.S.C. § 8102) and any Council regulations and policies promulgated pursuant to its authority, which require that the non-Federal entity take steps to provide a drug-free workplace.

### **.04 Foreign Travel**

- a. The non-Federal entity may not use funds from this award for travel outside of the United States unless the Grants Officer provides prior written approval. The non-Federal entity shall comply with the provisions of the Fly America Act (49 U.S.C. § 40118). The implementing regulations of the Fly America Act are found at 41 C.F.R. §§ 301-10.131 through 301-10.143.
- b. The Fly America Act requires that Federal travelers and others performing U.S. Government-financed air travel must use U.S. flag air carriers, to the extent that service by such carriers is available. Foreign air carriers may be used only in specific instances, such as when a U.S. flag air carrier is unavailable, or use of U.S. flag air carrier service will not accomplish the agency's mission.
- c. One exception to the requirement to fly U.S. flag carriers is transportation provided under a bilateral or multilateral air transport agreement, to which the United States Government and the government of a foreign country are parties, and which the Department of Transportation has determined meets the requirements of the Fly America Act pursuant to 49 U.S.C. § 40118(b). The United States Government has entered into bilateral/multilateral "Open Skies Agreements" (U.S. Government Procured Transportation) that allow Federally-funded transportation services for travel and cargo movements to use foreign air carriers under certain circumstances. There are multiple "Open Skies Agreements" currently in effect. For more information about the current bilateral and multilateral agreements, visit the [GSA website](#).<sup>17</sup> Information on the Open Skies agreements (U.S. Government Procured Transportation) and other specific country agreements may be accessed via the [Department of State's website](#).<sup>18</sup>
- d. If a foreign air carrier is anticipated to be used for any portion of travel under a Council financial assistance award the non-Federal entity must obtain prior written approval from the Grants Officer. When requesting such approval, the non-Federal entity must provide a justification in accordance with guidance provided by 41 C.F.R. § 301-10.142, which requires the non-Federal entity to provide the Grants Officer with the following: name; dates of travel; origin and destination of travel; detailed itinerary of travel; name of the air carrier and flight number for each leg of the trip; and a statement explaining why the non-Federal entity meets one of the exceptions to the regulations. If the use of a foreign air carrier is pursuant to a bilateral agreement, the non-Federal entity must provide the Grants Officer with a copy of the agreement or a citation to the official agreement available on the GSA website. The Grants Officer shall make the final determination and notify the non-Federal entity in writing. Failure to adhere to the provisions of the Fly America Act will result in the non-Federal entity not being reimbursed for any transportation costs for which the non-Federal entity improperly used a foreign air carrier.

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<sup>17</sup> GSA Fly America Act website - <http://www.gsa.gov/portal/content/103191>, verified 8/18/2015.

<sup>18</sup> Department of State Open Skies Agreements website - <http://www.state.gov/e/eb/tra/ata/index.htm>, verified 8/18/2015.



## **.05 Increasing Seat Belt Use in the United States**

Pursuant to EO 13043, recipients should encourage employees and contractors to enforce on-the-job seat belt policies and programs when operating company-owned, rented or personally owned vehicles.

## **.06 Research Involving Human Subjects**

- a. All proposed research involving human subjects must be conducted in accordance with 15 C.F.R. part 27 “Protection of Human Subjects.” No research involving human subjects is permitted under this award unless expressly authorized by special award condition, or otherwise in writing by the Grants Officer.
- b. Federal policy defines a human subject as a living individual about whom an investigator conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information. Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.
- c. Department of Commerce regulations at 15 C.F.R. part 27, applying to all Federal departments and agencies, require that recipients maintain appropriate policies and procedures for the protection of human subjects. In the event it becomes evident that human subjects may be involved in this project, the non-Federal entity shall submit appropriate documentation to the Federal Program Officer for approval by the appropriate Council officials. This documentation may include:
  1. Documentation establishing approval of the project by an institutional review board (IRB) approved for Federal-wide use under Department of Health and Human Services guidelines (*see also* 15 C.F.R. § 27.103);
  2. Documentation to support an exemption for the project under 15 C.F.R. § 27.101(b);
  3. Documentation to support deferral for an exemption or IRB review under 15 C.F.R. § 27.118;
  4. Documentation of IRB approval of any modification to a prior approved protocol or to an informed consent form.
- d. No work involving human subjects may be undertaken or conducted, or costs incurred and/or charged for human subjects research, until the appropriate documentation is approved in writing by the Grants Officer. Notwithstanding this prohibition, work may be initiated or costs incurred and/or charged to the project for protocol or instrument development related to human subjects research.

## **.07 Federal Employee Expenses**

Federal agencies are generally barred from accepting funds from a non-Federal entity to pay transportation, travel or other expenses for any Federal employee. Use of award funds (Federal or non-Federal) or the non-Federal entity’s provision of in-kind goods or services, for the purposes of transportation, travel or any other expenses for any Federal employee may raise appropriation augmentation issues. In addition, Council policy prohibits the acceptance of gifts, including travel payments for Federal employees, from recipients or applicants, regardless of the source.

## **.08 Minority Serving Institutions Initiative**

Pursuant to EOs 13555 (“White House Initiative on Educational Excellence for Hispanics”), 13270 (“Tribal Colleges and Universities”), and 13532 (“Promoting Excellence, Innovation, and Sustainability at Historically Black Colleges and Universities”), the Council is strongly committed to broadening the participation of minority serving institutions (MSIs) in its financial assistance programs. The Council’s goals include achieving full participation of MSIs in order to advance the development of human potential, strengthen the Nation’s capacity to provide high-quality education, and increase opportunities for MSIs to participate in and benefit from Federal financial assistance programs. The Council encourages all recipients to include meaningful participation of MSIs. Institutions eligible to be considered MSIs are listed on the Department of Education website.

## **.09 Research Misconduct**

The Council adopts, and applies to financial assistance awards for research, the Federal Policy on Research Misconduct (Federal Policy) issued by the Executive Office of the President’s Office of Science and Technology Policy on December 6, 2000 (65 FR 76260). As provided for in the Federal Policy, research misconduct refers to the fabrication, falsification or plagiarism in proposing, performing or reviewing research, or in reporting research results. Research misconduct does not include honest errors or differences of opinion. Non-Federal entities that conduct extramural research funded by the Council must foster an atmosphere conducive to the responsible conduct of sponsored research by safeguarding against and resolving allegations of research misconduct. Non-Federal entities also have the primary responsibility to prevent, detect and investigate allegations of research misconduct and, for this purpose, may rely on their internal policies and procedures, as appropriate, to do so. Federal award funds expended on an activity that is determined to be invalid or unreliable because of research misconduct may result in appropriate enforcement action under the award, up to and including award termination and/or suspension or debarment. The Council requires that any allegation that contains sufficient information to proceed with an inquiry be submitted to the Grants Officer, who will also notify the Treasury OIG of such allegation. Once the non-Federal entity has investigated the allegation, it shall submit its findings to the Grants Officer. The Council may accept the non-Federal entity’s findings or proceed with its own investigation. The Grants Officer will inform the non-Federal entity of the Council’s final determination.

## **.10 Publications, Videos, Signage and Acknowledgment of Sponsorship**

- a. Publication of results or findings in appropriate professional journals and production of video or other media is encouraged as an important method of recording, reporting and otherwise disseminating information and expanding public access to Federally-funded projects (*e.g.*, scientific research).
- b. Recipients are required to submit a copy of any publication materials, including but not limited to print, recorded or Internet materials, to the Council.
- c. When releasing information related to a funded project, recipients must include a statement that the project or effort undertaken was or is sponsored by the Council.
- d. Any signage produced with funds from the award or informing the public about the activities funded in whole or in part by the award, must first be approved in writing by the Grants Officer.
- e. Recipients are responsible for assuring that every publication of material based on, developed under, or otherwise produced under a Council financial assistance award, except scientific articles or papers



appearing in scientific, technical or professional journals, contains the following disclaimer or other disclaimer approved in writing by the Grants Officer:

*This [report/video/etc.] was prepared by [non-Federal entity name] using Federal funds under award [number] from the RESTORE Council. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the RESTORE Council.*

## **.11 Care and Use of Live Vertebrate Animals**

Recipients must comply with the Laboratory Animal Welfare Act of 1966, as amended, (Pub. L. No. 89-544, 7 U.S.C. § 2131 *et seq.*) (animal acquisition, transport, care, handling, and use in projects), and implementing regulations, 9 C.F.R. Parts 1, 2, and 3; the Endangered Species Act (16 U.S.C. § 1531 *et seq.*); Marine Mammal Protection Act (16 U.S.C. § 1361 *et seq.*) (taking possession, transport, purchase, sale, export or import of wildlife and plants); the Nonindigenous Aquatic Nuisance Prevention and Control Act (16 U.S.C. § 4701 *et seq.*) (ensure preventive measures are taken or that probable harm of using species is minimal if there is an escape or release); and all other applicable statutes pertaining to the care, handling and treatment of warm-blooded animals held for research, teaching or other activities supported by Federal financial assistance. No research involving vertebrate animals is permitted under any Council financial assistance award without the prior written approval of the Grants Officer.

## **.12 Homeland Security Presidential Directive 12**

If the performance of a grant award requires non-Federal entity personnel to have routine access to Federally-controlled facilities and/or Federally-controlled information systems (for purpose of this term “routine access” is defined as more than 180 days), such personnel must undergo the personal identity verification credential process. In the case of foreign nationals, the Council will conduct a check with U.S. Citizenship and Immigration Services’ (USCIS) Verification Division, a component of the Department of Homeland Security (DHS), to ensure that the individual is in a lawful immigration status and that he or she is eligible for employment within the United States. Any items or services delivered under a financial assistance award shall comply with the Council personal identity verification procedures that implement Homeland Security Presidential Directive 12, “Policy for a Common Identification Standard for Federal Employees and Contractors,” FIPS PUB 201, and OMB Memorandum M-05-24. The non-Federal entity shall ensure that its subrecipients and contractors (at all tiers) performing work under this award comply with the requirements contained in this term. The Grants Officer may delay final payment under an award if the subrecipient or contractor fails to comply with the requirements provided below. The non-Federal entity shall insert the following term in all subawards and contracts when the subaward non-Federal entity or contractor is required to have routine physical access to a Federally-controlled facility or routine access to a Federally-controlled information system:

- a. *The subrecipient or contractor shall comply with the Council personal identity verification procedures identified in the subaward or contract that implement Homeland Security Presidential Directive 12 (HSPD-12), Office of Management and Budget (OMB) Guidance M-05-24, as amended, and Federal Information Processing Standards Publication (FIPS PUB) Number 201, as amended, for all employees under this subaward or contract who require routine physical access to a Federally-controlled facility or routine access to a Federally-controlled information system.*
- b. *The subrecipient or contractor shall account for all forms of Government-provided identification issued to the subrecipient or contractor employees in connection with performance under this subaward or contract. The subrecipient or contractor shall return such identification to the issuing agency at the earliest of any of the following, unless otherwise determined by the Council: (1) When*

*no longer needed for subaward or contract performance; (2) Upon completion of the subrecipient or contractor employee's employment; or (3) Upon subaward or contract completion or termination.*

### **.13 Compliance with Department of Commerce Bureau of Industry and Security Export Administration Regulations**

- a. This clause applies to the extent that this financial assistance award involves access to export-controlled items.
- b. In performing this financial assistance award, the non-Federal entity may gain access to items subject to export control (export-controlled items) under the Export Administration Regulations (EAR). The non-Federal entity is responsible for compliance with all applicable laws and regulations regarding export-controlled items, including the EAR's deemed exports and reexports provisions. The non-Federal entity shall establish and maintain effective export compliance procedures at Council and non-Council facilities throughout performance of the financial assistance award. At a minimum, these export compliance procedures must include adequate controls of physical, verbal, visual, and electronic access to export-controlled items, including by foreign nationals.
- c. Definitions
  - 1. Export-controlled items. Items (commodities, software, or technology), that are subject to the EAR (15 C.F.R. §§ 730-774), implemented by the Department of Commerce's Bureau of Industry and Security. These are generally known as "dual-use" items, items with both a military and commercial application.
  - 2. Deemed Export/Reexport. The EAR defines a deemed export as a release of export-controlled items (specifically, technology or source code) to a foreign national in the U.S. Such release is "deemed" to be an export to the home country of the foreign national. 15 C.F.R. § 734.2(b)(2)(ii). A release may take the form of visual inspection, oral exchange of information, or the application abroad of knowledge or technical experience acquired in the U.S. If such a release occurs abroad, it is considered a deemed reexport to the foreign national's home country. Licenses may be required for deemed exports or reexports.
- d. The non-Federal entity shall control access to all export-controlled items that it possesses or that comes into its possession in performance of this financial assistance award, to ensure that access to, or release of, such items are restricted, or licensed, as required by applicable Federal laws, EOs, and/or regulations, including the EAR.
- e. As applicable, non-Federal entity personnel and associates at Council sites shall be informed of any procedures to identify and protect export-controlled items.
- f. To the extent the non-Federal entity wishes to provide foreign nationals with access to export-controlled items, the non-Federal entity shall be responsible for obtaining any necessary licenses, including licenses required under the EAR for deemed exports or deemed reexports.
- g. Nothing in the terms of this financial assistance award is intended to change, supersede, or waive the requirements of applicable Federal laws, EOs or regulations.
- h. Compliance with the foregoing will not satisfy any legal obligations the non-Federal entity may have regarding items that may be subject to export controls administered by other agencies such as the Department of State, which has jurisdiction over exports of munitions items subject to the

International Traffic in Arms Regulations (ITAR) (22 C.F.R. §§ 120-130), including releases of such items to foreign nationals.

- i. The non-Federal entity shall include this Subsection .13, including this Subparagraph i, in all lower tier transactions (subawards, contracts, and subcontracts) under this financial assistance award that may involve access to export-controlled items.

#### **.14 The Trafficking Victims Protection Act of 2000 (22 U.S.C. 7104(g)), as amended, and the implementing regulations at 2 C.F.R. part 175**

The Trafficking Victims Protection Act of 2000 authorizes termination of financial assistance provided to a private entity, without penalty to the Federal Government, if the non-Federal entity engages in certain activities related to trafficking in persons. The Council incorporates the following award term required by [2 C.F.R. § 175.15\(b\)](#).<sup>19</sup>

Award Term from 2 C.F.R. § 175.15(b):

##### **I. Trafficking in persons.**

- a. Provisions applicable to a non-Federal entity that is a private entity.
  1. You as the non-Federal entity, your employees, subrecipients under this award, and subrecipients' employees may not—
    - i. Engage in severe forms of trafficking in persons during the period of time that the award is in effect;
    - ii. Procure a commercial sex act during the period of time that the award is in effect; or
    - iii. Use forced labor in the performance of the award or subawards under the award.
  2. We as the Federal awarding agency may unilaterally terminate this award, without penalty, if you or a subrecipient that is a private entity —
    - i. Is determined to have violated a prohibition in paragraph a.1 of this award term; or
    - ii. Has an employee who is determined by the agency official authorized to terminate the award to have violated a prohibition in paragraph a.1 of this award term through conduct that is either— (A) Associated with performance under this award; or (B) Imputed to you or the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 C.F.R. Part 180, “OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement),” as implemented by our agency at 2 C.F.R. Part 1326, “Nonprocurement Debarment and Suspension.”
- b. Provision applicable to a non-Federal entity other than a private entity. We as the Federal awarding agency may unilaterally terminate this award, without penalty, if a subrecipient that is a private entity—
  1. Is determined to have violated an applicable prohibition in paragraph a.1 of this award term; or
  2. Has an employee who is determined by the agency official authorized to terminate the award to have violated an applicable prohibition in paragraph a.1 of this award term through conduct that is either—
    - i. Associated with performance under this award; or

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<sup>19</sup> See 2 C.F.R. § 175.15(b) - <http://www.gpo.gov/fdsys/pkg/CFR-2012-title2-vol1/pdf/CFR-2012-title2-vol1-sec175-15.pdf>, verified 8/18/2015.

- ii. Imputed to the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 C.F.R. Part 180, “OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement),” as implemented by our agency at 2 C.F.R. Part 1326, “Nonprocurement Debarment and Suspension.”
- c. Provisions applicable to any non-Federal entity.
  - 1. You must inform us immediately of any information you receive from any source alleging a violation of a prohibition in paragraph a.1 of this award term.
  - 2. Our right to terminate unilaterally that is described in paragraph a.2 or b of this section:
    - i. Implements section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 U.S.C. 7104(g)), and
    - ii. Is in addition to all other remedies for noncompliance that are available to us under this award.
  - 3. You must include the requirements of paragraph a.1 of this award term in any subaward you make to a private entity.
- d. Definitions. For purposes of this award term:
  - 1. Employee means either:
    - i. An individual employed by you or a subrecipient who is engaged in the performance of the project or program under this award; or
    - ii. Another person engaged in the performance of the project or program under this award and not compensated by you including, but not limited to, a volunteer or individual whose services are contributed by a third party as an in-kind contribution toward cost sharing or matching requirements.
  - 2. Forced labor means: labor obtained by any of the following methods: the recruitment, harboring, transportation, provision, or obtaining of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery.
  - 3. Private entity:
    - i. Means any entity other than a State, local government, Indian tribe, or foreign public entity, as those terms are defined in 2 C.F.R. 175.25;
    - ii. Includes: (A) A nonprofit organization, including any nonprofit institution of higher education, hospital, or tribal organization other than one included in the definition of Indian tribe at 2 C.F.R. 175.25(b); and (B) A for-profit organization.
  - 4. “Severe forms of trafficking in persons,” “commercial sex act,” and “coercion” have the meanings given at section 103 of the TVPA, as amended (22 U.S.C. 7102).

## **.15 The Federal Funding Accountability and Transparency Act of 2006 (“Transparency Act” or FFATA)—Public Law 109-282, as amended by section 6202(a) of Public Law 110-252 (31 U.S.C. 6101)**

- a. Searchable Website Requirements. The Federal Funding Accountability and Transparency Act of 2006 (FFATA) requires information on Federal awards (Federal financial assistance and expenditures) be made available to the public via a single, searchable website. This information is available at the [USA Spending website](http://USA.Spending.gov).<sup>20</sup> Recipients and subrecipients must include the following required data elements in their application:

<sup>20</sup> USA Spending.gov website - [www.USA.Spending.gov](http://www.USA.Spending.gov), verified 8/18/2015.

- Name of entity receiving award;
  - Award amount;
  - Transaction type, funding agency, Catalog of Federal Domestic Assistance Number, and descriptive award title;
  - Location of entity, primary location of performance (City/State/Congressional District/Country); and
  - Unique identifier of entity.
- b. Reporting Subawards and Executive Compensation. Prime grant recipients awarded a new Federal grant greater than or equal to \$25,000 on or after October 1, 2010, other than those funded by the Recovery Act, are subject to FFATA subaward reporting requirements as outlined in the OMB guidance issued August 27, 2010. The prime non-Federal entity is required to file a FFATA subaward report by the end of the month following the month in which the prime non-Federal entity awards any sub-grant greater than or equal to \$25,000. *See* Pub. L. No. 109-282, as amended by section 6202(a) of Pub. L. No. 110-252 (*see* 31 U.S.C. 6101 note). The reporting requirements are located in Appendix A of [2 C.F.R. Part 170](#).<sup>21</sup>

Award Term from Appendix A of 2 C.F.R. Part 170:

I. Reporting Subawards and Executive Compensation.

- a. Reporting of first-tier subawards.
  1. Applicability. Unless you are exempt as provided in paragraph d. of this award term, you must report each action that obligates \$25,000 or more in Federal funds that does not include Recovery funds (as defined in section 1512(a)(2) of the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5) for a subaward to an entity (*see* definitions in paragraph e. of this award term).
  2. Where and when to report.
    - i. You must report each obligating action described in paragraph a.1 of this award term to the FFATA Subaward Reporting System ([FSRS](#)).<sup>22</sup>
    - ii. For subaward information, report no later than the end of the month following the month in which the obligation was made. (For example, if the obligation was made on November 7, 2010, the obligation must be reported by no later than December 31, 2010.)
  3. What to report. You must report the information about each obligating action that the submission instructions posted at the [FSRS](#) website specify.
- b. Reporting Total Compensation of Non-Federal Entity Executives.
  1. Applicability and what to report. You must report total compensation for each of your five most highly compensated executives for the preceding completed fiscal year, if—
    - i. the total Federal funding authorized to date under this award is \$25,000 or more;
    - ii. in the preceding fiscal year, you received—
      - (A) 80 percent or more of your annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 C.F.R. 170.320 (and subawards); and
      - (B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 C.F.R. 170.320 (and subawards); and

<sup>21</sup> 2 C.F.R. § 170.320 on GPO website - <http://www.gpo.gov/fdsys/pkg/CFR-2011-title2-vol1/pdf/CFR-2011-title2-vol1-part170-appA.pdf>, verified 8/18/2015.

<sup>22</sup> Federal Funding Accountability and Transparency Act Subaward Reporting System - <http://www.fsrs.gov>, verified 8/18/2015.

- iii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, *see* the [U.S. Security and Exchange Commission](#) total compensation filings.<sup>23</sup>)
  - 2. Where and when to report. You must report executive total compensation described in paragraph b.1 of this award term:
    - i. As part of your registration profile in the System for Award Management ([SAM](#)),<sup>24</sup> and
    - ii. By the end of the month following the month in which this award is made, and annually thereafter.
- c. Reporting of Total Compensation of Subrecipient Executives.
  - 1. Applicability and what to report. Unless you are exempt as provided in paragraph d. of this award term, for each first-tier subrecipient under this award, you shall report the names and total compensation of each of the subrecipient's five most highly compensated executives for the subrecipient's preceding completed fiscal year, if—
    - i. In the subrecipient's preceding fiscal year, the subrecipient received—
      - (A) 80 percent or more of its annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 C.F.R. 170.320 (and subawards); and
      - (B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts), and Federal financial assistance subject to the Transparency Act (and subawards); and
    - ii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, *see* the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/execomp.htm>.)
  - 2. Where and when to report. You must report subrecipient executive total compensation described in paragraph c.1. of this award term:
    - i. To the non-Federal entity.
    - ii. By the end of the month following the month during which you make the subaward. For example, if a subaward is obligated on any date during the month of October of a given year (i.e., between October 1 and 31), you must report any required compensation information of the subrecipient by November 30 of that year.
- d. Exemptions. If, in the previous tax year, you had gross income, from all sources, under \$300,000, you are exempt from the requirements to report: i. Subawards, and ii. The total compensation of the five most highly compensated executives of any subrecipient.
- e. Definitions. For purposes of this award term:
  - 1. Entity means all of the following, as defined in 2 C.F.R. part 25:
    - i. A Governmental organization, which is a State, local government, or Indian tribe;
    - ii. A foreign public entity;
    - iii. A domestic or foreign nonprofit organization;
    - iv. A domestic or foreign for-profit organization;

<sup>23</sup> U.S. Security and Exchange Commission Executive Compensation “Fast Facts” - <http://www.sec.gov/answers/execomp.htm>, verified on 8/18/2015.

<sup>24</sup> System for Award Management (SAM) - <https://www.sam.gov>, verified on 8/18/2015.



- v. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.
  - 2. Executive means officers, managing partners, or any other employees in management positions.
  - 3. Subaward:
    - i. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the non-Federal entity award to an eligible subrecipient.
    - ii. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, *see* 2 C.F.R. § 200.330).
    - iii. A subaward may be provided through any legal agreement, including an agreement that you or a subrecipient considers a contract.
  - 4. Subrecipient means an entity that:
    - i. Receives a subaward from you (the non-Federal entity) under this award; and
    - ii. Is accountable to you for the use of the Federal funds provided by the subaward.
  - 5. Total compensation means the cash and noncash dollar value earned by the executive during the non-Federal entity's or subrecipient's preceding fiscal year and includes the following (for more information *see* 17 C.F.R. 229.402(c)(2)):
    - i. Salary and bonus.
    - ii. Awards of stock, stock options, and stock appreciation rights. Use the dollar amount recognized for financial statement reporting purposes with respect to the fiscal year in accordance with the Statement of Financial Accounting Standards No. 123 (Revised 2004) (FAS 123R), Shared Based Payments.
    - iii. Earnings for services under non-equity incentive plans. This does not include group life, health, hospitalization or medical reimbursement plans that do not discriminate in favor of executives, and are available generally to all salaried employees.
    - iv. Change in pension value. This is the change in present value of defined benefit and actuarial pension plans.
    - v. Above-market earnings on deferred compensation which is not tax-qualified.
    - vi. Other compensation, if the aggregate value of all such other compensation (e.g. severance, termination payments, value of life insurance paid on behalf of the employee, perquisites or property) for the executive exceeds \$10,000.
- c. System for Award Management (SAM) and Universal Identifier requirements.
- 1. Requirement for SAM. Unless you are exempted from this requirement under 2 C.F.R. § 25.110, you as the recipient must maintain the currency of your information in the SAM until you submit the final financial report required under this award or receive the final payment, whichever is later. This requires that you review and update the information at least annually after the initial registration, and more frequently if required by changes in your information or another award term.
  - 2. Requirement for unique entity identifier. If you are authorized to make subawards under this award, you:
    - i. Must notify potential subrecipients that no entity (see definition in paragraph C of this award term) may receive a subaward from you unless the entity has provided its unique entity identifier to you.
    - ii. May not make a subaward to an entity unless the entity has provided its unique entity identifier to you.

3. Definitions for purposes of this award term:

- i. System for Award Management (SAM) means the Federal repository into which an entity must provide information required for the conduct of business as a recipient. Additional information about registration procedures may be found at the System for Award Management [Internet site](#).<sup>25</sup>
- ii. Unique entity identifier means the identifier required for SAM registration to uniquely identify business entities.
- iii. Entity, as it is used in this award term, means all of the following, as defined at 2 C.F.R. part 25, subpart C:
  - (A) A Governmental organization, which is a State, local government, or Indian Tribe;
  - (B) A foreign public entity;
  - (C) A domestic or foreign nonprofit organization;
  - (D) A domestic or foreign for-profit organization; and
  - (E) A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.
- iv. Subaward:
  - (A) This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the non-Federal entity award to an eligible subrecipient.
  - (B) The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, *see* 2 C.F.R. § 200.330).
  - (C) A subaward may be provided through any legal agreement, including an agreement that you consider a contract.
- v. Subrecipient means an entity that:
  - (A) Receives a subaward from you under this award; and
  - (B) Is accountable to you for the use of the Federal funds provided by the subaward.

## **.16 Federal Financial Assistance Planning During a Funding Hiatus or Government Shutdown**

This term sets forth initial guidance that will be implemented for Federal assistance awards in the event of a lapse in appropriations, or a government shutdown. The Grants Officer may issue further guidance prior to an anticipated shutdown.

- a. Unless there is an actual rescission of funds for specific grant obligations, recipients of Federal financial assistance awards for which funds have been obligated generally will be able to continue to perform and incur allowable expenses under the award during a funding hiatus. Recipients are advised that ongoing activities by Federal employees involved in grant administration (including payment processing) or similar operational and administrative work cannot continue when there is a funding lapse. Therefore, there may be delays, including payment processing delays, in the event of a shutdown.
- b. All award actions will be delayed during a government shutdown; if it appears that a non-Federal entity's performance under a grant or cooperative agreement will require agency involvement, direction or clearance during the period of a possible government shutdown, the Program Officer or

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<sup>25</sup> System for Award Management (SAM) - <https://www.sam.gov>, verified on 8/18/2015.



Grants Officer, as appropriate, may attempt to provide such involvement, direction, or clearance prior to the shutdown or advise recipients that such involvement, direction, or clearance will not be forthcoming during the shutdown. Accordingly, recipients whose ability to withdraw funds is subject to prior agency approval, which in general are recipients that have been designated high risk, recipients of construction awards, or are otherwise limited to reimbursements or subject to agency review, will be able draw funds down from the relevant Automatic Standard Application for Payment (ASAP) account only if agency approval is given and coded into ASAP prior to any government shutdown or closure. This limitation may not be lifted during a government shutdown. Recipients should plan to work with the Grants Officer to request prior approvals in advance of a shutdown wherever possible. Recipients whose authority to draw down award funds is restricted may decide to suspend work until the government reopens.

- c. The ASAP system may remain operational during a government shutdown. As applicable, recipients that do not require Council approval to draw down advance funds from their ASAP accounts may be able to do so during a shutdown. The 30-day limitation on the drawdown of advance funds will apply notwithstanding a government shutdown and advanced funds held for more than 30 days shall be returned with interest.

## **R. CERTIFICATIONS**

At a minimum, the non-Federal entity must comply with the certifications and requirements in 31 C.F.R. § 34.802, assurances (Forms SF-424B and SF-424D, or equivalent, as applicable), and any required Council-specific certifications. Other certifications may be required by 2 C.F.R. part 200. Certifications must be signed by an authorized senior official of the entity receiving grant funds who can legally bind the organization or entity, and who has oversight for the administration and use of the funds in question.

## **ADCNR SUBAWARD GRANT AGREEMENT**

STATE OF ALABAMA

ADCNR Grant #: S1P08-ABMS

MONTGOMERY COUNTY

**SUBAWARD GRANT AGREEMENT – AMENDMENT NO. 1**

THIS SUBAWARD GRANT AGREEMENT, ("Agreement") is made and entered into by and between the State of Alabama Department of Conservation and Natural Resources (hereinafter "ADCNR") and the Dauphin Island Water and Sewer Authority (DIWSA) (hereinafter "Subrecipient"). Pursuant to this Agreement, ADCNR and Subrecipient (collectively hereinafter "Parties") agree as follows:

1. **PROJECT PURPOSE AND IDENTITY:** The purpose of this Agreement is to provide funding under the Resources and Ecosystem Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (hereinafter "RESTORE Act") to Subrecipient for implementation of the RESTORE Act Direct Component project titled "State Expenditure Plan #8: Aloe Bay/Mississippi Sound Water Quality Enhancement Project" (hereinafter "Project"). The purpose of this project is to design and construct a new Biological Nutrient Removal (BNR) water reclamation facility replacing the existing 0.98 MGD wastewater treatment facility currently owned and operated by the DIWSA, further described in the Federal Award GNSSP21AL0014-01-01. This Agreement between the Parties will be identified by the "ADCNR Grant Number" set forth above in the upper right corner of this Agreement. All invoices and other correspondence submitted to ADCNR in connection with this Agreement must be identified by said Grant Number.

This Amendment No. 1 is for an existing grant for the Alabama Department of Conservation and Natural Resources (ADCNR), Grant No. GNSSP21AL0014-01-01, Aloe Bay/Mississippi Sound Water Quality Enhancement Project Amendment No. 1. This amendment executes the following suite of actions:

- This amendment adds \$8,015,000.00 in Restore Funding increasing the total amount of Restore funding to \$19,860,000.00;
  - Revises Special Award Conditions #5 and #6; and
  - All other terms & conditions stated in the original award & any previous amendments remain in effect.
2. **FEDERAL AWARD INFORMATION:** The Project's Financial Assistance Award (hereinafter "Federal Award") in its entirety is hereby incorporated into this Agreement by reference. Information as to the Federal Award associated with the Project includes the following:
    - a. Federal Award Identification Number (FAIN): GNSSP21AL0014
    - b. Federal Award Period of Performance: 10/01/2019 to 12/17/2025
    - c. Total Amount of Federal Funds Obligated To Subrecipient: \$19,545,000.00
    - d. Subrecipient UEI: ZAUBZA6SJ3H1
    - e. Total Amount of Federal Award: \$19,860,000.00
    - f. Name of Federal Awarding Agency: Gulf Coast Ecosystem Restoration Council (hereinafter "RESTORE Council")
    - g. Pass-Through Entity & Awarding Official Contact Information:  
Alabama Department of Conservation and Natural Resources  
Commissioner Christopher M. Blankenship  
64 N. Union Street; Suite 468  
Montgomery, AL 36130
    - h. CFDA Number & Name: CFDA# 87.052 "Spill Impact Component Project Grants"
    - i. Indirect Cost Rate of Subrecipient: 0%

3. AGREEMENT FUNDING AMOUNT: ADCNR's funding commitment under this Agreement shall be within the budgetary limits as described herein and pursuant to the Federal Award and shall not exceed a total of nineteen million five hundred forty-five thousand and xx/100 dollars (\$19,545,000.00).
4. PROJECT PERIOD: The period allowed for Project completion by the Subrecipient (hereinafter "Project Period") shall commence when it is executed by both Parties and end on December 17, 2025.
5. AGREEMENT TERM: The term of this Agreement shall commence when the Agreement is executed by both Parties and end on December 17, 2025 (hereinafter "Agreement Term").
6. NOTICE: Contact information of Parties for purposes of providing notice pursuant to the terms of this Agreement are set forth below. In the event the designation of new contact information is necessary, such shall not require a formal amendment to this Agreement.

To ADCNR:

Alabama Department of Conservation and Natural Resources  
Attn: Christopher M. Blankenship, Commissioner  
64 N. Union St., Suite 468  
Montgomery, AL 36130

With a copy to:

Dr. Amy Hunter  
Deepwater Horizon Restoration Coordinator  
Alabama Department of Conservation and Natural Resources  
31115 Five Rivers Boulevard  
Spanish Fort, AL 36527  
Email: [amy.hunter@dcnr.alabama.gov](mailto:amy.hunter@dcnr.alabama.gov)

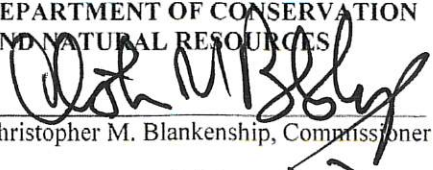
To Subrecipient:

Vaile Feemster - General Manager  
Dauphin Island Water and Sewer  
PO Box 400  
908 Alabama Avenue  
Dauphin Island, AL 36528  
[diwsa@aol.com](mailto:diwsa@aol.com)

7. PARTIES REPRESENT THAT THIS AGREEMENT SUPERSEDES ALL PROPOSALS, ORAL AND WRITTEN, ALL PREVIOUS CONTRACTS, AGREEMENTS, NEGOTIATIONS AND ALL OTHER COMMUNICATIONS BETWEEN THE PARTIES WITH RESPECT TO THE SUBJECT MATTER HEREOF.
8. DOCUMENTS: The documents which comprise this Agreement between ADCNR and the Subrecipient are:
  1. This Subaward Agreement;
  2. The Amendment for the existing grant for the Alabama Department of Conservation and Natural Resources (ADCNR), Grant No. GNSSP21AL0014-01-01 and any RESTORE Council-specific Special Award Conditions.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their respective officers thereunto duly authorized as of the date entered below.

STATE OF ALABAMA  
DEPARTMENT OF CONSERVATION  
AND NATURAL RESOURCES

  
Christopher M. Blankenship, Commissioner

Date:

7-27-23

DAUPHIN ISLAND WATER &  
SEWER AUTHORITY (DIWSA)

  
Vaile Feemster, General Manager

Date:

July 17, 2023

Reviewed By Accounting

  
DCNR Accounting Director

APPROVED LEGAL

gtal / neb

AL-06/22/2023

Subrecipient Name: Dauphin Island Water and Sewer Authority (DIWSA). UEI: ZAUBZA6SJ3H1

Title of Grant Project: State Expenditure Plan #8: Aloe Bay/Mississippi Sound Water Quality Enhancement Project

**Attachment**  
**Federal Award Identification**

The entity identified in this agreement is a subrecipient of a subaward, in accordance with 2 CFR 200.332. Be advised, the following information describes the Federal award and subaward:

<b>(I) Federal Award Identification</b>	
(i.) Subrecipient name	Dauphin Island Water and Sewer Authority (DIWSA)
(ii.) Subrecipient's unique entity identifier	UEI: ZAUBZA6SJ3H1
(iii.) Federal Award Identification Number (FAIN);	GNSSP21AL0014
(iv.) Federal Award Date (see §200.39 Federal award date) of award to the recipient by the Federal agency;	06/22/2023
(v.) Subaward Period of Performance Start and End Date;	This agreement shall commence when it is executed by both Parties and end on December 17, 2025.
(vi.) Amount of Federal Funds Obligated by this action by the pass-through entity to the subrecipient;	\$19,545,000.00
(vii.) Total Amount of Federal Funds Obligated to the subrecipient by the pass-through entity including the current obligation;	\$19,545,000.00
(viii.) Total Amount of the Federal Award committed to the subrecipient by the pass-through entity;	\$19,545,000.00
(ix.) Federal award project description, as required to be responsive to the Federal Funding Accountability and Transparency Act (FFATA);	The purpose of this project is to design and construct a new Biological Nutrient Removal (BNR) water reclamation facility replacing the existing 0.98 MGD wastewater treatment facility currently owned and operated by the DIWSA.
(x.) Name of Federal awarding agency, Name of pass-through entity, and contact information for awarding official of the pass-through entity.	Gulf Coast Ecosystem Restoration Council, Alabama Department of Conservation and Natural Resources, Christopher M. Blankenship Chris.blankenship@dcnr.alabama.gov
(xi.) CFDA Number and Name; the pass-through entity must identify the dollar amount made available under each Federal award and the CFDA number at time of disbursement;	CFDA # 87.052 "Spill Impact Component Project Grants" - total Federal Award issued to ADCNR, which is registered in SAM with the UEI: <u>WLNMNKHKF5T1</u> is <u>\$19,860,000.00</u> .
(xii.) Identification of whether the award is R&D; and	This is not a R&D award.
(xiii.) Indirect cost rate for the Federal award (including if the de minimis rate if charged per §200.414 Indirect (F&A) costs).	The indirect cost rate for the Federal award is 27.39%.

## **APPENDIX II TO 2 CFR PART 200: CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS**

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In addition to other provisions required by the Federal agency or non-Federal entity, all contracts made by the non-Federal entity under the Federal award must contain provisions covering the following, as applicable.

(A) Contracts for more than the simplified acquisition threshold, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

(B) All contracts in excess of \$10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be effected and the basis for settlement.

(C) Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of “federally assisted construction contract” in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, “Equal Employment Opportunity” (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and implementing regulations at 41 CFR part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”

(D) Davis-Bacon Act, as amended (40 USC 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 USC. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, “Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction”). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland “Anti-Kickback” Act (40 USC. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, “Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States”). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

(E) Contract Work Hours and Safety Standards Act (40 USC 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 USC 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 USC 3702 of

the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 USC 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

(F) Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of “funding agreement” under 37 CFR §401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that “funding agreement,” the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.

(G) Clean Air Act (42 USC 7401-7671q.) and the Federal Water Pollution Control Act (33 USC 1251-1387), as amended—Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 USC 7401-7671q) and the Federal Water Pollution Control Act as amended (33 USC 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

(H) Debarment and Suspension (Executive Orders 12549 and 12689)—A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

(I) Byrd Anti-Lobbying Amendment (31 USC 1352)—Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 USC 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

(J) See §200.323.

(K) See §200.216.

(L) See §200.322.



## **LABOR STANDARDS SUPPLEMENTARY CONDITIONS TO THE CONSTRUCTION CONTRACT**

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The project or program to which the construction work covered by this Contract pertains is funded in whole or in part by the United States of America. The following Federal Labor Standards provisions are included in this contract, as required by provisions applicable to such Federal assistance. Any statute or regulation contained herein shall also include any subsequent amendment or successor statute or regulation. The terms of these Labor Standards Supplementary Conditions takes precedence over all provisions that may be inconsistent with said Labor Standards Supplementary Conditions. The following sections are included in these Labor Standards Supplementary Conditions:

**SECTION A: Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction (29 CFR §5.5(a))**

**SECTION B: Contract Work Hours and Safety Standards Act (29 CFR §5.5(b))**

**SECTION C: 29 CFR Part 3: CONTRACTORS AND SUBCONTRACTORS ON PUBLIC BUILDING OR PUBLIC WORK FINANCED IN WHOLE OR IN PART BY LOANS OR GRANTS FROM THE UNITED STATES (Anti-Kickback Regulations, Copeland Act)**

**LISTING OF APPENDICES:**

**Appendix A – Davis-Bacon Poster (WH-1321)**

**Appendix B – U. S. Department of Labor Wage and Hour Division Payroll Reporting Form (WH-347)**

**Appendix C – Instructions for U. S. Department of Labor Wage and Hour Division Payroll Form (WH-347)**

**Appendix D – Request for Authorization of Additional Classification and Rate (SF-1444)**

**Appendix E – Labor Standards Interview Form (SF-1445)**

**Appendix F – Wage Determination**

**SECTION A: Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction**

*29 CFR §5.5(a) – Applies to any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds ... and which is subject to the labor standards provisions of any of the acts listed in 29 CFR §5.1.*

**(1) *Minimum wages.***

(i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in §5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided*, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

**The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.**

**(ii)**

(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination.<sup>1</sup> The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

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<sup>1</sup> Additional Wage Classifications can be requested by completing a REQUEST FOR AUTHORIZATION OF ADDITIONAL CLASSIFICATION AND RATE (SF-1444). A sample of SF-1444 is included as Appendix D. It can also be accessed from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/forms> or its successor site.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

**(2) *Withholding.*** ADCNR shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or

owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

**(3) Payrolls and basic records.**

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)

(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the RESTORE Council if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to ADCNR. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (*e.g.*, the last four digits of the employee's social security number).

**The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/payroll-certification> or its successor site.**

The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the RESTORE Council if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to ADCNR, the contractor, or the

Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of 29 CFR § 5.5 for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this 29 CFR § 5.5 .

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of 29 CFR § 5.5 available for inspection, copying, or transcription by authorized representatives of the (write the name of the agency) or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

**(4) *Apprentices and trainees—***

(i) *Apprentices*. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) *Trainees*. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage

and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) *Equal employment opportunity.* The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

**(5) *Compliance with Copeland Act Requirements.*** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract<sup>2</sup>.

**(6) *Subcontracts.*** The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

**(7) *Contract termination and debarment.*** A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

**(8) *Compliance with Davis-Bacon and Related Act Requirements.*** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

**(9) *Disputes concerning labor standards.*** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

**(10) *Certification of eligibility.***

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm

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<sup>2</sup> The requirements of 29 CFR Part 3 can also be found in Section C of these Supplementary Conditions.

ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

## **SECTION B: Contract Work Hours and Safety Standards Act**

*29 CFR §5.5(b) – Applies to certain federally assisted construction contracts over \$100,000 subject to Davis-Bacon and Related Acts wage standards where the Federal Government is not a direct party.*

**(1) Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

**(2) Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the clause set forth in paragraph 1 of 29 C.F.R. § 5.5(b), the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 of 29 C.F.R. § 5.5(b), in the sum of \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1 of 29 C.F.R. § 5.5(b).

**(3) Withholding for unpaid wages and liquidated damages.** The RESTORE Council or ADCNR shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 of 29 C.F.R. § 5.5(b).

**(4) Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph 1 through 4 of 29 C.F.R. § 5.5(b) and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs 1 through 4 of 29 C.F.R. § 5.5(b).



**SECTION C: 29 CFR Part 3 – Contractors and Subcontractors on Public Building or Work Financed in Whole or in Part by Loans or Grants from the United States** (*Anti-Kickback Regulations, Copeland Act*)

**§3.1 Purpose and scope.**

This part prescribes “anti-kickback” regulations under section 2 of the Act of June 13, 1934, as amended (40 U.S.C. 276c), popularly known as the Copeland Act. This part applies to any contract which is subject to Federal wage standards and which is for the construction, prosecution, completion, or repair of public buildings, public works or buildings or works financed in whole or in part by loans or grants from the United States. The part is intended to aid in the enforcement of the minimum wage provisions of the Davis-Bacon Act and the various statutes dealing with federally assisted construction that contain similar minimum wage provisions, including those provisions which are not subject to Reorganization Plan No. 14 (e.g., the College Housing Act of 1950, the Federal Water Pollution Control Act, and the Housing Act of 1959), and in the enforcement of the overtime provisions of the Contract Work Hours Standards Act whenever they are applicable to construction work. The part details the obligation of contractors and subcontractors relative to the weekly submission of statements regarding the wages paid on work covered thereby; sets forth the circumstances and procedures governing the making of payroll deductions from the wages of those employed on such work; and delineates the methods of payment permissible on such work.

**§3.2 Definitions.**

As used in the regulations in this part:

(a) The terms *building* or *work* generally include construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work. The terms include, without limitation, buildings, structures, and improvements of all types, such as bridges, dams, plants, highways, parkways, streets, subways, tunnels, sewers, mains, powerlines, pumping stations, railways, airports, terminals, docks, piers, wharves, ways, lighthouses, buoys, jetties, breakwaters, levees, and canals; dredging, shoring, scaffolding, drilling, blasting, excavating, clearing, and landscaping. Unless conducted in connection with and at the site of such a building or work as is described in the foregoing sentence, the manufacture or furnishing of materials, articles, supplies, or equipment (whether or not a Federal or State agency acquires title to such materials, articles, supplies, or equipment during the course of the manufacture or furnishing, or owns the materials from which they are manufactured or furnished) is not a *building* or *work* within the meaning of the regulations in this part.

(b) The terms *construction*, *prosecution*, *completion*, or *repair* mean all types of work done on a particular building or work at the site thereof, including, without limitation, altering, remodeling, painting and decorating, the transporting of materials and supplies to or from the building or work by the employees of the construction contractor or construction subcontractor, and the manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the building or work, by persons employed at the site by the contractor or subcontractor.

(c) The terms *public building* or *public work* include building or work for whose construction, prosecution, completion, or repair, as defined above, a Federal agency is a contracting party, regardless of whether title thereof is in a Federal agency.

(d) The term *building or work financed in whole or in part by loans or grants from the United States* includes building or work for whose construction, prosecution, completion, or repair, as defined above, payment or part payment is made directly or indirectly from funds provided by loans or grants by a Federal agency. The term includes building or work for which the Federal assistance granted is in the form of loan guarantees or insurance.

(e) Every person paid by a contractor or subcontractor in any manner for his labor in the construction, prosecution, completion, or repair of a public building or public work or building or work financed in whole or in part by loans or grants from the United States is *employed* and receiving *wages*, regardless of any contractual relationship alleged to exist between him and the real employer.

(f) The term *any affiliated person* includes a spouse, child, parent, or other close relative of the contractor or subcontractor; a partner or officer of the contractor or subcontractor; a corporation closely connected with the contractor or subcontractor as parent, subsidiary, or otherwise, and an officer or agent of such corporation.

(g) The term *Federal agency* means the United States, the District of Columbia, and all executive departments, independent establishments, administrative agencies, and instrumentalities of the United States and of the District of Columbia, including corporations, all or substantially all of the stock of which is beneficially owned by the United States, by the District of Columbia, or any of the foregoing departments, establishments, agencies, and instrumentalities.

### **§3.3 Weekly statement with respect to payment of wages.**

(a) As used in this section, the term *employee* shall not apply to persons in classifications higher than that of laborer or mechanic and those who are the immediate supervisors of such employees.

(b) Each contractor or subcontractor engaged in the construction, prosecution, completion, or repair of any public building or public work, or building or work financed in whole or in part by loans or grants from the United States, shall furnish each week a statement with respect to the wages paid each of its employees engaged on work covered by this part 3 and part 5 of this title during the preceding weekly payroll period. This statement shall be executed by the contractor or subcontractor or by an authorized officer or employee of the contractor or subcontractor who supervises the payment of wages, and shall be on the back of Form WH 347, "Payroll (For Contractors Optional Use)" or on any form with identical wording. Copies of WH 347 may be obtained from the Government contracting or sponsoring agency or from the Wage and Hour Division Web site at <http://www.dol.gov/whd/forms/index.htm> or its successor site.

(c) The requirements of this section shall not apply to any contract of \$2,000 or less.

(d) Upon a written finding by the head of a Federal agency, the Secretary of Labor may provide reasonable limitations, variations, tolerances, and exemptions from the requirements of this section subject to such conditions as the Secretary of Labor may specify.

**§3.4 Submission of weekly statements and the preservation and inspection of weekly payroll records.**

(a) Each weekly statement required under §3.3 shall be delivered by the contractor or subcontractor, within seven days after the regular payment date of the payroll period, to a representative of a Federal or State agency in charge at the site of the building or work, or, if there is no representative of a Federal or State agency at the site of the building or work, the statement shall be mailed by the contractor or subcontractor, within such time, to a Federal or State agency contracting for or financing the building or work. After such examination and check as may be made, such statement, or a copy thereof, shall be kept available, or shall be transmitted together with a report of any violation, in accordance with applicable procedures prescribed by the United States Department of Labor.

(b) Each contractor or subcontractor shall preserve his weekly payroll records for a period of three years from date of completion of the contract. The payroll records shall set out accurately and completely the name and address of each laborer and mechanic, his correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual wages paid. Such payroll records shall be made available at all times for inspection by the contracting officer or his authorized representative, and by authorized representatives of the Department of Labor.

**§3.5 Payroll deductions permissible without application to or approval of the Secretary of Labor.**

Deductions made under the circumstances or in the situations described in the paragraphs of this section may be made without application to and approval of the Secretary of Labor:

(a) Any deduction made in compliance with the requirements of Federal, State, or local law, such as Federal or State withholding income taxes and Federal social security taxes.

(b) Any deduction of sums previously paid to the employee as a bona fide prepayment of wages when such prepayment is made without discount or interest. A *bona fide prepayment of wages* is considered to have been made only when cash or its equivalent has been advanced to the person employed in such manner as to give him complete freedom of disposition of the advanced funds.

(c) Any deduction of amounts required by court process to be paid to another, unless the deduction is in favor of the contractor, subcontractor, or any affiliated person, or when collusion or collaboration exists.

(d) Any deduction constituting a contribution on behalf of the person employed to funds established by the employer or representatives of employees, or both, for the purpose of providing either from principal or income, or both, medical or hospital care, pensions or annuities on retirement, death benefits, compensation for injuries, illness, accidents,

sickness, or disability, or for insurance to provide any of the foregoing, or unemployment benefits, vacation pay, savings accounts, or similar payments for the benefit of employees, their families and dependents: *Provided, however,* That the following standards are met:

- (1) The deduction is not otherwise prohibited by law;
  - (2) It is either:
    - (i) Voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of or for the continuation of employment, or
    - (ii) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees;
  - (3) No profit or other benefit is otherwise obtained, directly or indirectly, by the contractor or subcontractor or any affiliated person in the form of commission, dividend, or otherwise; and
  - (4) The deductions shall serve the convenience and interest of the employee.
- (e) Any deduction contributing toward the purchase of United States Defense Stamps and Bonds when voluntarily authorized by the employee.
- (f) Any deduction requested by the employee to enable him to repay loans to or to purchase shares in credit unions organized and operated in accordance with Federal and State credit union statutes.
- (g) Any deduction voluntarily authorized by the employee for the making of contributions to governmental or quasi-governmental agencies, such as the American Red Cross.
- (h) Any deduction voluntarily authorized by the employee for the making of contributions to Community Chests, United Givers Funds, and similar charitable organizations.
- (i) Any deductions to pay regular union initiation fees and membership dues, not including fines or special assessments: *Provided, however,* that a collective bargaining agreement between the contractor or subcontractor and representatives of its employees provides for such deductions and the deductions are not otherwise prohibited by law.
- (j) Any deduction not more than for the “reasonable cost” of board, lodging, or other facilities meeting the requirements of section 3(m) of the Fair Labor Standards Act of 1938, as amended, and part 531 of this title. When such a deduction is made the additional records required under §516.25(a) of this title shall be kept.
- (k) Any deduction for the cost of safety equipment of nominal value purchased by the employee as his own property for his personal protection in his work, such as safety shoes, safety glasses, safety gloves, and hard hats, if such equipment is not required by law to be furnished by the employer, if such deduction is not violative of the Fair Labor Standards Act or prohibited by other law, if the cost on which the deduction is based does

not exceed the actual cost to the employer where the equipment is purchased from him and does not include any direct or indirect monetary return to the employer where the equipment is purchased from a third person, and if the deduction is either

(1) Voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance; or

(2) Provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees.

### **§3.6 Payroll deductions permissible with the approval of the Secretary of Labor.**

Any contractor or subcontractor may apply to the Secretary of Labor for permission to make any deduction not permitted under §3.5. The Secretary may grant permission whenever he finds that:

(a) The contractor, subcontractor, or any affiliated person does not make a profit or benefit directly or indirectly from the deduction either in the form of a commission, dividend, or otherwise;

(b) The deduction is not otherwise prohibited by law;

(c) The deduction is either (1) voluntarily consented to by the employee in writing and in advance of the period in which the work is to be done and such consent is not a condition either for the obtaining of employment or its continuance, or (2) provided for in a bona fide collective bargaining agreement between the contractor or subcontractor and representatives of its employees; and

(d) The deduction serves the convenience and interest of the employee.

### **§3.7 Applications for the approval of the Secretary of Labor.**

Any application for the making of payroll deductions under §3.6 shall comply with the requirements prescribed in the following paragraphs of this section:

(a) The application shall be in writing and shall be addressed to the Secretary of Labor.

(b) The application need not identify the contract or contracts under which the work in question is to be performed. Permission will be given for deductions on all current and future contracts of the applicant for a period of 1 year. A renewal of permission to make such payroll deduction will be granted upon the submission of an application which makes reference to the original application, recites the date of the Secretary of Labor's approval of such deductions, states affirmatively that there is continued compliance with the standards set forth in the provisions of §3.6, and specifies any conditions which have changed in regard to the payroll deductions.

(c) The application shall state affirmatively that there is compliance with the standards set forth in the provisions of §3.6. The affirmation shall be accompanied by a full statement of the facts indicating such compliance.

(d) The application shall include a description of the proposed deduction, the purpose to be served thereby, and the classes of laborers or mechanics from whose wages the proposed deduction would be made.

(e) The application shall state the name and business of any third person to whom any funds obtained from the proposed deductions are to be transmitted and the affiliation of such person, if any, with the applicant.

**§3.8 Action by the Secretary of Labor upon applications.**

The Secretary of Labor shall decide whether or not the requested deduction is permissible under provisions of §3.6; and shall notify the applicant in writing of his decision.

**§3.9 Prohibited payroll deductions.**

Deductions not elsewhere provided for by this part and which are not found to be permissible under §3.6 are prohibited.

**§3.10 Methods of payment of wages.**

The payment of wages shall be by cash, negotiable instruments payable on demand, or the additional forms of compensation for which deductions are permissible under this part. No other methods of payment shall be recognized on work subject to the Copeland Act.

**§3.11 Regulations part of contract.**

All contracts made with respect to the construction, prosecution, completion, or repair of any public building or public work or building or work financed in whole or in part by loans or grants from the United States covered by the regulations in this part shall expressly bind the contractor or subcontractor to comply with such of the regulations in this part as may be applicable. In this regard, see §5.5(a) of this subtitle.

## **LISTING OF APPENDICES**

### **Appendix A – Davis-Bacon Poster (WH-1321)**

The Davis-Bacon poster (WH-1321) **SHALL** be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers (29 CFR §5.5(a)(1)(i)). The Davis-Bacon Poster (WH-1321) is included as Appendix A. It can also be accessed from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/posters> or its successor site.

### **Appendix B – U. S. Department of Labor Wage and Hour Division Payroll Reporting Form (WH-347)**

A sample of Optional Form WH-347 is included as Appendix B. The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/forms> or its successor site.

### **Appendix C – Instructions for U. S. Department of Labor Wage and Hour Division Payroll Form (WH-347)**

Instructions for completion of Optional Form WH-347 are included as Appendix C. Instructions can also be accessed from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/forms> or its successor site.

### **Appendix D – Request for Authorization of Additional Classification and Rate (SF-1444)**

Additional Wage Classifications can be requested by completing a Request for Authorization of Additional Classification and Rate (Standard Form 1444). SF-1444 is included as Appendix D. It can also be accessed from the Wage and Hour Division Web site at <https://www.dol.gov/agencies/whd/government-contracts/construction/forms> or its successor site.

### **Appendix E – Labor Standards Interview (SF-1445)**

A sample of the Labor Standards Interview Form (SF-1445) is included as Appendix E. ADCNR will use this form to interview on-site employees at period site visits. This form can be accessed at <https://www.gsa.gov/cdnstatic/SF%201445.pdf?forceDownload=1> or its successor site.

### **Appendix F – Wage Determination**

**Appendix A – Davis Bacon Poster (WH-1321)**



# WORKER RIGHTS

## UNDER THE DAVIS-BACON ACT

### FOR LABORERS AND MECHANICS WORKING ON FEDERAL OR FEDERALLY ASSISTED CONSTRUCTION PROJECTS

The law requires employers to display this poster where employees can readily see it.

#### PREVAILING WAGES

You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this Notice for the work you perform.

#### OVERTIME

You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few exceptions.

#### ENFORCEMENT

Contract payments can be withheld to ensure workers receive wages and overtime pay due, and liquidated damages may apply if overtime pay requirements are not met. Davis-Bacon contract clauses allow contract termination and debarment of contractors from future federal contracts for three years. A contractor who falsifies certified payroll records or induces wage kickbacks may be subject to civil or criminal prosecution, fines and/or imprisonment.

#### APPRENTICES

Apprentice rates apply only to apprentices properly registered under approved Federal or State apprenticeship programs.

#### RETALIATION

The law prohibits discharging or otherwise retaliating against workers for filing a complaint, cooperating in an investigation, or testifying in a proceeding under the Davis-Bacon and Related Acts.

#### PROPER PAY

If you do not receive proper pay, or require further information on the applicable wages, contact the Contracting Officer listed below:

or contact the U.S. Department of Labor's Wage and Hour Division.



WAGE AND HOUR DIVISION  
UNITED STATES DEPARTMENT OF LABOR

1-866-487-9243  
TTY: 1-877-889-5627  
[www.dol.gov/whd](http://www.dol.gov/whd)



**Appendix B – U. S. Department of Labor Wage and Hour Division Payroll Form (WH-347)**

NAME OF CONTRACTOR				OR SUBCONTRACTOR				ADDRESS										OMB No. 1235-0008 Expires 09/30/2026						
PAYROLL NO.				FOR WEEK ENDING				PROJECT AND LOCATION										PROJECT OR CONTRACT NO.						
(1)		(2)	(3)	OT OR ST	(4) DAY AND DATE								(5)	(6)	(7)	(8) DEDUCTIONS					(9)			
NAME AND INDIVIDUAL IDENTIFYING NUMBER (e.g., LAST FOUR DIGITS OF SOCIAL SECURITY NUMBER) OF WORKER		NO. OF WITHHOLDING EXEMPTIONS	WORK CLASSIFICATION		HOURS WORKED EACH DAY								TOTAL HOURS	RATE OF PAY	GROSS AMOUNT EARNED	FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	NET WAGES PAID FOR WEEK		
				O																				
				S																				
				O																				
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While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Public Burden Statement

We estimate that it will take an average of 55 minutes to complete this collection, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W. Washington, D.C. 20210

Date \_\_\_\_\_

I, \_\_\_\_\_  
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by \_\_\_\_\_ on the \_\_\_\_\_  
(Contractor or Subcontractor)  
\_\_\_\_\_ ; that during the payroll period commencing on the \_\_\_\_\_  
(Building or Work)  
\_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, and ending the \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_,  
all persons employed on said project have been paid the full weekly wages earned, that no rebates have  
been or will be made either directly or indirectly to or on behalf of said  
\_\_\_\_\_ from the full  
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly  
from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part  
3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948,  
63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2) That any payrolls otherwise under this contract required to be submitted for the above period are  
correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the  
applicable wage rates contained in any wage determination incorporated into the contract; that the classifications  
set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship  
program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and  
Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered  
with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:  
(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

- in addition to the basic hourly wage rates paid to each laborer or mechanic listed in  
the above referenced payroll, payments of fringe benefits as listed in the contract  
have been or will be made to appropriate programs for the benefit of such employees,  
except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

- Each laborer or mechanic listed in the above referenced payroll has been paid,  
as indicated on the payroll, an amount not less than the sum of the applicable  
basic hourly wage rate plus the amount of the required fringe benefits as listed  
in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR  
SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 3729 OF  
TITLE 31 OF THE UNITED STATES CODE.

## **Appendix C – Instructions for Completing Payroll Form, WH-347**

**General:** Form WH-347 has been made available for the convenience of contractors and subcontractors required by their Federal or Federally-aided construction-type contracts and subcontracts to submit weekly payrolls. Properly filled out, this form will satisfy the requirements of Regulations, Parts 3 and 5 (29 C.F.R., Subtitle A), as to payrolls submitted in connection with contracts subject to the Davis-Bacon and related Acts.

While completion of Form WH-347 is optional, it is mandatory for covered contractors and subcontractors performing work on Federally financed or assisted construction contracts to respond to the information collection contained in 29 C.F.R. §§ 3.3, 5.5(a). The Copeland Act (40 U.S.C. § 3145) requires contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) Regulations at 29 C.F.R. § 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

Under the Davis-Bacon and related Acts, the contractor is required to pay not less than prevailing wage, including fringe benefits, as predetermined by the Department of Labor. The contractor's obligation to pay fringe benefits may be met either by payment of the fringe benefits to bona fide benefit plans, funds or programs or by making payments to the covered workers (laborers and mechanics) as cash in lieu of fringe benefits.

This payroll provides for the contractor to show on the face of the payroll all monies to each worker, whether as basic rates or as cash in lieu of fringe benefits, and provides for the contractor's representation in the statement of compliance on the payroll (as shown on page 2) that he/she is paying for fringe benefits required by the contract and not paid as cash in lieu of fringe benefits. Detailed instructions concerning the preparation of the payroll follow:

**Contractor or Subcontractor:** Fill in your firm's name and check appropriate box.

**Address:** Fill in your firm's address.

**Payroll No.:** Beginning with the number "1", list the payroll number for the submission.

**For Week Ending:** List the workweek ending date.

**Project and Location:** Self-explanatory.

**Project or Contract No.:** Self-explanatory.

**Column 1 - Name and Individual Identifying Number of Worker:** Enter each worker's full name and an individual identifying number (e.g., last four digits of worker's social security number) on each weekly payroll submitted.

**Column 2 - No. of Withholding Exemptions:** This column is merely inserted for the employer's convenience and is not a requirement of Regulations, Part 3 and 5.

**Column 3 - Work Classifications:** List classification descriptive of work actually performed by each laborer or mechanic. Consult classification and minimum wage schedule set forth in contract specifications. If additional classifications are deemed necessary, see Contracting Officer or Agency representative. An individual may be shown as having worked in more than one classification provided an accurate breakdown of hours worked in each classification is maintained and shown on the submitted payroll by use of separate entries.

**Column 4 - Hours worked:** List the day and date and straight time and overtime hours worked in the applicable boxes. On all contracts subject to the Contract Work Hours Standard Act, enter hours worked in excess of 40 hours a week as "overtime".

**Column 5 - Total:** Self-explanatory

**Column 6 - Rate of Pay (Including Fringe Benefits):** In the "straight time" box for each worker, list the actual hourly rate paid for straight time worked, plus cash paid in lieu of fringe benefits paid. When recording the straight time hourly rate, any cash paid in lieu of fringe benefits may be shown separately from the basic rate. For example, "\$12.25/.40" would reflect a \$12.25 base hourly rate plus \$0.40 for fringe benefits. This is of assistance in correctly computing overtime. See "Fringe Benefits" below. When overtime is worked, show the overtime hourly rate paid plus any cash in lieu of fringe benefits paid in the "overtime" box for each worker; otherwise, you may skip this box. See "Fringe Benefits" below. Payment of not less than time and one-half the basic or regular rate paid is required for overtime under the Contract Work Hours Standard Act of 1962 if the prime contract exceeds \$100,000. In addition to paying no less than the predetermined rate for the classification which an individual works, the contractor must pay amounts predetermined as fringe benefits in the wage decision made part of the contract to approved fringe benefit plans, funds or programs or shall pay as cash in lieu of fringe benefits. See "FRINGE BENEFITS" below.

**Column 7 - Gross Amount Earned:** Enter gross amount earned on this project. If part of a worker's weekly wage was earned on projects other than the project described on this payroll, enter in column 7 first the amount earned on the Federal or Federally assisted project and then the gross amount earned during the week on all projects, thus "\$163.00/\$420.00" would reflect the earnings of a worker who earned \$163.00 on a Federally assisted construction project during a week in which \$420.00 was earned on all work.

**Column 8 - Deductions:** Five columns are provided for showing deductions made. If more than five deduction are involved, use the first four columns and show the balance deductions under "Other" column; show actual total under "Total Deductions" column; and in the attachment to the payroll describe the deduction(s) contained in the "Other" column. All deductions must be in accordance with the provisions of the Copeland Act Regulations, 29 C.F.R., Part 3. If an individual worked on other jobs in addition to this project, show actual deductions from his/her weekly gross wage, and indicate that deductions are based on his gross wages.

**Column 9 - Net Wages Paid for Week:** Self-explanatory.

**Totals** - Space has been left at the bottom of the columns so that totals may be shown if the contractor so desires.

**Statement Required by Regulations, Parts 3 and 5:** While the "statement of compliance" need not be notarized, the statement (on page 2 of the payroll form) is subject to the penalties provided by 18 U.S.C. § 1001, namely, a fine, possible imprisonment of not more than 5 years, or both. Accordingly, the party signing this statement should have knowledge of the facts represented as true.

**Items 1 and 2:** Space has been provided between items (1) and (2) of the statement for describing any deductions made. If all deductions made are adequately described in the "Deductions" column above, state "*See Deductions column in this payroll.*" *See "FRINGE BENEFITS"* below for instructions concerning filling out paragraph 4 of the statement.

**Item 4 FRINGE BENEFITS - Contractors who pay all required fringe benefits:** If paying all fringe benefits to approved plans, funds, or programs in amounts not less than were determined in the applicable wage decision of the Secretary of Labor, show the basic cash hourly rate and overtime rate paid to each worker on the face of the payroll and check paragraph 4(a) of the statement on page 2 of the WH-347 payroll form to indicate the payment. Note any exceptions in section 4(c).

**Contractors who pay no fringe benefits:** If not paying all fringe benefits to approved plans, funds, or programs in amounts of at least those that were determined in the applicable wage decision of the Secretary of Labor, pay any remaining fringe benefit amount to each laborer and mechanic and insert in the "straight time" of the "Rate of Pay" column of the payroll an amount not less than the predetermined rate for each classification plus the amount of fringe benefits determined for each classification in the application wage decision. Inasmuch as it is not necessary to pay time and a half on cash paid in lieu of fringe benefits, the overtime rate shall be not less than the sum of the basic predetermined rate, plus the half time premium on basic or regular rate, plus the required cash in lieu of fringe benefits at the straight time rate. In addition, check paragraph 4(b) of the statement on page 2 the payroll form to indicate the payment of fringe benefits in cash directly to the workers. Note any exceptions in section 4(c).

**Use of Section 4(c), Exceptions:** Any contractor who is making payment to approved plans, funds, or programs in amounts less than the wage determination requires is obliged to pay the deficiency directly to the covered worker as cash in lieu of fringe benefits. Enter any exceptions to section 4(a) or 4(b) in section 4(c). Enter in the Exception column the craft, and enter in the Explanation column the hourly amount paid each worker as cash in lieu of fringe benefits and the hourly amount paid to plans, funds, or programs as fringe benefits. The contractor must pay an amount not less than the predetermined rate plus cash in lieu of fringe benefits as shown in section 4(c) to each such individual for all hours worked (unless otherwise provided by applicable wage determination) on the Federal or Federally assisted project. Enter the rate paid and amount of cash paid in lieu of fringe benefits per hour in column 6 on the payroll. See paragraph on "Contractors who pay no fringe benefits" for computation of overtime rate.

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**Public Burden Statement:** We estimate that it will take an average of 55 minutes to complete this collection of information, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, U.S. Department of Labor, Room S3502, 200 Constitution Avenue, N.W., Washington, D.C. 20210.

**Appendix D – Request for Authorization of Additional Classification and Rate (SF-1444)**



<b>Request For Authorization Of Additional Classification And Rate</b>	Check Appropriate Box	<b>OMB Control Number: 9000-0066</b> <b>Expiration Date: 5/31/2025</b>
	<input type="checkbox"/> Service Contract <input type="checkbox"/> Construction Contract	

**Instructions:** The Contractor shall complete items 3 through 16, keep a pending copy, and submit the request, in quadruplicate, to the Contracting Officer.

1. <b>To:</b> Administrator, Wage And Hour Division U.S. Department Of Labor Washington, DC 20210	2. <b>From:</b> (Reporting Office)
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3. Contractor	4. Date Of Request
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5. Contract Number	6. Date Bid Opened (Sealed Bidding)	7. Date Of Award	8. Date Contract Work Started	9. Date Option Exercised (If Applicable) (Service Contract Only)
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10. Subcontractor (If Any)
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11. Project And Description Of Work (Attach Additional Sheet If Needed)
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12. Location (City, County, And State)
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13. In Order To Complete The Work Provided For Under The Above Contract, It Is Necessary To Establish The Following Rate(s) For The Indicated Classification(s) Not Included In The Department Of Labor Determination
---

Number:

Dated:

a. List In Order: Proposed Classification Title(s); Job Description(s); Duties; And Rationale For Proposed Classifications (Service contracts only)	b. Wage Rate(s)	c. Fringe Benefits Payments
(Use reverse or attach additional sheets, if necessary)		

14. Signature And Title Of Subcontractor Representative (If Any)	15. Signature And Title Of Prime Contractor Representative
---	---

16. Signature Of Employee Or Representative	Title	Check Appropriate Box - Referencing Block 13. <input type="checkbox"/> Agree <input type="checkbox"/> Disagree
---	-------	---

**To Be Completed By Contracting Officer (Check As Appropriate - See FAR 22.1019 (Service Contract Labor Standards) Or FAR 22.406-3 (Construction Wage Rate Requirements))**

- ☐ The Interested Parties Agree And The Contracting Officer Recommends Approval By The Wage And Hour Division. Available Information And Recommendations Are Attached.
- ☐ The Interested Parties Cannot Agree On The Proposed Classification And Wage Rate. A Determination Of The Question By The Wage And Hour Division Is Therefore Requested. Available Information And Recommendations Are Attached.

(Send 3 copies to the Department of Labor)

Signature Of Contracting Officer Or Representative	Title And Commercial Telephone Number	Date Submitted
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**Paperwork Reduction Act Statement**

This information collection meets the requirements of 44 U.S.C. § 3507, as amended by section 2 of the Paperwork Reduction Act of 1995. You do not need to answer these questions unless we display a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 9000-0066. We estimate that it will take .5 hours to read the instructions, gather the facts, and answer the questions. Send only comments relating to our time estimate, including suggestions for reducing this burden, or any other aspects of this collection of information to: U.S. General Services Administration, Regulatory Secretariat Division (M1V1CB), 1800 F Street, NW, Washington, DC 20405.

**Appendix E – Labor Standards Interview Form (SF-1445)**

## LABOR STANDARDS INTERVIEW

CONTRACT NUMBER				EMPLOYEE INFORMATION				
NAME OF PRIME CONTRACTOR				LAST NAME		FIRST NAME		MI
				STREET ADDRESS				
NAME OF EMPLOYER				CITY		STATE	ZIP CODE	
SUPERVISOR'S NAME								
LAST NAME		FIRST NAME		MI	WORK CLASSIFICATION		WAGE RATE	
ACTION							CHECK BELOW	
							YES	NO
Do you work over 8 hours per day?								
Do you work over 40 hours per week?								
Are you paid at least time and a half for overtime hours?								
Are you receiving any cash payments for fringe benefits required by the posted wage determination decision?								
WHAT DEDUCTIONS OTHER THAN TAXES AND SOCIAL SECURITY ARE MADE FROM YOUR PAY?								
HOW MANY HOURS DID YOU WORK ON YOUR LAST WORK DAY BEFORE THIS INTERVIEW?				TOOLS YOU USE				
DATE OF LAST WORK DAY BEFORE INTERVIEW (YYMMDD)								
DATE YOU BEGAN WORK ON THIS PROJECT (YYMMDD)								
THE ABOVE IS CORRECT TO THE BEST OF MY KNOWLEDGE								
EMPLOYEE'S SIGNATURE							DATE (YYMMDD)	
INTERVIEWER	SIGNATURE			TYPED OR PRINTED NAME			DATE (YYMMDD)	
INTERVIEWER'S COMMENTS								
WORK EMPLOYEE WAS DOING WHEN INTERVIEWED				ACTION (If explanation is needed, use comments section)			YES	NO
				IS EMPLOYEE PROPERLY CLASSIFIED AND PAID?				
				ARE WAGE RATES AND POSTERS DISPLAYED?				
FOR USE BY PAYROLL CHECKER								
IS ABOVE INFORMATION IN AGREEMENT WITH PAYROLL DATA?								
<input type="checkbox"/> YES <input type="checkbox"/> NO								
COMMENTS								
CHECKER								
LAST NAME		FIRST NAME		MI	JOB TITLE			
SIGNATURE							DATE (YYMMDD)	

## **Appendix F – Wage Determination**

Superseded General Decision Number: AL20230110

State: Alabama

Construction Type: Heavy

County: Mobile County in Alabama.

#### HEAVY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none"><li>. Executive Order 14026 generally applies to the contract.</li><li>. The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.</li></ul>
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none"><li>. Executive Order 13658 generally applies to the contract.</li><li>. The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.</li></ul>

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/05/2024
1	06/28/2024

\* ENGI0653-013 06/03/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR (PIPELINE)		
Backhoe, Excavator, Trackhoe.....	\$ 48.89	18.00
Bulldozer.....	\$ 48.89	18.00

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\* SUAL2015-038 08/02/2017

	Rates	Fringes
CARPENTER, Includes Form Work....	\$ 19.05	7.86
CEMENT MASON/CONCRETE FINISHER, Includes Water Sewer Lines.....	\$ 13.78 **	0.00
ELECTRICIAN.....	\$ 19.56	0.00
LABORER: Common or General, Includes Water Sewer Lines.....	\$ 15.21 **	6.16
LABORER: Pipelayer, Includes Water Sewer Lines.....	\$ 11.95 **	0.00
OPERATOR: Backhoe/Excavator/Trackhoe, Includes Water Sewer Lines (Excludes, PIPELINE).....	\$ 13.56 **	0.00
OPERATOR: Loader, Includes Water Sewer Lines.....	\$ 17.64	2.14
TRUCK DRIVER: Dump Truck, Includes Water Sewer Lines.....	\$ 12.56 **	2.12

-----  
WELDERS - Receive rate prescribed for craft performing  
operation to which welding is incidental.

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\*\* Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.20) or 13658 (\$12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other

health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

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The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

#### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

#### Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.



## Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

## State Adopted Rate Identifiers

Classifications listed under the "SA" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R. 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

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## WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator

(See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

## **PROCUREMENT OF RECOVERED MATERIALS**

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The prime contractor must comply with federal regulations regarding procurement of recovered materials found at 2 CFR §200.323.

2 CFR §200.323 requires the Project Owner and its contractors to comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

The following summary of products designated by 40 CFR Part 247 has been provided to assist in contractor compliance; however, compliance is the contractor's sole responsibility. Note that this listing is not all inclusive and one or more products may or may not be applicable to this scope of work for this construction contract. Contractors should refer to 40 CFR Part 247 for additional information.

40 CFR §247.12 designates the following Construction Products:

(a) Building insulation products, including the following items:

(1) Loose-fill insulation, including but not limited to cellulose fiber, mineral fibers (fiberglass and rock wool), vermiculite, and perlite;

(2) Blanket and batt insulation, including but not limited to mineral fibers (fiberglass and rock wool);

(3) Board (sheathing, roof decking, wall panel) insulation, including but not limited to structural fiberboard and laminated paperboard products, perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites; and

(4) Spray-in-place insulation, including but not limited to foam-in-place polyurethane and polyisocyanurate, and spray-on cellulose.

(b) Structural fiberboard and laminated paperboard products for applications other than building insulation, including building board, sheathing, shingle backer, sound deadening board, roof insulating board, insulating wallboard, acoustical and non-acoustical ceiling tile, acoustical and non-acoustical lay-in panels, floor underlayments, and roof overlay (coverboard).

(c) Cement and concrete, including concrete products such as pipe and block containing:

(1) Coal fly ash;

- (2) Ground granulated blast furnace slag (GGBF);
- (3) Cenospheres; or
- (4) Silica fume from silicon and ferrosilicon metal production.
- (d) Carpet made from polyester fiber made from recovered materials for use in moderate-wear applications such as single-family housing and similar wear applications.
- (e) Floor tiles and patio blocks containing recovered rubber or plastic.
- (f) Shower and restroom dividers/partitions containing recovered plastic or steel.
- (g)
  - (1) Consolidated latex paint used for covering graffiti; and
  - (2) Reprocessed latex paint used for interior and exterior architectural applications such as wallboard, ceilings, and trim; gutter boards; and concrete, stucco, masonry, wood, and metal surfaces.
- (h) Carpet cushion made from bonded polyurethane, jute, synthetic fibers, or rubber containing recovered materials.
- (i) Flowable fill containing coal fly ash and/or ferrous foundry sands.
- (j) Railroad grade crossing surfaces made from cement and concrete containing fly ash, recovered rubber, recovered steel, recovered wood, or recovered plastic.
- (k) Modular threshold ramps containing recovered steel, rubber, or aluminum.
- (l) Nonpressure pipe containing recovered steel, plastic, or cement.
- (m) Roofing materials containing recovered steel, aluminum, fiber, rubber, plastic or plastic composites, or cement.

40 CFR §247.13 designates the following Transportation Products:

- (a) Traffic barricades and traffic cones used in controlling or restricting vehicular traffic.
- (b) Parking stops made from concrete or containing recovered plastic or rubber.
- (c) Channelizers containing recovered plastic or rubber.
- (d) Delineators containing recovered plastic, rubber, or steel.
- (e) Flexible delineators containing recovered plastic.

40 CFR §247.14 designates the following Park and Recreation Products:

- (a) Playground surfaces and running tracks containing recovered rubber or plastic.
- (b) Plastic fencing containing recovered plastic for use in controlling snow or sand drifting and as a warning/safety barrier in construction or other applications.
- (c) Park benches and picnic tables containing recovered steel, aluminum, plastic, or concrete.
- (d) Playground equipment containing recovered plastic, steel, or aluminum.

40 CFR §247.15 designates the following Landscaping Products:

- (a) Hydraulic mulch products containing recovered paper or recovered wood used for hydroseeding and as an over-spray for straw mulch in landscaping, erosion control, and soil reclamation.
- (b) Compost made from recovered organic materials.
- (c) Garden and soaker hoses containing recovered plastic or rubber.
- (d) Lawn and garden edging containing recovered plastic or rubber.
- (e) Plastic lumber landscaping timbers and posts containing recovered materials.
- (f) Fertilizer made from recovered organic materials.

## **PROHIBITION ON CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OF EQUIPMENT**

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The prime contractor must comply with federal regulations regarding prohibition on certain telecommunications and video surveillance services or equipment found at 2 CFR §200.216, which states:

(a) Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:

(1) Procure or obtain;

(2) Extend or renew a contract to procure or obtain; or

(3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.

(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

(b) In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.

(c) See Public Law 115-232, section 889 for additional information.

(d) See also §200.471.

## DOMESTIC PREFERENCES FOR PROCUREMENTS

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The prime contractor must, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods, products, or material produced in the United States (including, but not limited to, iron, aluminum, steel, cement and other manufactured products).

Additional information about federal regulations regarding domestic preferences for procurements can be found at 2 CFR §200.322, which states:

(a) As appropriate and to the extent consistent with law, the non-Federal entity should, to the greatest extent practicable under a Federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award.

(b) For purposes of this section:

(1) “Produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

(2) “Manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

**The requirements of this section must be included in all contracts and subcontracts for work or products under this award pursuant to 2 CFR § 200.322 and Executive Order 14005 Ensuring the Future is Made in All of America by All of America’s Workers (January 25, 2021).**

## **CONTRACTING WITH SMALL AND MINORITY BUSINESSES, WOMEN'S BUSINESS ENTERPRISES, AND LABOR SURPLUS AREA FIRMS**

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**Documentation of compliance with the following requirements is a matter of contractor responsibility. When subcontracting, the contractor must submit documentation of good faith efforts to meet the project's MBE/WBE requirements before contracted work can commence. (MBE/WBE requirements are outlined below and can be found at 2. C. F. R. §200.321.) Failure on the part of the contractor to submit proper documentation may cause the Owner not to execute or to terminate the contract.**

(a) The prime contractor must take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible.

(b) Affirmative steps must include:

- (1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
- (2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
- (3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
- (4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises; and,
- (5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

The prime contractor should note that this requirement mandates two responsibilities. Separate solicitations must be made of minority **and** women's business enterprises.

### **SUBMITTAL OF MINORITY BUSINESS ENTERPRISE AND WOMEN'S BUSINESS ENTERPRISE (MBE/WBE) DOCUMENTATION**

Before the Notice of Award can be issued, the lowest responsive and responsible bidder will be required to submit either:

- A written certification that no subcontracts will be issued.
- OR -
- The Subcontractor Listing Form detailing all subcontractors that will perform work on the project, including name, contact person, address, phone, and status (MBE, WBE or Non).



If subcontractors will be utilized, the lowest responsive and responsible bidder will be required to submit the following for subcontracts proposed to be awarded to MBE/WBE enterprises:

- A certification from each MBE and/or WBE firm declaring its status as a MBE or WBE firm. This can be an SBA [OR OTHER STATE AGENCY] certification. A self-certification is acceptable, if the certification specifies the basis for MBE/WBE designation (e.g., the business is 51% owned and daily operation is controlled by one or more women or minority owners).

If subcontractors will be utilized, the lowest responsive and responsible bidder will be required to submit the following for subcontracts proposed to be awarded to Non-MBE/WBE:

- For all subcontracts for which there are capable certified MBE/WBE firms existing to potentially perform the work, letters transmitted to MBE and WBE firms requesting quotes or proposals for specific subcontracting opportunities, for construction, equipment, materials, or supply needs and encouraging inquiries for further details. Solicitations should have been sent in a timely manner, including allowed response time. (See “Sample Letter from Contractor to MBE/WBE Firms” below.)
- A listing of certified MBE and WBE firms from whom quotes or proposals were received, if any, who were not awarded subcontracts, for construction, equipment, materials or supplies.
- Evidence that each Non-MBE/WBE subcontractor or supplier selected for the scope of work or material purchase, was lower in price than each MBE/WBE proposal (or that there is some other acceptable reason to select the Non-MBE/WBE) and that the scope of work, or material purchase, was the same for both the MBE/WBE and Non-MBE/WBE.

**Points of contacts to send the advertisements, RFQ package and/or construction bid package for MBE/WBE outreach. Contact with ADECA can be by sending hard copy documents, but make sure to require a signature and maintain documentation of receipt. Contact can also be made by email, but make sure to obtain an email response confirming receipt of the message.**

1. Alabama Department of Economic and Community Affairs (ADECA)

Attn: Mr. Scott Stewart

Office of Minority Business Enterprise

P.O. Box 5690

Montgomery, AL 36103-5690

[Scott.Stewart@adeca.alabama.gov](mailto:Scott.Stewart@adeca.alabama.gov)

[2. Alabama Small Business Development Center Network](#)

[Attn: Mr. Brian Davis](#)

[The University of Alabama](#)

[P.O. Box 870386](#)

[Tuscaloosa, AL 35487-0396](#)

[\(205\)348-7621](#)

[3. Alabama Small Business Development Center](#)

Attn: Louise Grover  
1500 1<sup>st</sup> Avenue North, Unit 62  
Birmingham, AL 35203

**Should the Prime Contractor intend to later issue a subcontract, the above affirmative steps must be followed and documentation of such submitted to the Owner for review as described under this section.**

## **SAMPLE LETTER FROM CONTRACTOR TO MBE/WBE FIRMS**

### **(CONTRACTOR'S LETTERHEAD)**

[DATE]

[MBE/WBE COMPANY NAME]

[ADDRESS]

[CITY, STATE ZIP]

RE: [NAME OF PROJECT]

Dear [MBE/WBE FIRM]:

This company intends to submit a bid on the above referenced project.

We are soliciting a proposal from you for any item or items on this project for which you are qualified to subcontract. You may submit proposals to subcontract items of construction or for project materials and supplies if you are a distributor of materials or equipment.

A [BID SCHEDULE OR DESCRIPTION OF THE SPECIFIC ITEM TO BID] is attached for your review. You are encouraged to submit proposals on any item(s) for which you are qualified to subcontract. Proposals must be submitted by [SUBMITTAL DEADLINE] to be considered.

For further details, you are encouraged to contact [NAME OF OWNER REPRESENTATIVE] by email at [EMAIL ADDRESS] or by telephone at [TELEPHONE NUMBER] during normal business hours.

Sincerely,

[NAME OF REPRESENTATIVE]

[NAME OF COMPANY]

Enclosure: [BID SCHEDULE OR DESCRIPTION OF THE SPECIFIC ITEM TO BID]

## **41 CFR §60-1.4(b) EQUAL OPPORTUNITY CLAUSE**

*(for Federally Assisted Construction Contracts)*

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During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

(4) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(8) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

The recipient further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, that if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The recipient agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The recipient further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

## **41 CFR §60-4.2(d) NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (Executive Order 11246)**

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.
2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

<b>Time- tables</b>	<b>Covered Area</b> (Geographical area where the contract is to be performed)	<b>Goals for minority participation for each trade</b>	<b>Goals for female participation in each trade</b>
Until Further Notice	Baldwin County, AL	25.9 %	6.9% for all Covered Areas
	Mobile County, AL	25.9 %	

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.
4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is the Alabama County within the Gulf Coast Region where the contract will be performed.

## **41 CFR §60-4.3(a) STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS (Executive Order 11246)**

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1. As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and

training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.



d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, sexual orientation, gender identity, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

**SUBCONTRACTOR LISTING FORM** (v.9.30.2023)

The prime contractor must submit this form to the Owner prior to contract execution and must update it for each subcontractor performing any work resulting from this contract. If additional lines are needed, this form may be duplicated.

<b>Subcontractor Name and Contact Person</b>	<b>Subcontractor Address and Phone Number</b>	<b>Subcontractor Active UEI</b>	<b>MBE (Y/N)</b>	<b>WBE (Y/N)</b>	<b>On Site during this period (Y/N)</b>

**COMPLETED BY:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

# DISCLOSURE OF LOBBYING ACTIVITIES

Complete this form to disclose lobbying activities pursuant to 31 U.S.C.1352

OMB Number: 4040-0013

Expiration Date: 02/28/2025

<b>1. * Type of Federal Action:</b> <input type="checkbox"/> a. contract <input checked="" type="checkbox"/> b. grant <input type="checkbox"/> c. cooperative agreement <input type="checkbox"/> d. loan <input type="checkbox"/> e. loan guarantee <input type="checkbox"/> f. loan insurance	<b>2. * Status of Federal Action:</b> <input type="checkbox"/> a. bid/offer/application <input checked="" type="checkbox"/> b. initial award <input type="checkbox"/> c. post-award	<b>3. * Report Type:</b> <input checked="" type="checkbox"/> a. initial filing <input type="checkbox"/> b. material change
<b>4. Name and Address of Reporting Entity:</b> <input checked="" type="checkbox"/> Prime <input type="checkbox"/> SubAwardee * Name <input style="width:300px;" type="text"/> * Street 1 <input style="width:300px;" type="text"/> Street 2 <input style="width:300px;" type="text"/> * City <input style="width:150px;" type="text"/> State <input style="width:150px;" type="text"/> Zip <input style="width:50px;" type="text"/> Congressional District, if known: <input style="width:150px;" type="text"/>		
<b>5. If Reporting Entity in No.4 is Subawardee, Enter Name and Address of Prime:</b>     		
<b>6. * Federal Department/Agency:</b> <input style="width:350px;" type="text"/>	<b>7. * Federal Program Name/Description:</b> <input style="width:350px;" type="text"/> CFDA Number, if applicable: <input style="width:150px;" type="text"/>	
<b>8. Federal Action Number, if known:</b> <input style="width:350px;" type="text"/>	<b>9. Award Amount, if known:</b> \$ <input style="width:150px;" type="text"/>	
<b>10. a. Name and Address of Lobbying Registrant:</b> Prefix <input style="width:50px;" type="text"/> * First Name <input style="width:150px;" type="text"/> Middle Name <input style="width:150px;" type="text"/> * Last Name <input style="width:250px;" type="text"/> Suffix <input style="width:50px;" type="text"/> * Street 1 <input style="width:150px;" type="text"/> Street 2 <input style="width:200px;" type="text"/> * City <input style="width:100px;" type="text"/> State <input style="width:100px;" type="text"/> Zip <input style="width:50px;" type="text"/>		
<b>b. Individual Performing Services</b> (including address if different from No. 10a) Prefix <input style="width:50px;" type="text"/> * First Name <input style="width:150px;" type="text"/> Middle Name <input style="width:150px;" type="text"/> * Last Name <input style="width:250px;" type="text"/> Suffix <input style="width:50px;" type="text"/> * Street 1 <input style="width:150px;" type="text"/> Street 2 <input style="width:200px;" type="text"/> * City <input style="width:100px;" type="text"/> State <input style="width:100px;" type="text"/> Zip <input style="width:50px;" type="text"/>		
<b>11.</b> Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when the transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.  * Signature: <input style="width:200px;" type="text"/> Completed on submission to Grants.gov * Name: Prefix <input style="width:50px;" type="text"/> * First Name <input style="width:150px;" type="text"/> Middle Name <input style="width:150px;" type="text"/> * Last Name <input style="width:250px;" type="text"/> Suffix <input style="width:50px;" type="text"/> Title: <input style="width:150px;" type="text"/> Telephone No.: <input style="width:100px;" type="text"/> Date: <input style="width:200px;" type="text"/> Completed on submission to Grants.gov		
<b>Federal Use Only:</b>		Authorized for Local Reproduction Standard Form - LLL (Rev. 7-97)

**SECTION 01001**  
**GENERAL REQUIREMENTS**

**PART 1        GENERAL**

**1.01    GENERAL**

- A.    A brief description of the Work is stated in the Advertisement for Bids. To determine the full scope of the project or any particular part of the project, coordinate the applicable information in the several parts of these Contract Documents.

**PART 2        SEQUENCE OF OPERATIONS**

**2.01    SCHEDULING**

- A.    Prior to starting the Work, confer with the Engineer and Owner's representative to develop an approved Work schedule. Do not make connections between existing Work and new Work until necessary inspection and tests have been completed on the new Work and it is found to conform in all respects to the requirements of the Contract Documents.
- B.    Work on existing facilities shall be performed on a schedule and in a manner that will permit the existing wastewater treatment system to operate continuously, unless agreed to by the Owner as described herein.

**2.02    SHUTDOWN OR ALTERATION OF EXISTING OPERATIONS OR UTILITIES**

- A.    Continuous operation of the existing wastewater treatment system is of critical importance.
- B.    Connections to existing services or utilities, or other Work that requires the temporary shutdown of any existing operations or utilities shall be planned in detail with appropriate scheduling of the Work and coordinated with the Owner or Engineer. The approved schedule for shutdown or restart shall be indicated on the Contractor's Progress Schedule, and advance notice shall be given in order that the Owner or Engineer may witness the shutdown, tie-in, and startup.
- C.    All materials and equipment (including emergency equipment) necessary to expedite tie-ins shall be on hand prior to the shutdown of existing services or utilities.

**2.03    OPERATION OF EXISTING SYSTEM PROHIBITED**

- A.    At no time undertake to close off any lines or open valves or take any other action which would affect the operation of the existing system, except as specifically required by the Drawings and Specifications and after approval is

## GENERAL REQUIREMENTS

granted by the Owner. Request approval to change the system operation three (3) working days in advance of the time that interruption of the existing system is required.

### 2.04 EQUIPMENT AND SYSTEM TESTING

- A. Functional (or run) testing, in the presence of the manufacturer's representative and/or Engineer, will be required for each item of equipment following installation. Functional testing is defined, as that testing necessary to determine if installed equipment and systems will operate as intended.
- B. In addition to the functional test, specific performance testing of installed equipment and systems shall be conducted by the Contractor as required in the section specifying the equipment or system.
- C. The Contractor shall furnish all labor, materials, tools, equipment, instruments, and services necessary to perform the functional and performance testing.

### 2.05 SEQUENCE OF DEMOLITION AND CONSTRUCTION

- A. Project Construction Sequence: The overall intent of the project construction sequence is to keep the existing plant in operation during construction of the new facility. At no time shall the facility lose the ability to convey and treat wastewater.
  - 1. This sequence of operation is intended to provide one logical option for proceeding through the construction phases, however, it is not expected to be the only sequence to accomplish the required work.
  - 2. The Contractor may determine other sequences that ultimately result in the same outcome with a varied timeline and with similar or improved outage periods.
  - 3. Alternate sequences should be submitted for review and approval by the Owner and Engineer.
  - 4. For clarity, this sequence description has separate sections for Electrical, Process and Controls, however it is expected the General Contractor (GC) and the individual disciplines (subcontractors) will work together to minimize plant and individual processes downtime by scheduling outages with coinciding work between disciplines.
- B. Plant Outage & Notifications:
  - 1. All partial plant outages will require 14 days' notice to the OWNER; additionally, confirmation of outages should be given at 72 hours and 24 hours prior to the shutdown.

## GENERAL REQUIREMENTS

2. Local short term (<24hrs) outages not affecting overall plant production (i.e. SCADA systems, chemical systems, sampling systems, individual pumps and mechanical systems) require a 7-day notice to the OWNER.
3. The contractor shall submit a detailed shutdown work plan and schedule for approval by the OWNER and ENGINEER
4. A pre-shutdown coordination meeting will be required between plant personnel, Engineer and Contractor prior to approval of the shutdown plan.

### C. Phase 1 Demolition and Construction:

1. The new Chlorine Contact Basin (CCB) must be fully operational before work can begin on demo of the existing CCB and construction of the process tanks.

Phase	
1.0	Construct Outfall Junction Manhole (JMH)
1.0	Bypass 12" Outfall Pipe with temporary outfall from existing CCB into new outfall junction box. Cut-in new 12" 90 bend to existing CCB effluent pipe lay 12" pipe to outfall JMH
1.0	Demo Maintenance Building (can be performed in any phase)
1.0	Construct Digester (can be performed in any phase)
1.1	Construct Dewatering Building (can be performed in any phase)
1.1	Demo existing outfall to new outfall JMH to clear room for new CCB
1.1	Remove and Relocate "WT GAS" gas system powerline
1.1	Construct New CCB and connect to new outfall JMH
1.1	Re-Route RO CNT to new JMH discharge; install SO2 and Cl2 solution lines to new CCB
1.2	Feed new CCB with temporary bypass from clarified effluent; Install clarified effluent flow meter
1.2	Plug 12" PVC Sand Filter BW Discharge to existing IPS
1.2	Temporarily relocate existing plant water pumping system to new CCB and connect to existing plant water system

### D. Phase 2 Demolition and Construction:

2.0	Demo existing CCB and associated piping
2.0	Demo existing EQ Basin and associated piping
2.0	Demo existing Drying Beds



## GENERAL REQUIREMENTS

### E. Phase 3 Demolition and Construction:

3.0	Construct new process basins and headworks
3.0	Construct operations building
3.0	Construct new influent pump station (IPS) and odor control
3.0	Install new piping, pumps, valves, and onsite sewer collection system
3.1	Startup new process basins, headworks and IPS
3.1	Install 10" FM connection*
3.1	Install 12" FM connection*
3.1	Transfer seed sludge
3.2	Commision Filter and UV system
3.2	Commision new plant water system
3.2	Remove and dispose all liquid, sludge and debris from old tanks
3.3	Demo old process tanks/headworks/screens/blowers/pipe/valves/etc.
3.3	Demo existing IPS and influent sewer gravity/forcemain/mechanical and electrical components
3.3	Demo existing lab and office buildings, remove rip rap, reinforce seawall. Decomission old electrical systems.
3.4	Construct drying beds
3.4	Complete fine grading/drives/parking/fencing/landscaping/etc.

**\*DIWSA has the ability to pump wastewater through the 10" FM or 12" FM during the connection period.**

## PART 3 SITE CONDITIONS

### 3.01 SITE INVESTIGATION AND REPRESENTATION

- A. The Contractor acknowledges satisfaction as to the nature and location of the Work, the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the prosecution of the Work, and all other matters which can in any way affect the Work or the cost thereof under this Contract.
- B. The Contractor further acknowledges satisfaction as to character, quality, and quantity of surface and subsurface materials to be encountered from his inspection of the site and from reviewing any available records of exploratory Work furnished by the Owner or included in these Documents. Failure by the Contractor to become acquainted with the physical conditions of the site and all the available information will not relieve the Contractor from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

## GENERAL REQUIREMENTS

- C. The Contractor warrants that as a result of examination and investigation of all the aforesaid data, the Contractor can perform the Work in a good and workmanlike manner and to the satisfaction of the Owner. The Owner assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this Contract, unless (1) such representations are expressly stated in the Contract, and (2) the Contract expressly provides that the responsibility therefor is assumed by the Owner.

### 3.02 INFORMATION ON SITE CONDITIONS

- A. General: Any information obtained by the Engineer regarding site conditions, groundwater elevations, existing construction of site facilities as applicable, and similar data will be available for inspection at the office of the Engineer upon request. Such information is offered as supplementary information only. Neither the Engineer nor the Owner assumes any responsibility for the completeness or interpretation of such supplementary information.

### 3.03 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

- A. Utilities and structures adjacent to or expected to be encountered in the Work are the Contractor's sole responsibility to locate. A utility notification service is available and it is encouraged that it be used to notify those utilities that participate in the service.
- B. Where the Contractor's operations could cause damage or inconvenience to railway, telegraph, telephone, television, power, oil, gas, water, sewer, or irrigation systems, the operations shall be suspended until all arrangements necessary for the protection of these utilities and services have been made by the Contractor.
- C. Notify all utility offices which are affected by the construction operation at least forty-eight (48) hours in advance. Under no circumstances expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for all existing underground utilities.
- D. The Contractor shall be solely and directly responsible to the Owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
- E. Neither the Owner nor its officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the Work.

## GENERAL REQUIREMENTS

- F. If the Contractor while performing the Contract discovers utility facilities not identified by the public agency in the Contract Drawings or Specifications, he shall immediately notify the public agency and utility in writing.
- G. The public utility, where they are the Owner, shall have the sole discretion to perform repairs or relocation Work or permit the Contractor to do such repairs or relocation Work at a reasonable price.
- H. The Contractor shall replace, at his own expense, all existing utilities or structures removed or damage during construction, unless otherwise provided for in these Contract Documents or ordered by the Engineer.

### 3.04 INTERFERING STRUCTURES

- A. Take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. The completeness and accuracy of information shown cannot be guaranteed, and it is presented simply as a guide to avoid known possible difficulties.
- B. Protect underground and aboveground existing structures from damage, whether or not they lie within the limits of the easements obtained by the Owner. Where such existing fences, gates, barns, sheds, buildings, or any other structure must be removed in order to properly carry out the construction, or are damaged during construction, restore to their original condition to the satisfaction of the property owner involved at the Contractor's own expense. Notify the Engineer of any damaged underground structure and make repairs or replacements before backfilling.
- C. Without additional compensation, the Contractor may remove and replace in a condition as good as or better than original, such small miscellaneous structures as fences, mailboxes, and signposts that interfere with the Contractor's operation.
- D. Contractor is responsible for holding all traffic signals and light poles that interfere with construction or are susceptible to damage from construction activities.

### 3.05 FIELD RELOCATION

- A. During the progress of construction, it is expected that minor relocations of the Work will be necessary. Such relocations shall be made only by direction of the Engineer. If existing structures are encountered which prevent the construction, and which are not properly shown on the Drawings, notify the Engineer before continuing with the construction in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures. If the Contractor fails to so notify the Engineer when an existing structure is encountered, and proceeds with the construction despite this interference, he shall do so at his own risk.

**PART 4 SALVAGE OF MATERIALS**

**4.01 SALVAGE OF EQUIPMENT AND MATERIALS REMOVED**

- A. If existing equipment or materials are removed and replaced, they shall be salvaged by the Owner. Upon removal and replacement, the Contractor shall place the equipment or materials at an on-site location directed by the Owner.

**PART 5 TEMPORARY CONSTRUCTION UTILITIES AND FACILITIES**

**5.02 PROJECT SIGN**

- A. The Contractor shall install a Project sign at the entrance to the construction site in accordance with the funding agency requirements.

**5.03 TEMPORARY WATER**

- A. The Contractor shall provide all water required to accomplish the actual construction, including water required for testing, flushing and sterilization. Temporary piping for transporting the water to the Work shall be paid for by the Contractor.

**5.04 TEMPORARY ELECTRIC POWER**

- A. The Contractor shall be responsible for obtaining a source of electric power for construction. The Contractor shall pay the cost of electric service for construction and testing until substantial completion is achieved.

**5.05 SAFETY REQUIREMENT FOR TEMPORARY ELECTRIC POWER**

- A. Temporary electric power installation shall meet the construction safety requirements of OSHA, State, and other governing agencies.

**5.06 SANITARY FACILITIES**

- A. The Contractor shall provide and maintain sanitary facilities for his employees and his subcontractors' employees that will comply with the regulations of the local and state departments of health and as directed by the Engineer.

**5.07 RECEIVING, INSPECTION, AND UNLOADING PRODUCTS**

- A. Contractor shall record the receipt of products at the job site.
- B. Upon receipt of products at the job site, Contractor shall inspect for completeness and evidence of damage during shipment.
  - 1. Owner's representative may be present for inspection.

## GENERAL REQUIREMENTS

2. Should there appear to be damage, notify the Owner's representative immediately and inform the Manufacturers and the Transportation Company.
  3. Expedite replacement of damaged, incomplete, or lost items.
- C. After completion of inspection, unload products in accordance with manufacturer's instructions for unloading, or as specified. Do not unload damaged or incomplete products to be returned to manufacturer for replacement, except as necessary to expedite return shipment.

### 5.08 HANDLING, STORAGE, AND MAINTENANCE OF PRODUCTS

- A. Handle products in accordance with the manufacturer's written recommendations, and in a manner to prevent damage.
- B. Store products prior to installation as recommended by the manufacturer.
1. Store products such as pipe and reinforcing steel off the ground in approved storage yards.
  2. Store items subject to damage by the elements, vandalism, or theft in secure buildings.
  3. Provide environmentally controlled storage facilities for items requiring environmental control for protection.
- C. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.
- D. Store products to provide access for inspection and inventory control. Contractor shall document products in storage to facilitate inspection and to estimate progress payments for products delivered but not installed in the Work.

### 5.09 STORAGE OF MATERIALS

- A. Materials shall be so stored as to ensure the preservation of their quality and fitness for the Work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the Owner or lessee.
- B. Delicate instruments and materials subject to vandalism shall be placed under locked cover and, if necessary, provide with temperature control as recommended by the manufacturer.

**PART 6 SAFETY AND CONVENIENCE**

**6.01 CONSTRUCTION SAFETY PROGRAM**

- A. The Contractor shall develop and maintain for the duration of this Contract, a safety program that will effectively incorporate and implement all required safety provisions. The Contractor shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program.
- B. The duty of the Engineer to conduct construction review of the Contractor's performance is not intended to include a review or approval of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

**6.02 SAFETY EQUIPMENT**

- A. The Contractor, as part of his safety program, shall maintain at his office or other well-known place at the job site, safety equipment applicable to the Work as prescribed by the governing safety authorities, all articles necessary for giving first-aid to the injured, and shall establish the procedure for the immediate removal to a hospital or a doctor's care of any person who may be injured on the job site.
- B. The Contractor shall do all Work necessary to protect the general public from hazards, including, but not limited to, pedestrian sidewalk or walkway, and trenches or excavations in roadway. Barricades, lanterns, and proper signs shall be furnished in sufficient amount to safeguard the public and the Work.
- C. The performance of all Work and all completed construction, particularly with respect to ladders, platforms, structure openings, scaffolding, shoring, lagging, machinery guards and the like, shall be in accordance with the applicable governing safety authorities.
- D. During construction, the Contractor shall construct and at all times maintain satisfactory and substantial temporary chain link fencing, solid fencing, railing, barricades or steel plates, as applicable, at all openings, obstruction, or other hazards in streets, sidewalks, floors, roofs, and walkways. All such barriers shall have adequate warning light as necessary, or required, for safety.

**6.03 ACCIDENT REPORTS**

- A. If death or serious injuries or serious damage are caused, the accident shall be reported immediately by telephone or messenger to the Engineer. In addition, the Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of or in connection with, the performance of the Work whether on, or adjacent to, the site, giving full details and statements of witnesses.

## GENERAL REQUIREMENTS

- B. If claim is made by anyone against the Contractor or any subcontractor on account of any accidents, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

### 6.04 SAFE ACCESS BY FEDERAL, STATE, AND LOCAL GOVERNMENT OFFICIALS

- A. Authorized representatives of the Alabama Department of Environmental Management, and other government officials shall at all time have safe access to the Work, and the Contractor shall provide proper facilities for such access and inspection.

### 6.05 PROTECTION OF PROPERTY

- A. Protect stored materials, cultivated trees and crops, and other items located adjacent to the proposed Work. Notify property owners affected by the construction at least forty-eight (48) hours in advance of the time construction begins. During construction operations, construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to his residence or place of business for a period exceeding eight (8) hours, unless the Contractor has made special arrangements with the affected persons.

### 6.06 FIRE PREVENTION AND PROTECTION

- A. The Contractor shall perform all Work in a fire-safe manner. He shall supply and maintain on the site adequate fire-fighting equipment capable of extinguishing incipient fires. The Contractor shall comply with applicable Federal, State, and local fire-prevention regulations. Where these regulations do not apply, applicable parts of the National Fire Prevention Standard for Safeguarding Building Construction Operation (NFPA No. 241) shall be followed.

### 6.07 TRAFFIC MAINTENANCE AND SAFETY

- A. Comply with all rules and regulations of the State, County, and City authorities regarding closing or restricting the use of public streets or highways. No public or private road shall be closed, except by express permission of the Owner. Conduct the Work so as to assure the least possible obstruction to traffic and normal commercial pursuits. Protect all obstructions within traveled roadways by installing approved signs, barricades, and lights where necessary for the safety of the public. The convenience of the general public and residents adjacent to the project and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.
- B. When flagmen and guards are required by regulation or when deemed necessary for safety, they shall be furnished with approved orange wearing apparel and other regulation traffic-control devices.

**6.08 ACCESS AND NOTIFICATION FOR POLICE, FIRE, AND POSTAL SERVICE**

- A. Notify the fire department and police department before closing any street or portion thereof. No closing shall be made without the Owner's approval. Notify said departments when the streets are again passable for emergency vehicles. Conduct operations with the least interference to fire equipment access and at no time prevent such access.
- B. The Contractor shall leave a night emergency telephone number or numbers with the police departments, so that contact may be made easily at all times in case of barricade or flare trouble or other emergencies.
- C. Maintain postal service facilities in accordance with the requirements of the U.S. Postal Service, and at the completion of the Work in each area, replace them in their original location and in a condition satisfactory to the U.S. Postal Service.

**PART 7 USE OF EXPLOSIVES**

- A. The Contractor shall use all precaution, control, and safety features necessary to insure the safety of life or property in the area of operation.
- B. Blasting operations shall be performed under the most skilled supervision. Where necessary, Contractor shall use suitable mats or other approved methods to smother blast.
- C. No loaded holes shall be left unattended.
- D. Extreme care shall be taken to minimize the amount and degree of ground vibration, noise, overpressure, and flying debris.
- E. All explosives shall be stored in a safe manner, in compliance with local, state and federal laws and ordinances.

**PART 8 PRESERVATION, RESTORATION, AND CLEANUP**

**8.01 EROSION CONTROL**

- A. The Contractor shall protect floodplains and wetlands by complying with the requirements in Title 33 of the Code of Federal Regulations Part 330, Appendix A. The Contractor shall provide silt fences and straw bales or wattles, as required or by the recommendations of the Owner or Engineer.
- B. The CONTRACTOR shall be responsible for obtaining a construction stormwater permit, in accordance with ADEM Administrative Code Chapter 335-6-6, for all land disturbance activities, and associated areas, that exceed one acre or disturbance activities less than one acre that are a part of, adjacent to, or in close proximity to, or associated with a larger plan of development that might



## GENERAL REQUIREMENTS

eventually exceed one acre. The contractor shall also be responsible for installing and maintaining all BMPs required by the stormwater permit.

### 8.02 SITE RESTORATION AND CLEANUP

- A. At all times during the Work, keep the premises clean and orderly, and upon completion of the Work, repair all damage caused by equipment and leave the project free of rubbish or excess materials of any kind.
- B. All existing drainage ditches and culverts shall be reopened and graded and natural drainage restored. Restore culverts broken or damaged to their original condition and location.

### 8.03 FINISHING OF SITE, BORROW, AND STORAGE AREAS

- A. Upon completion of the project, all areas used by the Contractor shall be properly cleared of all temporary structures, rubbish, and waste materials and properly graded to drain and blend in with the abutting property. Areas used for the deposit of waste materials shall be finished to properly drain and blend with the surrounding terrain.

### 8.04 RESEEDING AND FERTILIZING

- A. If damaged originally seeded areas inside and outside of the construction area shall be fertilized and reseeded with first-quality seed or planted with new sod as approved by the property owner. All ground preparation, reseeded, and sodding shall be done in accordance with the best accepted practices for lawn planting. The Contractor shall be responsible for obtaining a satisfactory grass turf acceptable to the property owner.

### 8.05 STREET CLEANUP DURING CONSTRUCTION

- A. Thoroughly clean all foreign material caused by the construction operations from all streets and roads at the conclusion of each day's operation.

## PART 9 SUBMITTALS DURING CONSTRUCTION

### 9.01 GENERAL

- A. Requirements in this Section are in addition to any specific requirements for submittals specified in other Sections of these Contract Documents.
- B. Submittals to the Engineer shall be addressed to:

Ardurra Group  
200 Clinton Avenue West, Suite 704  
Huntsville, AL 35801  
**Attn: Harrison Saucier**

## GENERAL REQUIREMENTS

- C. Submitted data shall be fully sufficient in detail for determination of compliance with the Contract Documents.
- D. Review, acceptance, or approval of substitutions, schedules, shop Drawings, lists of materials, and procedures submitted or requested by the Contractor shall not add to the Contract amount, and all additional costs which may result therefrom shall be solely the obligation of the Contractor.
- E. The Owner is not precluded, by virtue of review, acceptance, or approval, from obtaining a credit for construction savings resulting from allowed concessions in the Work or materials therefore.
- F. It shall not be the responsibility of the Owner to provide engineering or other services to protect the Contractor from additional costs accruing from such approvals.
- G. No equipment or material for which listings, Drawings, or descriptive material is required shall be installed until the Engineer has on hand copies of such approved lists and the appropriately stamped final shop Drawings.
- H. The review of Drawings by the Engineer will be limited to general design requirements only, and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein.
- I. Submittals will be acted upon by the Engineer as promptly as possible, and returned to the Contractor no later than the time allowed for review in SHOP DRAWING SUBMITTAL PROCEDURE. Delays caused by the need for resubmittals shall not constitute reason for an extension of Contract time.

### 9.02 SHOP DRAWING SUBMITTAL PROCEDURE

- A. The Contractor shall submit five (5) copies, to the Engineer for his review, of shop Drawings, electrical diagrams, and catalog cuts for fabricated items and manufactured items (including mechanical and electrical equipment) furnished under this Contract. Shop Drawings shall be submitted in sufficient time to allow the Engineer not less than twenty (20) regular working days for examining the shop Drawings.
- B. These shop Drawings shall be accurate, distinct, and complete, and shall contain all required information, including satisfactory identification of items, units, and assemblies in relation to the Contract Drawings and Specifications.
- C. Shop Drawings shall be submitted only by the Contractor, who shall indicate by a signed stamp on the shop Drawings, or other approved means, that he (the Contractor) has checked and approved the shop Drawings, and that the Work shown is in accordance with Contract requirements and has been checked for dimensions and relationship with Work of all other trades involved. The practice of submitting incomplete or unchecked shop Drawings for the Engineer

## GENERAL REQUIREMENTS

to correct or finish will not be acceptable, and shop Drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the Contract Documents and will be returned to the Contractor for resubmission in the proper form.

- D. When the shop Drawings have been reviewed by the Engineer, two (2) sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the shop Drawing may be rejected and one set will be returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit the shop Drawings in the same manner and quantity as specified for the original submittal, unless otherwise directed by the Engineer. If changes are made by the Contractor (in addition to those requested by the Engineer) on the resubmitted shop Drawings, such changes shall be clearly explained in a transmittal letter accompanying the resubmitted shop Drawings.
- E. The review of such shop Drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for correctness of dimension, fabrication details, and space requirements, or for deviations from the Contract Drawings or Specifications, unless the Contractor has called attention to such deviations in writing by the letter accompanying the shop Drawings and the Engineer approves the change or deviation in writing at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the shop Drawings.
- F. The Contractor agrees that shop Drawing submittals processed by the Engineer do not become Contract Documents and are not Change Orders; that the purpose of the shop Drawing review is to establish a reporting procedure and is intended for the Contractor's convenience in organizing his Work and to permit the Engineer to monitor the Contractor's progress and understanding of the design.

### 9.03 SHOP DRAWING REQUIREMENTS

- A. Shop Drawings referred to herein shall include shop Drawings and other submittals for both shop and field-fabricated items. The Contractor shall submit, as applicable, the following for all prefabricated or manufactured structural, mechanical, electrical, plumbing, process systems, and equipment:
  - 1. Shop Drawings or equipment Drawings, including dimensions, size and location of connections to other Work, and weight of equipment.
  - 2. Catalog information and cuts.
  - 3. Installation or placing Drawings for equipment, drives, and bases.
  - 4. Supporting calculations for equipment and associated supports specified to be designed by equipment manufacturers or suppliers.
  - 5. Wiring and control diagrams of systems and equipment.

## GENERAL REQUIREMENTS

6. Complete manufacturer's specifications, including materials description and paint system.
  7. List of special motor features being provided (i.e., space heaters, altitude corrections, thermal protectors, etc.).
  8. Complete motor rating for all motors fifteen (15) hp and larger, including motor no-load, starting, and full-load current at rated voltage; full-load speed and full-load current at one hundred-ten (110%) percent voltage; motor efficiency and power factor at  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and full load at rated voltage.
  9. Performance data and pump curves.
  10. Suggested spare parts list with current price information.
  11. List of special tools required for checking, testing, parts replacement, and maintenance (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics).
  12. List of special tools furnished with the equipment.
  13. List of materials and supplies required for the equipment prior to and during startup.
  14. List of materials and supplies furnished with the equipment.
  15. Samples of finish colors for selection.
  16. Special handling instructions.
  17. Requirements for storage and protection prior to installation.
  18. Requirements for routine maintenance required prior to plant startup.
  19. List of all requested exceptions to the Contract Documents.
- B. The submittals shall include satisfactory identification of items, units, and assemblies in relation to the Specification Section number, and the system or equipment identification or tag number shown on the Drawings or as provided in the applicable Specification Section.
- C. Should the Contractor propose any item on his shop Drawings, or incorporate an item into the Work, and that item should subsequently prove to be defective or otherwise unsatisfactory, (regardless of the Engineer's preliminary review), the Contractor shall, at his own expense, replace the item with another item that will perform satisfactorily.

### 9.04 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. The CONTRACTOR shall furnish four (4) copies of a complete instruction manual for installation, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment or system under this Contract. All equipment manufacturers and/or suppliers shall be made aware of these requirements and all associated costs shall be included in the costs for

## GENERAL REQUIREMENTS

furnishing the equipment or system. Each instruction manual furnished shall be fixed in a hard-back binder which is clearly labeled to designate the system or equipment for which it is intended with reference to the building and equipment number and the Specification section where the item is specified.

- B. The manuals shall be furnished at least thirty (30) calendar days prior to the scheduled completion of the Work but in no case shall submission of the manuals be delayed beyond seventy-five (75%) percent completion point of the Work. Submission of the manuals shall precede any payment to the CONTRACTOR for Work completed in excess of the seventy-five (75%) percent completion level. Any deficiencies found by the ENGINEER to exist in the manuals submitted shall be corrected by the CONTRACTOR within thirty (30) calendar days following notification by the ENGINEER of the deficiencies.
- C. Each instruction manual shall include, but not be limited, to the following:
  - 1. Diagrams and illustrations.
  - 2. Detailed description of the function of each principal component of the system.
  - 3. Performance and nameplate data.
  - 4. Installation instructions.
  - 5. Procedure for starting.
  - 6. Proper adjustment.
  - 7. Test procedures.
  - 8. Procedure for operating.
  - 9. Shutdown instructions.
  - 10. Emergency operating instructions and troubleshooting guide.
  - 11. Safety precautions.
  - 12. Maintenance and overhaul instructions which shall include detailed assembly Drawings with part numbers, parts list, instructions for ordering spare parts, and complete preventive maintenance instruction required to ensure satisfactory performance and longevity of the equipment.
  - 13. Lubrication instructions, which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication.
  - 14. List of electrical relay settings and control and alarm contact settings.
  - 15. Electrical interconnection wiring diagram for equipment furnished, including all control and lighting systems.

## GENERAL REQUIREMENTS

- D. Manuals shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
- E. Manuals shall be assembled in one (1) or more binders, each with title page, typed table of contents, and heavy section dividers with numbered plastic index tabs. Each manual shall be divided into sections paralleling the equipment Specifications. Binders shall be three (3) ring, hard-back type. All data shall be punched for binding and composition and printing shall be arranged so that punching does not obliterate any data. The Project title, division designation, and manual title printed thereon shall be furnished by the ENGINEER.
- F. Where more than one (1) binder is required, they shall be labeled "Vol. 1", "Vol. 2", and so on. The table of contents for the entire set, identified by volume number, shall appear in each binder. Submit manual organization and format to the Engineer for approval prior to manual preparation.
- G. Each O & M Manual shall be transmitted to the ENGINEER prior to the installation of the equipment and all equipment shall be serviced in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the ENGINEER prior to final acceptance of the Project.

### 9.05 MAINTENANCE SUMMARY FORMS

- A. In addition to the O & M Manuals, provide Maintenance Summaries in the format of the form bound at the end of this Section and described below. The timing of submission of these forms shall be the same as prescribed above for the Operation and Maintenance Manuals.
- B. An individual Maintenance Summary for each equipment item shall be completed following the outlined provided; and six (6) copies submitted for review by the ENGINEER. The manufacturer's standard form will not be acceptable as a substitute for the Maintenance Summary.
- C. The term "Maintenance Operation" as used in the Maintenance Summary bound at the end of this Section is understood to mean any routine operation required to ensure the satisfactory performance and longevity of the equipment. Examples of some typical Maintenance Operations are lubrications, belt tensioning, adjustment of pump packing glands, routine adjustments, etc.
- D. The Maintenance Summary may take as many pages as required. However, the order and format shown must be adhered to. Only 8½ inch by eleven (11) inch paper will be accepted.

### 9.06 RECORD DRAWINGS

- A. The Contractor will prepare a set of Record Drawings for the Project, which will include the changes made in materials, equipment, locations, and dimensions of

## GENERAL REQUIREMENTS

the Work. Each month, or as otherwise agreed, the Contractor shall submit to the Engineer a current listing and description of each change incorporated into the Work since the preceding submittal.

### 9.07 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

- A. Where required in the Specifications, the Contractor shall submit manufacturer's certification of proper installation of equipment prior to startup or performance testing. Such certificate shall state that the equipment or system has been installed in accordance with the manufacturer's recommendation and has been inspected by a manufacturer's authorized representative, that it has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed, and the proper electrical and mechanical connections have been made.

### 9.08 MATERIAL AND EQUIPMENT COLORS

- A. The Engineer will provide a schedule of colors within thirty (30) days after approval of materials and equipment and after receiving samples of all standard colors those items requiring selections.
- B. No individual color selections will be made until after approval of all pertinent materials and equipment and after receipt of appropriate samples.

### 9.09 CERTIFICATES OF COMPLIANCE WITH SPECIFIED STANDARDS AND CODES

- A. A Certificate of Compliance shall be furnished for materials specified to a recognized standard or code prior to the use of any such materials in the Work. The Engineer may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and shall state that the materials involved comply in all respects with the requirements of the Specifications. A Certificate of Compliance shall be furnished with each lot of material delivered to the Work and the lot so certified shall be clearly identified in the certificate.
- B. All materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents and any such material not conforming to such requirements will be subject to rejection whether in place or not.
- C. The Engineer reserves the right to refuse permission for use of material on the basis of a Certificate of Compliance.
- D. The form of the Certificate of Compliance and its disposition shall be as directed by the Engineer.

9.10 STARTING OF SYSTEMS

A. Definitions:

1. System: A system means the overall process or a portion thereof, that performs a specific function. A system may consist of two (2) or more subsystems as well as two (2) or more types of equipment.
2. Subsystem: A subsystem is a portion of a larger systems consisting of two (2) or more types of equipment.
3. Functional Testing: Tests necessary to demonstrate that installed equipment and systems function as specified and operate in the manner intended. Functional testing is a prerequisite to performance testing for equipment and systems specified to have a performance test.
4. Performance Testing: Tests necessary to demonstrate, after successful functional testing, that equipment and systems meet specified performance requirements.
5. Startup:
  - a. Startup of any portion of the entire facility is considered complete when, in the opinion of the Engineer, the facility or designated portion has properly operated for seven (7) continuous days without significant interruption. The startup period is in addition to the specified functional and performance testing and training.
  - b. Significant interruption during startup shall include any of the following events:
    - 1). Failure of a system (process, control, building service, etc.) that is not permanently corrected within four (4) hours after such failure occurs.
    - 2). Failure of a process equipment unit (mechanical, electrical, instrument, etc.) that is not permanently corrected within six (6) hours after such failure occurs.
    - 3). Failure of an analytical, HVAC, building service, or hoisting equipment unit that is not permanently corrected within eight (8) hours after such failure occurs.
  - c. "Permanently corrected" shall consist of all the following:
    - 1). Work repaired and replaced to conform with specified requirements.
    - 2). Parts and components replaced as recommended by original manufacturer and conforming with reviewed submittals.



## GENERAL REQUIREMENTS

- 3). Piping and valves properly installed and connected.
- 4). Wiring properly terminated and enclosed in raceways.
- 5). Accessories, including spare parts and lubricants, furnished as specified.
- d. Occurrence of a significant interruption shall require startup then in progress to be stopped and restarted after permanent corrections are made.
6. Operation: The operation period begins when the facility has been substantially completed as defined in the GENERAL CONDITIONS.

### B. Testing and Startup Responsibilities

1. Contractor's Responsibilities: The Contractor shall:
  - a. Furnish labor and materials, tools, instruments, and service for checking, testing, and startup specified for each equipment item. This includes such services as required by the manufacturer's representatives, subcontractors, electricians, instrumentation technicians, and pipe fitters.
  - b. Prepare testing schedule and incorporate testing and startup activities in the progress schedule for the Work.
  - c. Designate one (1) person (other than field superintendent) to be responsible for coordinating and expediting testing and start-up responsibilities, and to be present during all pre-startup meetings and available to Owner's personnel during the testing and startup.
  - d. Obtain and furnish qualified manufacturer's representative to assist testing of each equipment type and system.
  - e. Develop a standard testing log to be used as a record of testing each item and subsystem. This log shall:
    - 1). Be subject to approval of Engineer.
    - 2). Include subsystem and equipment name.
    - 3). Have provisions for recording dates of completion for checking, inspection by manufacturer, verification of instrumentation and controls, and completion of subsystem tests, and;
    - 4). Provide space for problems remaining with equipment and for signature of Engineer and manufacturer's representative indicating acceptance.

## GENERAL REQUIREMENTS

- f. Notify Engineer and Owner at least fourteen (14) days prior to the date when each equipment system is scheduled to be initially started; also submit testing plan starting schedule, quantity and source of utilities, chemicals, and other materials needed.
- g. Furnish spare parts and special tools as specified for the respective equipment.
- h. Furnish O & M information needed for O & M Manuals, as specified herein.

2. Owner's Responsibilities: The Owner will:

- a. Furnish for Contractor's use during startup:
  - 1). Electrical power.
  - 2). Potable and/or raw water for testing, as appropriate.
  - 3). Chemicals including chlorine, polyaluminum chloride, lime, sodium bisulfite and sodium hexametaphosphate, provided adequate prior notice is given by Contractor.
  - 4). Sample containers for Contractor's use in sample collection.
- b. Provide sampling labor and materials and laboratory analysis.
- c. Furnish Owner's representative to witness all tests.

C. Testing Preparation

- 1. Cleaning and Checking: Prior to initial startup of equipment:
  - a. Inspect and clean equipment, devices, and connected piping so they are free of foreign material.
  - b. Lubricate equipment in accordance with manufacturer's instructions.
  - c. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
  - d. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
  - e. Check power supply to electric-powered equipment for correct voltage.
  - f. Obtain manufacturer's certification of proper installation, where specified.
- 2. Ready-To-Test Determination: Equipment shall be determined ready to test by Engineer based on the following:

## GENERAL REQUIREMENTS

- a. Notification by Contractor of equipment and system readiness for testing.
  - b. Submittal of testing plan stating detailed procedures including quantity and source of utilities, chemicals, and other materials needed for each test.
  - c. Receipt of O & M Manuals incorporating review comments.
  - d. Receipt of manufacturer's certification of proper installation, where specified.
  - e. Cleanliness of equipment, devices, and connected work.
  - f. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
3. Pre-testing Meeting: Contractor shall arrange a meeting to review the Contractor's detailed testing plan for each equipment item and system, at least two (2) days prior to the first test run.

### D. Functional Testing

1. Subsystem Tests: Startup and operate the individual components and subsystems that make up each equipment system, as specified in the respective sections of the Specifications. Functional testing of a complete system shall not begin until subsystem testing is completed to the Engineer's satisfaction.
2. Equipment and System Tests: Contractor shall functionally test each separate piece of equipment, and each system requiring simultaneous operation of interdependent equipment, in accordance with the following procedures:
  - a. Separate items of equipment demonstrated to function properly during subsystem testing shall require no further functional test, if documentation of subsystem testing is accepted by Engineer.
  - b. Functional testing of each system shall begin after subsystems and equipment units have been satisfactorily tested.
  - c. Functional testing will begin at a time mutually agreed upon by the Engineer, Owner, Manufacturer's Representative(s) and Contractor.
    - 1). The Owner or Engineer will be present during tests.
    - 2). Notify Engineer, Owner, and Manufacturer's Representative at least seven (7) days prior to schedule date of functional tests.
  - d. Performance tests, where specified for individual equipment, shall not begin until functional testing of the complete systems in which they operate is completed to the satisfaction of the Engineer.

## GENERAL REQUIREMENTS

e. If, in the opinion of the Engineer, each system meets the requirements specified, they will be accepted as conforming for the purposes of advancing to the performance testing phase. If, in the opinion of the Engineer, the functional test results do not meet the requirements specified, the systems will be considered as nonconforming.

1). In the case of a nonconforming system, advancement to the performance testing phase shall not commence until the Contractor has made such adjustments, changes, and additions necessary to correct the system and retest it as specified and, in the opinion of the Engineer, the system functions as specified.

3. Documentation: Contractor shall document subsystem and system tests in writing, in a format acceptable to the Engineer. Obtain respective manufacturer's signature and approval for subsequent performance testing or startup on the appropriate test logs.

### E. Performance Testing

1. Testing Fluid: Performance testing shall use plant fluid or material that the equipment or system is designed to handle during normal service conditions, unless otherwise specified.

2. Equipment and Subsystem Tests: Contractor shall:

a. Clean and check equipment and devices, as specified herein prior to starting equipment and subsystem performance tests.

b. Performance testing will begin at a time mutually agreed upon by the Engineer, Owner, Manufacturer's Representative(s), and Contractor.

1). The Owner or Engineer will be present during tests.

2). Notify Engineer, Owner, and manufacturer's representative at least seven (7) days prior to schedule date of performance testing.

c. Operate the necessary equipment units as specified in the respective O & M Manuals for a continuous period of four (4) hours.

d. Follow Engineer-approved testing plan and detailed procedures specified for each equipment unit and subsystem.

e. Complete acceptable performance testing of all equipment and subsystems included in a system, and submit test documentation before starting the system performance test.

### F. Startup

1. Performance testing of all individual equipment and subsystems shall be completed before the startup period begins, unless otherwise allowed by the Engineer.

## GENERAL REQUIREMENTS

2. Prepare startup activity schedule.
  - a. Schedule shall identify and sequence distinct activities to be conducted or tasks to be accomplished.
  - b. Examples of startup activities to be conducted are:
    - 1). Demonstrate manual and automatic operation of equipment.
    - 2). Simulate power failure and observe operation of components, tripping of breakers, etc.
  - c. Conduct additional non process activities such as:
    - 1). Operate all plumbing systems.
    - 2). Operate all HVAC systems.
    - 3). Open, close, lock, and unlock all doors and windows to check master keying.
    - 4). Check all electrical and lighting systems.
  - d. Indicate timing and interdependence of activities in the program, indicating each system, subsystem, and unit to be operated. Allow for rotation of standby units with operating units so that each unit is started and stopped at least twice and receives approximately the same elapsed time of operation.
3. After review and revisions requested by Engineer and Owner, begin the startup activities. Attend a pre-startup meeting not more than five (5) days to startup to review the program and resolve questions.
4. During startup operations, keep complete records of each activity and performance of each system, subsystem, and equipment unit. Use similar forms approved for functional testing, or as otherwise submitted and approved by Engineer.
5. If performance testing of certain systems cannot be completed before successful startup, continue such performance tests after entire facility is in continuous operation.
6. After successful startup as defined in this Section, perform remaining Work to not interfere with facility operations.

### G. Continuous Operation

1. Owner will accept equipment and systems as ready for continuous operation only after successful testing and startup is completed and documented, test and startup reports submitted and manufacturers' services completed for training of Owner's personnel.

## GENERAL REQUIREMENTS

2. After successful performance testing of a particular equipment type or system, Owner may elect to start up a portion of the equipment or system for continuous operation in accordance with the GENERAL CONDITIONS. Such operation will not interfere with testing of other equipment and systems that may still be underway, and shall not preclude the need to start up the portion operated in combination with the rest of the facility when all testing is completed.
3. Where completed systems require disinfection, they shall only be accepted for continuous operation after disinfection work specified is satisfactorily completed.

### 9.11 SUPPLIERS'/ MANUFACTURERS' SPECIAL SERVICES

- A. Installation Assistance: Competent and experienced technical personnel shall represent the manufacturers of all equipment and systems as may be necessary to resolve assembly or installation problems at the Work site which are attributable to, or associated with, the equipment furnished.
- B. Functional Testing: Where functional testing services are called for in the Technical Specifications, or when technical assistance is necessary to resolve performance problems that may become apparent during the performance test, the manufacturer's representative shall provide such assistance as necessary to demonstrate the specified performance.
- C. Startup: Where startup services are called for in the Technical Specifications, or when technical assistance is necessary due to any malfunction of the equipment or system furnished, the manufacturer's representative shall provide such services as necessary to provide the Owner with an acceptable operating facility.
- D. Costs for Services:
  1. Costs for providing services during installation, testing, and for the training of Owner's personnel shall be included in the costs for providing the applicable specified equipment.
  2. Where the number of days for services is not stated in the Technical Specifications, services shall be furnished for installation, testing, and plant startup as required to provide the Owner with a satisfactory operating facility.

**END SECTION**

## GENERAL REQUIREMENTS

### TYPICAL MAINTENANCE SUMMARY FORM

1. EQUIPMENT ITEM
2. MANUFACTURER
3. NAMEPLATE DATE (hp, voltage, speed, etc.)
4. MANUFACTURER'S LOCAL REPRESENTATIVE

Name \_\_\_\_\_ Telephone Number \_\_\_\_\_

Address \_\_\_\_\_

5. SPARE PARTS. Include your recommendations regarding what spare parts, if any should be kept on the job.
6. MAINTENANCE REQUIREMENTS

Maintenance Operation <sup>1</sup>	Frequency <sup>2</sup>	Lubricant (If Applicable) <sup>3</sup>	Comments

1. List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable.
2. List required frequency of each maintenance operation.
3. List lubricant manufacturers, types, and identification numbers.

**SECTION 01100**  
**SUMMARY OF WORK**

**PART 1 GENERAL**

1.01 SUMMARY

- A. This Section includes the following:
1. Work covered by the Contract Documents.
  2. Organization and interpretation of Contract Documents.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: **Aloe Bay Water Quality Enhancement Wastewater Treatment Facility**

1. Project Location: 701 LeMoyne Dr., Dauphin Island Alabama

- B. Project No. 100200.32

- C. OWNER: Dauphin Island Water and Sewer Authority

1. OWNER's Representative: Vaile Feemster

2. OWNER's Address: 908 Alabama Ave., Dauphin Island Alabama

- D. Engineer: Jim Smith PE

- E. The Work consists of the following:

Operations Building  
Two (2) BNR process basins  
Two (2) secondary clarifiers  
Tertiary filtration systems  
Aeration systems  
Pumping systems  
Solids handling & maintenance facility & screw press  
UV disinfection system and redundant chlorine contact basin  
SCADA control system

- F. Project will be constructed under a single prime contract.

1.03 ORGANIZATION AND INTERPRETATION OF CONTRACT DOCUMENTS

- A. Specifications and Drawings included in these Contract Documents establish the performance, quality requirements, location and general arrangement of



## SUMMARY OF WORK

materials and equipment, and establish the minimum standards for quality of workmanship and appearance.

- B. A part of the work that is necessary or required to make each installation satisfactory and operable for its intended purpose, even though it is not specifically included in the Specifications or on the Drawings, shall be performed as incidental work as if it were described in the Specifications and shown on the Drawings.

### **PART 2 PRODUCTS (Not Used)**

### **PART 3 EXECUTION (Not Used)**

**END OF SECTION**

## SECTION 01210 - ALLOWANCES

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes administrative and procedural requirements governing allowances.
  - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.
  - 2. Unit-cost allowances.
  - 3. Quantity allowances.
  - 4. Contingency allowances.
  - 5. Testing and inspecting allowances.
- C. Related Sections include the following:
  - 1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
  - 2. Division 1 Section "Unit Prices" for procedures for using unit prices.
  - 3. Division 1 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
  - 4. Divisions 2 through 16 Sections for items of Work covered by allowances.

#### 3. SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

4. SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

5. COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

6. LUMP-SUM UNIT-COST AND QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

7. CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

8. UNUSED MATERIALS

- A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
  - 1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver

## ALLOWANCES

unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

### 2.PRODUCTS (Not Used)

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

#### 2. PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

#### 3. SCHEDULE OF ALLOWANCES

- A. See bid schedule for additional allowances

END OF SECTION 01210

**SECTION 01250**  
**CONTRACT MODIFICATION PROCEDURES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. See Division 1 Section "Allowances" for procedural requirements for handling and processing allowances.
- C. See Division 1 Section "Unit Prices" for administrative requirements for using unit prices.

**1.02 MINOR CHANGES IN THE WORK**

- A. ENGINEER will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form provided by ENGINEER.

**1.03 PROPOSAL REQUESTS**

- A. OWNER-Initiated Proposal Requests: ENGINEER will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by ENGINEER are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.

## CONTRACT MODIFICATION

- d. Include an updated CONTRACTOR's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. CONTRACTOR-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, CONTRACTOR may propose changes by submitting a request for a change to ENGINEER.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated CONTRACTOR's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use forms provided by ENGINEER

### 1.04 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in purchase amount only where indicated as part of the allowance.
  2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

## CONTRACT MODIFICATION

3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
  4. OWNER reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or CONTRACTOR's handling, labor, installation, overhead, and profit. Submit claims within 14 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. OWNER will reject claims submitted later than 14 days after such authorization.
1. Do not include CONTRACTOR's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  2. No change to CONTRACTOR's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

### 1.05 CHANGE ORDER PROCEDURES

- A. On OWNER's approval of a Proposal Request, ENGINEER will issue a Change Order for signatures of OWNER and CONTRACTOR on forms provided by ENGINEER.

### 1.06 CONSTRUCTION CHANGE DIRECTIVE

- A. Work Change Directive: ENGINEER may issue a Construction Change Directive on forms provided by ENGINEER. Work Change Directive instructs CONTRACTOR to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

**PART 2    PRODUCTS (Not Used)**

**PART 3    EXECUTION (Not Used)**

**END OF SECTION**



## SECTION 01300 SUBMITTALS

### PART 1 GENERAL

#### 1.01 DESCRIPTION OF REQUIREMENTS

- A. This Section specifies the general methods and requirements of submissions applicable to Shop Drawings, Product Data, and Samples. Detailed submittal requirements are specified in the technical Sections.
- B. All submittals shall be clearly identified by reference to Section Number, Paragraph, Drawing Number or Detail as applicable. Submittals shall be clear, legible, and of sufficient size for presentation of data.

#### 1.02 SHOP DRAWINGS, PRODUCT DATA, SAMPLES

- A. Shop Drawings
  - 1. Shop drawings as specified in individual Sections include custom-prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the work,
  - 2. All shop drawings submitted by suppliers and subcontractors shall be sent directly to the CONTRACTOR for checking. The CONTRACTOR shall be responsible for their submission at the proper time to prevent delays in delivery of materials.
  - 3. Check all suppliers and subcontractors shop drawings regarding measurements, size of members, materials and details to make sure that they conform to the intent of the Drawings and related Sections. Return shop drawings found to be inaccurate or otherwise in error to the second tier subcontractors for correction.
  - 4. All details on shop drawings shall show clearly the relation of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted.

B. Product Data

1. Product data specified in individual Sections include standard prepared data for manufactured products (sometimes referred to as catalog data) such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing and printed product warranties, as applicable to the work.

C. Samples

1. Samples specified in individual Sections include, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols and units of work to be used by the CONTRACTOR or OWNER for independent inspection and testing, as applicable to the work.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Review shop drawings, product data and samples, including those by second tier subcontractors, prior to submission to determine and verify the following:
  1. Field measurements
  2. Field construction criteria
  3. Catalog numbers and similar data
  4. Conformance with related Sections
- B. Each shop drawing, sample and product data submitted by the CONTRACTOR shall have affixed to it the following Certification Statement including the CONTRACTOR's Company name and signed by the CONTRACTOR: "Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements." Shop drawings and product data sheets 11-in x 17-in, and smaller, shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. 8<sup>1</sup>/<sub>2</sub> -in x 11-in sheets shall be the minimum sized submittal size. The cover sheet shall fully describe the packaged data and include a listing of all items within the package. Provide to the OWNER's Representative a copy of each transmittal sheet for shop drawings, product data and samples.

## SUBMITTALS

- C. The CONTRACTOR shall utilize a 10-character submittal identification numbering system in the following manner:
1. The first character shall be a D, S, P or M which represents Shop/Working Drawing and other Product Data (D), Sample (S), Preliminary Submittal (P) or Operating/ Maintenance Manual (M).
  2. The next five digits shall be the applicable Section Number.
  3. The next three digits shall be the numbers 001 to 999 to sequentially number each initial separate item or drawing submitted under each specific Section Number.
  4. The last character shall be a letter, A to Z, indicating the submission, or resubmission of the same Drawing, i.e., "A=1st submission, B=2nd submission, C=3rd submission, etc. A typical submittal number would be as follows:  
  
D-03300-008-B  
  
D                   = Shop Drawing  
03300               = Section for Concrete  
008                 = The eighth initial submittal under this section  
B                   = The second submission (first resubmission) of that particular shop drawing
- D. Notify the ENGINEER in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.
- E. The review and approval of shop drawings, samples or product data by the ENGINEER shall not relieve the CONTRACTOR from the responsibility for the fulfillment of the terms of the contract. All risks of error and omission are assumed by the CONTRACTOR and the ENGINEER will have no responsibility therefore.
- F. No portion of the work requiring a shop drawing, sample, or product data shall be started nor shall any materials be fabricated or installed prior to the approval or qualified approval of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to approved shop drawings and data shall be at the CONTRACTOR's risk. The OWNER will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- G. Project work, materials, fabrication, and installation shall conform to approved shop drawings, applicable samples, and product data.

### 1.04 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule and in such sequence as to cause no delay in the Work or in the work of any other contractor.

## SUBMITTALS

- B. Each submittal, appropriately coded, should allow 14 calendar days following receipt of submittal to the ENGINEER for review and return to the CONTRACTOR.
  - C. Number of submittals required:
    - 1. Shop Drawings: Five copies.
    - 2. Product Data: Five copies.
    - 3. Samples: Submit the number stated in the respective Sections, two minimum for each submittal.
  - D. Submittals shall contain:
    - 1. The date of submission and the dates of any previous submissions.
    - 2. The Project title and number.
    - 3. CONTRACTOR identification.
    - 4. The names of:
      - a. CONTRACTOR
      - b. Supplier
      - c. Manufacturer
    - 5. Identification of the product, with the section number, page and paragraph(s).
    - 6. Field dimensions, clearly identified as such.
    - 7. Relation to adjacent or critical features of the work or materials.
    - 8. Applicable standards, such as ASTM or Federal Standards numbers.
    - 9. Identification of deviations from Design Documents.
    - 10. Identification of revisions on resubmittals.
    - 11. A blank space suitably sized for CONTRACTOR stamps.
    - 12. Where calculations are required to be submitted by the CONTRACTOR, the calculations shall have been checked by a qualified individual other than the preparer. The submitted calculations shall clearly show the names of the preparer and of the checker.
- 1.05 REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES
- A. The review of shop drawings, data and samples will be for general conformance with the design concept and Design Documents. They shall not be construed:
    - 1. as permitting any departure from the design requirements;
    - 2. as relieving the CONTRACTOR of responsibility for any errors, including details, dimensions, and materials;

## SUBMITTALS

3. as approving departures from details furnished by the ENGINEER, except as otherwise provided herein.
- B. The CONTRACTOR remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- C. If the shop drawings, data or samples as submitted describe variations and show a departure from the design requirements which CONTRACTOR finds to be in the interest of the OWNER and to be so minor as not to involve a change in Contract Price or Contract Time, the CONTRACTOR may return the reviewed drawings with the minor changes noted.
- D. Submittals will be returned to the CONTRACTOR under one of the following codes.

Code 1 - "RETURNED WITH NO EXCEPTIONS" is assigned when there are no notations or comments on the submittal. When returned under this code the CONTRACTOR may release the equipment and/or material for manufacture.

Code 2 - "RETURNED AS NOTED" - This code is assigned when a confirmation of the notations and comments IS NOT required by the CONTRACTOR. The CONTRACTOR may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 - "RETURNED AS NOTED/CO" - This combination of codes is assigned when a confirmation of the notations and comments IS required by the CONTRACTOR. The CONTRACTOR may, at his own risk, release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the ENGINEER within 14 calendar days of the date of the ENGINEER's transmittal requiring the confirmation.

Code 4 - "RETURNED AS NOTED/RESUBMIT" - This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package. This resubmittal is to address all comments, omissions and non-conforming items that were noted.

Code 5 - "REVISE AND RESUBMIT" is assigned when the submittal does not meet the intent of the Subcontract Documents. The CONTRACTOR must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

Code 6 - "COMMENTS ATTACHED" is assigned where there are comments attached to the returned submittal which provide additional data to aid the CONTRACTOR.

Code 7 - "RECEIPT ACKNOWLEDGED" - This code is assigned to acknowledge receipt of a submittal that is not subject to the ENGINEER's review and approval; and, is being filed for informational purposes only. This code is generally used in acknowledging receipt of *means and methods of construction* work plan, field conformance test reports, and Health and Safety plans.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

- E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the CONTRACTOR shall identify all revisions made to the submittals, either in writing on the letter of transmittal or on the shop drawings by use of revision triangles or other similar methods. The resubmittal shall clearly respond to each comment made on the previous submission. Additionally, the CONTRACTOR shall direct specific attention to any revisions made other than the corrections requested on previous submissions.
- F. Partial submittals may not be reviewed. The ENGINEER will be the judge as to the completeness of a submittal. Submittals not complete will be returned to the CONTRACTOR and will be considered "Not Approved" until resubmitted. The ENGINEER may at his option provide a list or mark the submittal directing the CONTRACTOR to the areas that are incomplete.
- G. Repetitive Review
  - 1. Shop drawings and other submittals will be reviewed no more than twice at the ENGINEER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense, based on the ENGINEER's then prevailing rates. The CONTRACTOR shall reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER. Submittals are required until they are acceptable to the ENGINEER.
  - 2. Any need for more than one resubmission, or any other delay in obtaining ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.
- H. If the CONTRACTOR considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the CONTRACTOR shall give written notice thereof to the ENGINEER at least 5 working days prior to release for manufacture.
  - 1. When the shop drawings have been completed to the satisfaction of the ENGINEER the CONTRACTOR shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the ENGINEER.

### 1.06 DISTRIBUTION

- A. Distribute reproductions of approved shop drawings and copies of approved product data and samples, where required, to the job site file and elsewhere as directed by the ENGINEER. Number of copies shall be as directed by the

ENGINEER but shall not exceed six.

**1.07 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM**

- A. If specifically required in other related Sections, submit a P.E. (Professional Engineer) Certification for each item required, in the form attached to this Section, completely filled in and stamped.

**1.08 GENERAL PROCEDURES FOR SUBMITTALS**

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work of other related Sections, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. No extension of time will be authorized because of the CONTRACTOR's failure to transmit submittals sufficiently in advance of the Work.

**END OF SECTION**

## **SECTION 01590 FIELD OFFICES**

### **PART 1 GENERAL**

#### **1.01 CONTRACTOR'S FIELD OFFICE**

The Contractor shall establish and maintain a field office on this Project and have available at the office a responsible representative who can officially receive communications from the Engineer. The Contractor shall have one complete, up-to-date set of Drawings, Specifications and Contract Documents (including all Addenda and Change Orders) in this office at all times, available for reference at any time. The office shall be provided with WiFi, copy machine, toilet facilities, light, air conditioning and heat; the cost of which shall be borne by the Contractor. Notices, instructions, orders, directions or other communications from the Engineer, left at this office, shall be considered as received by the Contractor.

#### **1.02 RESIDENT REPRESENTATIVE'S FIELD OFFICE**

- A. Contractor shall provide, maintain, and subsequently remove as its property, field office(s) as specified below, for the exclusive use of Engineer and its representatives.
- B. Engineer's field office, equipped as specified below, shall be available for Engineer's use prior to the start of work at project site, and shall remain on the site for 30 days after final acceptance of all work, unless otherwise approved by the Engineer.
- C. Contractor shall maintain field office in good repair and acceptable appearance.
- D. Provide sanitary facilities in compliance with state and local health authorities.
- E. The office shall be provided with WiFi internet connection, power, air conditioning and heat; the cost of which shall be borne by the Contractor
- F. Field office(s) shall be trailer type mobile structure(s) with the following minimum features and equipment, new or like new in appearance and function:
  - 1. All-metal frame.
  - 2. All-metal exterior, sides, and roof.
  - 3. Security guard screens on all windows.
  - 4. Toilet and wash basin in separate compartments with hot and cold water and drains.
  - 5. Insulated double walls, floor, and roof.
  - 6. Self-contained, built-in electric heater with self-contained air conditioning unit.
  - 7. Fluorescent/LED ceiling lights.
  - 8. 110-volt electric wall plugs.
  - 9. Minimum Interior Height: 7 feet.
  - 10. Minimum Interior Width: 12 feet.



11. Minimum Interior Length: 15 feet.
12. Railed stairway to entrances.
13. Number of Offices: One (1), 12 feet by 10 feet.
14. Doors with Cylinder Locks: One (1).
15. Number of Windows with Blinds: Two (2)
16. Work Surface: One (1), 30 inches by 10 feet at desk height.
17. Swivel Chairs: Two (2).
18. Meeting Table: One (1), 42 inches by 90 inches.
19. Folding Chairs: Six (6).
20. Four-Drawer Steel File with Lock
21. Wastepaper Basket
22. First-Aid Kit: One (1).
23. Wifi router and internet connection
24. Carbon Dioxide (10-pound) Fire Extinguisher: One (1)

**END OF SECTION**

**SECTION 01720**  
**PROJECT RECORD DOCUMENTS**

**PART 1 GENERAL**

**1.01 WORK INCLUDED**

The Contractor shall obtain from the Engineer, one (1) set of blueline prints of the Contract Drawings. These prints shall be kept and maintained in good condition at the project site and a qualified representative of the Contractor shall enter upon these prints, from day-to-day, the actual "as-built" record of the construction progress. Entries and notations shall be made in a neat and legible manner and these prints shall be delivered to the Engineer upon completion of the construction. APPROVAL FOR FINAL PAYMENT WILL BE CONTINGENT UPON COMPLIANCE WITH THIS PROVISION.

The Contractor shall maintain at the site one record copy of all Plans in good order and annotated to show changes made during construction. Contractor shall meet monthly with the Engineer to review the record Plans and verify they correctly reflect all changes made during the month.

The Contractor shall keep an accurate record of the utility type, location, size, and material for all utilities installed including related appurtenances both above and below ground.

Final horizontal and vertical alignment of mains and related appurtenances shall be clearly shown and referenced to permanent surface improvements. Verified vertical and horizontal (VVH) alignment shall be surveyed and shown every 100 feet (or more often as circumstances dictate) or at any change (horizontal or vertical) in pipe direction. VVH's shall be recorded by an Alabama state registered/professional land surveyor with a GPS unit with sub-meter accuracy, reflecting locations tied to Alabama State Plane coordinates. VVH data may be presented in tabular form on the As-Built Plans. Plans shall clearly show all field changes of dimension and detail including changes made by the Engineer. Contractor shall not conceal any work until required information is recorded. Payment for as-built Plans shall be included as a separate line item.

As-built Plans are required for all systems to be accepted by the Engineer. As-builts will be prepared by a surveyor or an engineer registered in the State of Alabama and will contain the following information:

1. Northing and Easting of all valves, fittings, and connections to existing lines.
2. Location of mains from property easement lines or edge of pavement at intervals of 300 feet.
3. Elevations to the top of the pipe at intervals of 100 feet and at all drainage and sewer main crossings. Established and known bench marks shall be shown on As-Builts.
4. Pertinent easement information.

## PROJECT RECORD DOCUMENTS

5. Certification by the surveyor or engineer accepting responsibility for accuracy of information supplied on the as-built Plans and a statement certifying that all mains are within easements and/or public rights-of-way.

As-Builts will be drawn at the same scale as the original plans and shall be submitted as a pdf and AutoCAD files.

Prior to Final Acceptance, the Contractor shall deliver a complete set of original Plans and a copy of the pdf and CAD files. A transmittal letter in duplicate, containing the following shall be attached to the submittal:

1. Date
2. Project title and number
3. Contractor's name and address
4. Title and number of each As-Built Document
5. Certification that each document as submitted is complete and accurate
6. Signature of the Contractor or his authorized representative

### 1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE:

- A. Section 01300 - Submittals.
- B. General Conditions.

### 1.03 MAINTENANCE OF DOCUMENTS

- A. Maintain at job site, one copy of:
  1. Contract Drawings
  2. Specifications
  3. Addenda
  4. Reviewed Shop Drawings
  5. Change Orders
  6. Other Modifications to Contract
- B. Store documents in approved location, apart from documents used for construction.
- C. Provide files and racks for storage of documents.
- D. Maintain documents in clean, dry legible condition.
- E. Do not use record documents for construction purposes.
- F. Make documents available at all times for inspection by Engineer and Owner.

### 1.04 MARKING DEVICES

Provide colored pencil or felt-tip marking pen for all marking.

## PROJECT RECORD DOCUMENTS

### 1.05 RECORDING

- A. Label each document "PROJECT RECORD" in 2-inch high printed letters.
- B. Keep record documents current.
- C. Do not permanently conceal any work until required information has been recorded.
- D. Contract Drawings: Legibly mark to record actual construction:
  - 1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
  - 2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
  - 3. Field changes of dimension and detail.
  - 4. Changes made by Change Order or Field Order.
  - 5. Details not on original Contract Drawings.
- E. Specifications and Addenda: Legibly mark up each Section to record:
  - 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
  - 2. Changes made by Change Order or Field Order.
  - 3. Other matters not originally specified.
- F. Shop Drawings: Maintain as record documents; legibly annotate Shop Drawings to record changes made after review.

### 1.06 SUBMITTAL

- A. At completion of project, deliver record documents to Engineer.
- B. Accompany submittal with transmittal letter, in duplicate, containing:
  - 1. Date.
  - 2. Project Title and Number.
  - 3. Contractor's Name and Address.
  - 4. Title and Number of each Record Document.
  - 5. Certification that each Document as Submitted is Complete and Accurate.
  - 6. Signature of Contractor, or his authorized Representative.

**END OF SECTION**

**SECTION 01730**  
**OPERATION AND MAINTENANCE DATA**

**PART 1 – GENERAL**

**1.01 SCOPE OF WORK**

- A. This Section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

**1.02 RELATED WORK**

- A. Submittals are included in Section 01300.

**1.03 SERVICES OF MANUFACTURERS' REPRESENTATIVE**

- A. Equipment furnished shall include the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance. This supervision may be divided into two or more time periods as required by the installation program.
- B. See the detailed specifications for additional requirements for furnishing the services of manufacturer's representatives.
- C. A certificate in the form attached to this Section as Table 01730-1, from the manufacturer and signed by Owner's representative stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted for each piece of equipment in the Divisions indicated above.
- D. For equipment furnished under other Divisions, furnish the services of accredited representatives of the manufacturer only when some evident malfunction or over-heating makes such services necessary in the opinion of the ENGINEER.

**1.04 OPERATING MANUALS**

- A. Three (3) complete sets of final hard copy Operation and Maintenance Manuals and one (1) electronic copy on CD are to be provided to the OWNER. Additional copies required for CONTRACTOR review and use shall be in addition to the number listed above.
- B. Operation and maintenance instructions covering all equipment furnished under shall be delivered at least 30 days prior to scheduled start-up directly to the CONTRACTOR.

## OPERATION AND MAINTENANCE DATA

1. The manual for each piece of equipment shall be a separate document with the following specific requirements:
  - a. Contents:
    - 1) Table of contents and index
    - 2) Brief description of each system and components
    - 3) Equipment Attribute sheets for submittal of name plate data
    - 4) Starting and stopping procedures
    - 5) Special operating instructions
    - 6) Routine maintenance procedures
    - 7) Manufacturer's printed operating and maintenance instructions, parts list, illustrations and diagrams
    - 8) One copy of each wiring diagram
    - 9) One copy of each approved shop drawing and each Design Builder/Contractor's coordination and layout drawing
    - 10) List of spare parts, manufacturer's price, and recommended quantity
    - 11) Name, address and telephone numbers of local service representatives.
  - b. Material
    - 1) Loose leaf on 20 lb minimum, white punched paper
    - 2) Page size, 8½-in by 11-in
    - 3) Drawings and Diagrams
      - a) Provide reinforced punched binder tab, bind in with text.
      - b) Reduce larger drawings and fold to size of text pages but not larger than 11 inches x 17 inches or provide a suitable packet with drawing identification.
    - 4) Provide fly-leaf for each separate product, or each piece of operating equipment.
      - a) Provide typed description of product, and major component parts of equipment.
      - b) Provide indexed tabs.
    - 5) Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List:
      - a) Title of project.
      - b) Identity of separate structure or location as applicable.
      - c) Identity of general subject matter covered in the manual.
    - 6) Binders:
      - a) Commercial quality three-post binders with durable and cleanable plastic covers.
      - b) Maximum post width: 2 inches
      - c) When multiple binders are used, correlate the data into related consistent groupings.
  - c. Submittals to the CONTRACTOR
    - 1) Four preliminary copies of manuals shall be submitted to the

## OPERATION AND MAINTENANCE DATA

CONTRACTOR, no later than 30 days following approval of the shop drawings for each piece of equipment. Provide number of final copies listed in Item 1.04-A above of complete manuals prior to testing.

### d. Electronic Manuals

- 1) Electronic Format - The Vendor provided equipment, sub-system, or system manuals shall be in PDF format, compliant with the Adobe PDF Specification, The manual shall be Searchable Image (formerly Image+Text). The Optical Character Recognition (OCR) of the image shall be at a 95% confidence level, using Adobe Acrobat® Capture® 3.x or an equivalent product. The manuals shall be organized and delivered as follows:
  - a) Filed Division - One individual multi-page (where applicable) PDF file shall be provided for each equipment submittal as described Item 1.04-B-1-a.
  - b) Table of Contents -- A table of contents will be developed for each of the vendor manual PDF files. The table of contents will be hierarchical in accordance with the contents specified in item 1.04-B-1-a.
  - c) Bookmarks will be programmed and organized to match the table of contents. Each bookmark will link to the start of the corresponding subject in the body of the PDF file. No bookmark links will reference files external to the pdf file containing the bookmark links.
- 2) Drawings - All drawings shall be in PDF format as specified in item 1.04-B-1-d-1. Drawings (CAD) - In addition, all drawings shall be provided in native format (i.e. AutoCAD-2010).
- 3) All scanned materials shall be cleaned to remove all smudges, fingerprints, artifacts, and other extraneous marks. All notes, version stamps, etc., shall be preserved.
- 4) Scanning shall be done in PDF format as indicated above. Scanning accuracy shall be as follows:
  - a) Textual content shall be not less than 300 dots per inch (DPI) and not more than necessary to comply with the OCR specification in item 1.04-B-1-d-1.
  - b) Color images and diagrams shall be scanned in not less than number of colors of the document or 256 colors whichever is greater. Resolution shall be not less than 300 dots per inch (DPI).
  - c) Color photographs shall be saved in the full range of colors. Resolution shall be not less than 300 dots per inch (DPI).
  - d) Black and white (non-text/table) shall be not less than 256 gray scale levels. Resolution shall be not less than 300 dots per inch (DPI).
- 5) Electronic copies shall be provided on flash drives (USB) or external hard drive.

## OPERATION AND MAINTENANCE DATA

- 6) All media transmittals shall be accompanied by a detailed paper printout of the files on each media. This printout shall consist of the file name, file size, date of creation, submittal number, and a brief but accurate description of the files.
- 7) All files must be organized in an intuitive manner that directly corresponds to the order of the Table of Contents and nomenclature of the submittal log.

### e. Equipment Attribute Sheets

- 1) Equipment Attribute Sheets as presented in Table 01730-3 shall be provided for all equipment as follows:
  - a) An Equipment Attribute Sheet that includes nameplate data, manufacturer and supplier information, and information pertinent to the type of equipment shall be provided for each piece of equipment supplied under this contract. Where more than one of the same type of equipment is provided, an Equipment Attribute Sheet must be completed for each piece.
  - b) Hard copies for each piece of equipment shall be attached to each specification and are to be completed and submitted to the OWNER with the operation and maintenance manuals.

## 1.05 CONTENTS, EACH VOLUME

- A. Title Sheet: Provide title of project, names, addresses and telephone numbers of CONTRACTOR and SUPPLIER with name of responsible parties.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Delete inapplicable information.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- E. Type Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.

## 1.06 MANUAL FOR MATERIALS AND FINISHES

- A. Building Products, Applied Materials and Finishes: Include product data with catalog number, size, composition and color and texture designations. Provide information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and



## OPERATION AND MAINTENANCE DATA

methods, and recommended schedule for cleaning and maintenance.

- C. Moisture Protection and Weather Exposed Products: Include product data listing, applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in individual product specifications.
- E. Provide a listing in Table of Contents for design data, if provided by CMAR, with tabbed fly sheet and space for insertion of data.

### 1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. For each Item of Equipment and Each System provide the following:
  - 1. Overview of System and description of unit or system, component parts, and nameplate data sheets for equipment. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with Engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
  - 2. Panelboard Circuit Directories including electrical service characteristics, controls and communications, and color coded wiring diagrams as installed.
  - 3. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences; regulation, control, stopping, shut-down and emergency instructions; and summer, winter, and any special operating instructions.
  - 4. Maintenance Requirements
    - a. Routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
    - b. Servicing and lubrication schedule and list of lubricants required.
    - c. Manufacturer's printed operation and maintenance instructions.
    - d. Sequence of operation by controls manufacturer.
    - e. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
  - 5. Control diagrams by controls manufacturer as installed.
  - 6. Coordination drawings, with color coded piping diagrams as installed.
  - 7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

## OPERATION AND MAINTENANCE DATA

8. Bill of Materials
  9. List of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
  10. Test and balancing reports as specified.
  11. Additional Requirements: As specified in individual product specification.
- B. Provide a listing in Table of Contents for design data, if provided by CONTRACTOR, with tabbed fly sheet and space for insertion of data.

### 1.08 QUICK REFERENCE SHEETS FOR EQUIPMENT

- A. For each item of equipment furnished provide the following:
1. A minimum of one 8½-inch x 11-inch laminated quick reference sheet. Sheets shall be three hole punched and may be double sided.
  2. Each quick reference sheet shall include the following minimum information:
    - a. Brief descriptions of each piece of equipment and components
    - b. Starting and stopping procedures
    - c. Special operating instruction
    - d. Routine maintenance procedures
    - e. Calibration procedures
    - f. Pump curves
    - g. Trouble shooting procedures
    - h. Name, address, and telephone numbers of local service representative
  3. Provide three copies of quick reference sheets to the ENGINEER for review.
  4. After quick reference sheets have been approved, provide four copies of laminated quick reference sheets to the OWNER in one commercial coiled three-ring binder with durable and cleanable plastic cover.

### 1.09 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment and systems, at agreed upon times. The OWNER may video tape instructions while they are being given to OWNER's personnel.

## **OPERATION AND MAINTENANCE DATA**

- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

### **1.10 CONTRACTOR/ENGINEER O&M REVIEW CHECKLIST**

The CONTRACTOR/ENGINEER will review Operation and Maintenance manuals on operating equipment for conformance with the requirement of this Section. The review will generally be based on the check list presented in Table 01730-2.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

OPERATION AND MAINTENANCE DATA

TABLE 01730-1

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION TESTING AND INSTRUCTION

Owner: \_\_\_\_\_

Department Project: \_\_\_\_\_

Contract No. \_\_\_\_\_ Project No. \_\_\_\_\_

EQUIPMENT SPECIFICATION SECTION \_\_\_\_\_

EQUIPMENT DESCRIPTION \_\_\_\_\_

I \_\_\_\_\_, Authorized representative of  
(Print Name)

\_\_\_\_\_  
(Print Manufacturer's Name)

\_\_\_\_\_  
(Print equipment name and model with serial No.)

installed for the subject project [has] [have] been installed in a satisfactory manner, [has] [have] been satisfactorily tested, [is] [are] ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the unit[s] on Date: \_\_\_\_\_ Time: \_\_\_\_\_

Certified By: \_\_\_\_\_ DATE: \_\_\_\_\_  
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGMENT OF MANUFACTURER'S INSTRUCTION

[I] [We] the undersigned, authorized representatives of the \_\_\_\_\_ and/or Plant Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and [am] [are] prepared to assume normal operational responsibility for the equipment:

\_\_\_\_\_ DATE: \_\_\_\_\_

\_\_\_\_\_ DATE: \_\_\_\_\_

\_\_\_\_\_ DATE: \_\_\_\_\_

## OPERATION AND MAINTENANCE DATA

TABLE 01730-2

### O & M REVIEW CHECKLIST

EQUIPMENT SUBMITTED \_\_\_\_\_ DATE OF SUBMITTAL \_\_\_\_\_

MANUFACTURER \_\_\_\_\_ DEGREE OF APPROVAL \_\_\_\_\_

SPECIFICATION SECTION \_\_\_\_\_ DRAWING NUMBER \_\_\_\_\_

- \_\_\_\_\_ Is submittal correct for model series/configuration originally submitted with shop drawings?
- \_\_\_\_\_ Is binding correct with assigned color/ printing etc. and pertains to final three volumes?
- \_\_\_\_\_ Is submittal properly indexed?
- \_\_\_\_\_ Does submittal pertain only to equipment being furnished?
- \_\_\_\_\_ Is submittal easily understood and instructively arranged?
- \_\_\_\_\_ Does submittal include start-up, shutdown and troubleshooting procedures?
- \_\_\_\_\_ Are sufficient drawings and schematics included to supplement written descriptions?
- \_\_\_\_\_ Is listing of nameplate data for each piece of equipment supplied provided and attached?
- \_\_\_\_\_ Are all drawings provided printed on paper which is 11 inches high and folded to 8½ inches wide?
- \_\_\_\_\_ Is proper and complete instructions for servicing included?
- \_\_\_\_\_ Is there a suggested operating log sheet for equipment?
- \_\_\_\_\_ Is schedule for lubrication provided?
- \_\_\_\_\_ Is there a recommended preventive maintenance schedule?
- \_\_\_\_\_ Are necessary safety precautions clearly indicated where they relate to the equipment?
- \_\_\_\_\_ Is area representative information provided, i.e., Name, Address, Telephone

## OPERATION AND MAINTENANCE DATA

Number?

\_\_\_\_\_ Are specified spare parts indicated and listed?

\_\_\_\_\_ Are Equipment Attribute Sheets provided as specified?

The following are points of rejection necessitating resubmittal by CONTRACTOR:

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**END OF SECTION**

## SECTION 02050 DEMOLITION

### PART 1 GENERAL

#### 1.01 WORK INCLUDED

- A. The demolition indicated on the drawings and required by the specifications do not profess to show or indicate every detail necessary to complete this project. The drawings and Specifications indicate the overall intent. The contractor shall provide the labor, construction equipment, materials and incidentals, and new equipment necessary to meet the intent of the contract documents. Demolition of existing equipment shall include: the removal of all equipment and related support appurtenances (such as conduit, electrical boxes, and pipe); and the patching of all holes resulting from the removal of equipment. Demolition required to alter or remove all or parts of existing structures shall be conducted in a manner that protects the existing structures and those facilities to remain in service, and the proper disposal of all construction debris. The Contractor shall also provide the means to maintain the plant's ability to treat wastewater within present limits at all times while the demolition and renovation takes place.
- B. Included, but not limited to, are demolition and removals of existing materials, equipment, or work necessary to install the new work as shown and specified and to connect same with existing work in an approved manner. Demolition includes, but is not necessarily limited to, structural steel, structural concrete, miscellaneous metal, piping, equipment, attachments, appurtenances, and similar existing facilities.
- C. Demolitions and removals which may be specified under other sections shall conform to requirements of this section.
- D. All work shall comply with all federal, state, and local codes and regulations regarding safety.

#### 1.02 SUBMITTALS

Contractor shall submit for review proposed methods, equipment, and operations sequence. Include coordination for shut-off capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of Owner's operations.

#### 1.03 JOB CONDITIONS

- A. Protection
  - 1. Contractor shall execute the demolition and removal work to prevent damage or injury to structures, occupants thereof and adjacent features

## DEMOLITION

which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from, adjacent structures.

2. Closing or obstructing of roadways, sidewalks, and passageways adjacent to the work by the placement or storage of materials will not be permitted, and all operations shall be conducted with a minimum interference to traffic on these ways unless approved by the Engineer.
3. Contractor shall erect and maintain barriers, lights, sidewalk sheds, and other required protective devices.
4. Contractor shall repair damage done to facilities to remain, or to any property belonging to the Owner or occupants of the facilities at no additional cost to the Owner.

### B. Scheduling

1. Contractor shall carry out his operations so as to avoid interference with operations and work in the existing facilities.

### C. Notification

1. At least 48 hours prior to commencement of a demolition or removal, Contractor shall notify the Engineer in writing of his proposed schedule. Owner shall inspect the existing equipment and identify and mark those items which are to remain the property of the Owner. No removals shall be started without the written permission of the Engineer.

### D. Explosives

1. Do not bring explosives on site nor use explosives for demolition.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 GENERAL

- A. All materials and equipment removed from existing work shall become the property of the Contractor, except for those which the Owner has identified and marked for its use. All materials and equipment marked by the Owner to remain its property, or designated to be relocated, shall be carefully removed by the Contractor so as not to be damaged, and then cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner.



## DEMOLITION

- B. Contractor shall dispose of all demolition materials, equipment, debris, and all other items not marked by the Owner to remain as its property off the site and in conformance with all existing applicable laws and regulations.
- C. Surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces and which have holes, scars, chipped or other damaged surfaces revealed by the removal shall be repaired by the Contractor with the same or matching materials as the existing surface or as may be otherwise approved by the Engineer.
- D. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
  - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
  - 2. Clean adjacent structures, facilities, and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the work.

### 3.02 STRUCTURAL REMOVALS

- A. Existing structures which are designated to be demolished shall be removed in their entirety unless noted otherwise on the drawings.
- B. All concrete, concrete block, reinforcement, plaster, wire mesh and other items contained in or upon the structures shall be removed and taken from the site, unless otherwise approved by the Engineer. Demolished items shall not be used in backfill adjacent to structures or in pipeline trenches.
- C. All structural and miscellaneous metals designated to remain the property of the Owner shall be removed and stored on or adjacent to the site in a protected place specified by the Owner or loaded onto trucks provided by the Owner.
- D. After removal of parts or all of masonry walls, slabs and like work which tie into new work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.
- E. After removing the demolished structures, remaining cavities shall be backfilled with soil unless otherwise noted on the drawings.

3.03 PIPE REMOVED

- A. Piping removals shall consist of dismantling and removing of existing piping, valves and other appurtenances as specified, shown, or required for the completion of the work. It shall include cutting, capping, and plugging as required.
- B. Excavate all necessary material to remove the pipe which has been designated for removal. Dispose of the excavated material and remove the pipe. The pipe shall be relocated where indicated on the drawings. Pipe not scheduled to be relocated shall become the property of the contractor and shall be removed from the project site. Seal all holes left in walls of structures or manholes that are to remain in place.
- C. The trench resulting from the removal of pipe shall be backfilled except when the trench lies within the limits of subsequent excavation.
- D. Where existing piping is not removed in its entirety, the remaining abandoned portion of the pipe will be sealed with precast, vitrified, or concrete stoppers or with masonry of a type and thickness acceptable to the Engineer.
- E. Where existing piping through demolished structures is to remain in service, pipes shall be connected through the structures with new pipe of a type and in a manner acceptable to the Engineer without additional cost to the Owner.
- F. After connecting across or sealing the existing pipes remaining, cavities shall be backfilled with soil. When connecting pipes are used, suitable backfill shall be carefully tamped solidly under and around the pipe.

3.04 MANHOLES ABANDONED

- A. Existing manholes which are designated to be abandoned shall be removed to a minimum of one foot below the ground surface in a manner that will not damage pipes that are to remain.
- B. Castings shall remain the property of the Owner and shall be carefully removed and stored within the project limits for pickup by the Owner.

3.05 ELECTRICAL REMOVAL

- A. Electrical removal shall consist of the removal of Owner's existing control panels, pumps and motors, conduits and wires, poles and overhead wiring, and miscellaneous electrical equipment all as shown, specified, or required to perform the work.
- B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation, and to keep the integrity of the grounding system.

**3.06 CLEAN UP**

Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste, and debris of every sort shall be removed. The premises shall be left clean, neat and orderly.

**END OF SECTION**

**SECTION 02101  
CIVIL SITEWORK**

**PART 1      GENERAL**

**1.01    WORK INCLUDED**

- A.    This Section covers the Work necessary to complete the sitework for the project. Civil sitework includes clearing, grading for roads and driveways, chain link fencing and gates, and finish grading and grassing.

**1.02    GENERAL**

- A.    RELATED WORK SPECIFIED IN OTHER SECTIONS

- 1.    See Sections EARTHWORK and ROADS AND DRIVEWAYS for additional requirements.

- B.    See CONDITIONS OF THE CONTRACT and Section GENERAL REQUIREMENTS, for information and requirements that apply to the Work specified herein and are mandatory for this project.

**PART 2      PRODUCTS**

**2.01    GENERAL**

- A.    The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

**2.02    SEEDING AND MULCHING**

- A.    Topsoil: Topsoil shall be a natural, friable soil, representative of product soils in the vicinity. It shall be well-drained, free from admixture of subsoil and foreign matter, objects larger than two (2) inches in diameter, toxic substances, and any other deleterious material that may be harmful to plant growth and be a hindrance to grading, planting, and maintenance operations. Soil excavated on site may be used provided it meets the requirements of topsoil.
- B.    Seed shall meet the requirements of these Specifications and comply with the Alabama Seed Law Act No. 424, General Acts, 1963 Vol. 2, Page 931, latest revision. The type of quick growing seed used shall be appropriate to provide an early ground cover during the particular season when planting is done. The rate of spread shall be as specified in Section 3.01D.

- C. Mulch shall meet the material requirements of the State of Alabama Department of Transportation Standard Specifications for Highway's and Bridges, latest revision.
- D. For areas requiring sod it shall be Tifton Bermuda free of weeds and other undisuable grasses. Minimum ½ yard cuts.
- E. Fertilizer: Commercial plant food containing eight (8%) percent nitrogen, eight (8%) percent available phosphate, and eight (8%) percent potassium, uniform in composition, dry, free-blowing, and delivered in containers bearing manufacturer's guaranteed analysis.
- F. For areas requiring erosion control matting see Section 02490 EROSION CONTROL MATTING.

2.03 ROADS AND DRIVEWAYS

- A. Roads and driveways shall be as specified in Section ROADS AND DRIVEWAYS.

2.04 CHAIN LINK FENCING

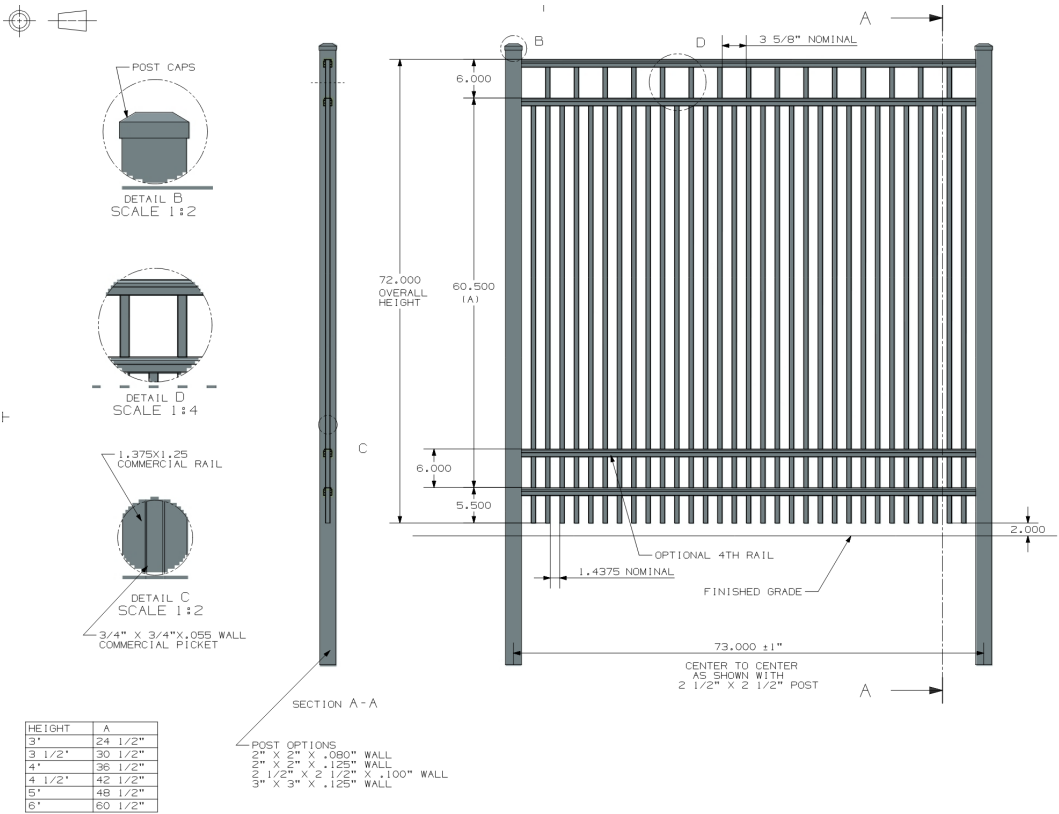
- A. Materials shall be new and products of recognized, reputable manufacturers. Used, rolled, or regalvanized materials are not acceptable.
- B. All materials shall be treated wood, or wood of natural resistance to decay, hot-dipped galvanized steel, or aluminum. Steel posts and other appurtenances shall have a minimum zinc coating of 1.2 ounces per square foot of surface.
- C. Chain Link Fabric: Chain link fence fabric, seventy-two (84) inches high, woven of No. 9 gauge wire, in standard two (2)-inch diamond-mesh pattern, selvages twisted and barbed, galvanized after weaving with 1.2 ounce zinc coating meeting the requirements of ASTM A392, Class 1.
- D. Posts: Federal Specification RR-F-191, fence posts, gates, and accessories, except as hereinafter modified. Standard lengths for setting in ground or in concrete as required for conditions shown. Wooden posts shall conform to the details and dimensions indicated in the drawings, and shall be straight, sound and seasoned with ends sawed off square or as indicated. All knots shall be trimmed flush with the surface.
- E. Line Posts: For fences up to eight (8)-feet zero (0)-inches high, use 2½-inch outside diameter, ASTM A120, Schedule 40 steel pipe, weight 3.65 pounds per linear foot.
- F. End, Corner, Angle, and Pull Posts: Use 2 7/8-inch outside diameter standard weight steel pipe, weight 5.79 pounds per linear foot.

- G. Gate Posts: For single swing gates up to six (6)-feet wide, use 2 7/8-inch outside diameter steel pipe, 5.79 pounds per foot. For single swing gates six (6)-feet wide to thirteen (13)-feet wide, use four (4)-inch outside diameter steel pipe, 9.1 pounds per foot. For other sizes, follow manufacturer's recommendations.
- H. Post Tops: Post tops shall be pressed steel, or malleable iron, designed as a weathertight closure cap for tubular posts. Provide one (1) cap for each post, unless equal protection is afforded by combination post top cap and barbed wire supporting arm where barbed wire is required. Where top rail is used, provide tops to permit passage of top rail.
- I. Tension Wire: Tension wire shall be zinc or aluminum-coated coil spring steel wire not less than No. 7 gauge (0.177 inch diameter). Provide tie clips of manufacturer's standard as approved for attaching the wire to the fabric, at intervals not exceeding twenty-four (24)-inches.
- J. Stretcher Bars and Bands: Stretcher bars shall be one-piece lengths equal to full height of fabric with a minimum cross-section of 3/16 inch by 3/4-inch. Provide one (1) stretcher bar for each gate and end post and two (2) for each corner and pull post. Bar bands shall be heavy-pressed steel, spaced not over fifteen (15)-inches on center to secure stretcher bars to tubular end, corner, pull, and gate posts.
- K. Top Rail: Not less than eighteen (18)-foot-long tubular steel, 1 5/8-inch outside diameter, weight 2.27 pounds per linear foot. Couplings to be outside-sleeve type and at least six (6)-inches long. Top rail to extend through line post tops to form continuous brace from end-to-end of each stretch of fence.
- L. Braces: Brace pipe shall be the same material as the top rail and shall be installed midway between the top rail and extend from the terminal post to the first adjacent line post. Braces shall be securely fastened to the posts by heavy-pressed steel and malleable fittings, then securely trussed from line post to base of terminal post with a 3/8-inch truss rod and tightener.
- M. Fittings: Malleable steel, cast iron, or pressed steel galvanized to meet the requirements of ASTM A153. Fittings to include extension arms for barbed wire, stretcher bars and clamps, clips, tension rods, brace rods, hardware, fabric bands and fastenings, and all accessories. Provide forty-five (45) degree bracket type supports to accommodate three (3) strands of barbed wire as shown.
- N. Barbed Wire: Four-point pattern with three strands of No. 12-1/2 gauge wire, and one (1) inch barbs five (5)-inches apart. Zinc-coated barbed wire shall meet the requirements of ASTM A121, Class 3.

## 2.05 ALUMINUM FENCING

- A. Fencing along the East property boundary facing Lemoyne Drive shall be heavy duty aluminum industrial fencing.

- 1.Aluminum fence shall have 1-5/8” min reinforce rails and 1” pickets
- 2.Fence shall be manufactured by Ultrafence model UAF 201, Elite Fence or approved equal.
- 3.Posts: 3”x3”x0.125”wall. Post shall be minimum spacing of 72”.
- 4.Powder coatings manufactured from fluorocarbon polymer resins shall exceed the requirements of AAMA 2605.
- 5.Provide 10-year warranty for factory finish against cracking, peeling, and blistering under normal use.
- 6.Install according to the manufactures recommendations.



O. Chain Link Fence Gates:

- 1. Gates shall swing as indicated, complete with latches, stops, keepers, and hinges.
- 2. Gate frames shall be constructed of tubular members welded at all corners or assembled with fittings. Fabricate frames of standard weight steel pipe, 1.90-inch outside diameter, weight 2.72 pounds per linear foot. Welds shall be painted with zinc-based paint. Where corner fittings are used, gates shall have truss rods of 5/16-inch minimum

nominal diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing as required, spaced so that no members are more than eight (8)-feet apart. Gate leaves ten (10)-feet or over shall be extended one (1)-foot above the top horizontal member to which (3) three strands of barbed wire, uniformly spaced, shall be attached by use of bands, clips, or hook bolts.

3. Gate fabric shall be the same type as used in the fence construction. The fabric shall be attached securely to the gate frame at intervals not exceeding fifteen (15) inches.
4. Gate hinges shall be of adequate strength for gate and with large bearing surfaces for clamping into position. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one (1) person.
5. Gate latches, stops, and keepers shall be provided for all gates. Latches shall have a plunger-bar arranged to engage the center stop, except that for single gates of openings less than ten (10) feet wide a forked latch may be provided. Latches shall be arranged for locking with padlocks. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger-bar of the latch of double gates. No stop is required for single gates. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full position.
6. For double gates, the size and configuration shall be as indicated on the Drawings. Provide gate stops for all double gates, consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, requiring one (1) padlock for locking both gate leaves.
7. Provide keepers for all vehicle gates, which automatically engages the gate leaf and holds it open in the OPEN position until manually released.

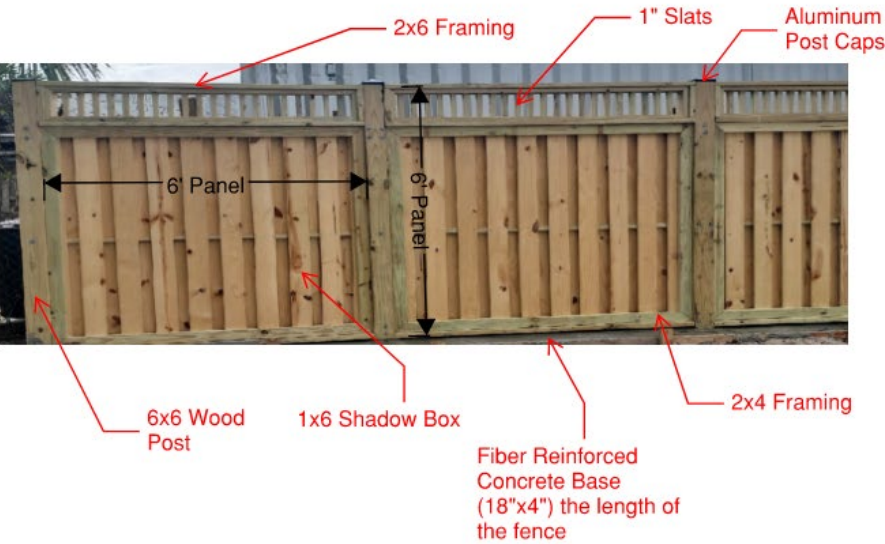
## 2.06 WOOD FENCING

- A. All materials shall be pressure treated pine, cedar or redwood, or approved wood of natural resistance to decay.
- B. Provide 24" wide drainage breaks at 12' OC on the north concrete fence base.

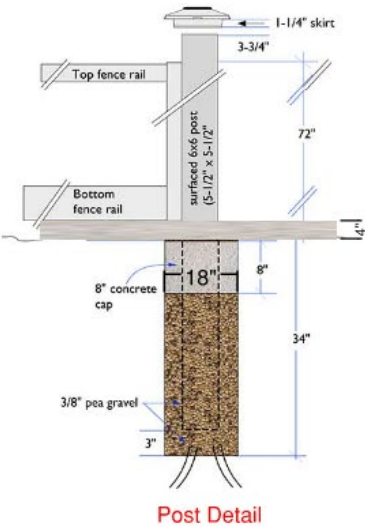


C.

Wood Panel Fence Detail



- Notes:
- 1. All fasteners and screws shall be stainless steel
  - 2. Wood panel fence to be installed on the North and South property line
  - 3. Wood fencing shall be cedar or red wood



**PART 3 EXECUTION****3.01 GRADING, SEEDING AND MULCHING (For non landscaped areas)**

- A. Pre-Finish Grading: Complete rough grading to grades indicated on the Drawings or to accomplish adequate drainage patterns required by the site layout. Rough grading shall allow for the addition of materials needed to accomplish finish grading. Fill areas required during subgrade preparation shall be compacted to eighty-five (85%) percent of the relative maximum density. Topsoil shall be spread over the prepared rough grade using a rubber-tired tractor with grader blade or equivalent.
- B. Fertilizing: Apply commercial fertilizer at the rate of nine hundred twenty (920) pounds per one-acre or at a rate determined from soil tests, distributing uniformly with a rotary mechanical spreader. Apply soil additives such as lime if the soil pH requires adjustment.
- C. Finish Grading: After placing topsoil and applied materials, rake the topsoil to a uniform grade so that all areas drain, as indicated on the grading plan or as required to complete drainage patterns. Lightly compact with a cultipacker before planting grass. Remove all trash from the area prior to planting grass.
- D. Seeding
  - 1. Seeding and mulching operations will not be permitted when wind velocities exceed fifteen (15) miles per hour. Seed shall be sown only when the soil is moist and in proper condition to induce growth. No seeding shall be done when the ground is unduly wet or otherwise not in a tillable condition.
  - 2. Whenever a suitable amount of area has been graded, it shall be made ready and grassed as specified in this Section. Grassing shall be incorporated into the project at the earliest practical time in the life of the Contract.
- E. The several operations involved in the work shall proceed in the following sequence: preparation of the ground; seeding; spreading of mulch; cutting-in mulch; and rolling or preparation of the ground; installation of erosion control matting, placing soil; hydroseeding; placing excelsior mat.
- F. The ground over which the seed is to be sown shall be prepared by diskharowing and thoroughly pulverizing the soil to a suitable depth. The prepared soil shall be loose and reasonably smooth. It shall be reasonably free of large clods, roots, and other material, which will interfere with the work or subsequent mowing and maintenance operations. Apply lime at two (2) tons per acre, and 8,8,8 commercial fertilizer at nine hundred twenty (920 lbs.) pounds per acre.

- G. While the soil is still loose and moist, the seed shall be scattered uniformly over the grassing area. The rate of spread for the seed mixture shall be per schedule.

<b>August through February</b>	<b>Winter</b>
Kentucky 31	30 lbs/acre
Reseeding Crimson Clover	15 lbs/acre
Bermuda Grass (Unhulled)	30 lbs/acre
Perennial Rye Grass	30 lbs/acre
<b>March through July</b>	<b>Spring</b>
Kentucky 31	30 lbs/acre
Kobe Lespedeza (Var. Tenn)	30 lbs/acre
Bermuda Grass (Cynodon Ductylon)	20 lbs/acre
	(Hulled)

- H. Approximately two (2) inches, loose thickness of mulch material shall be applied uniformly over the seeded area, and the mulch material cut into the soil with equipment specified, to produce a loose mulched thickness of three (3) to four (4) inches. Care shall be exercised that the materials are not cut too deeply into the soil.

- I. Immediately after completion of the seeding, the entire mulched area shall be rolled thoroughly with the equipment specified. At least two (2) trips of the entire area will be required.

- J. Maintenance:

1. Water to keep surface soil moist. Repair washed out areas by filling with topsoil, liming, fertilizing, and seeding. Replace mulch on banks when washed or blown away. Mow grass to two (2) inches after grass reaches at least three (3) inches in height, and mow frequently enough to keep grass from exceeding 3 ½ inches.
2. If a satisfactory stand of grass has not been established in eight (8) weeks, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately. A satisfactory stand of grass is defined as having no bare spots larger than three (3) square feet and not more than ten (10%) percent of total area with bare spots larger than one (1) square foot.
3. The seeded areas shall be watered to provide optimum growth conditions for the establishment of the grass. In no case, however, shall the period of maintaining such moisture be less than two weeks after the planting. Manual watering shall continue at least every four (4) days until the end of the growing season.

- K. See Section 02490 for installation of EROSION CONTROL MATTING where required.
- L. The Contractor shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include filing, leveling, and repairing of any washed or eroded areas. Replant any areas in which the establishment of the grass stand does not develop satisfactorily.
- M. Clean-up the job site following seeding and mulching. Remove rubbish, excess materials, temporary structures, and equipment. Leave the work in a neat and presentable condition.
  - 1. Bermuda Sod shall be installed in all swales, ditches, all slopes 3:1 or greater, within 10' of all building structures, and within 3' of all walkways and driveways.

3.02 ROADS AND DRIVEWAYS

- A. Proposed access roads and driveways shall be of the type specified in Section ROADS AND DRIVEWAYS and shall be constructed to the lines and grade shown on the Drawings. All roads and driveways shall include two (2%) percent slopes away from a centerline crown. If required, adjacent grades shall include drainage ditches along the shoulder of the road.
- B. Subgrade preparation of roads and driveways shall comply with Section 230 of the State of Alabama Highway Department Standard Specifications, except as modified herein.
- C. Excavated areas beneath sidewalks, roads, driveways, curbs and gutters shall be backfilled with suitable fill material and compacted to a minimum ninety-eight (98%) percent of the maximum relative density. The final subgrade surface shall be compacted to an even density and shall be smooth and true to line and grade prior to placing road surfacing.

END OF SECTION

## **SECTION 02140 DEWATERING**

### **PART 1 GENERAL**

#### **1.01 WORK INCLUDED**

Furnish all labor and equipment required to dewater all excavations. Dewatering of all excavations shall be the responsibility of the Contractor, and no additional compensation will be allowed for same.

#### **1.02 RELATED WORK**

Earthwork is included in Section 02200.

Slope protection and erosion control is included in Section 02270.

#### **1.03 SUBMITTALS**

None.

### **PART 2 PRODUCTS**

None in this Section.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

Dewatering of many of the construction excavations shall be required as necessary to provide a dry work environment as indicated by the geotechnical report, drawings and these specifications. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation.

Extra pumps shall be maintained on site for use in the event of a breakdown of operating pumps.

**END OF SECTION**

**SECTION 02200  
EARTHWORK**

**PART 1     GENERAL**

**1.01    WORK INCLUDED**

- A.    Clear, excavate, dewater, sheet, backfill, and do related Work necessary to complete Work shown or specified.
- B.    Codes, Specifications, and standards referred to by number or title shall form a part of this Specification to the extent required by the references thereto. Latest revisions as of the date of bid opening shall apply, unless otherwise specified.

**1.02    DEFINITIONS**

A.    Excavation

- 1.    Removal of earth and rock to form cavities for the construction of foundations and structures and to form trenches for the installation of piping.
- 2.    Cavity formed by the removal of earth and rock.

B.    Earth

Unconsolidated material in the crust of the earth derived by weathering and erosion. Includes:

- 1.    Materials of both inorganic and organic origin.
- 2.    Boulders less than 1/3 cubic yard in volume, gravel, sand, silt, and clay.
- 3.    Materials which can be excavated with backhoe, trenching machine, dragline, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.

C.    Rock

A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes any combination of the following:

- 1.    Limestone, sandstone, dolomite, granite, marble, and lava.
- 2.    Boulders 1/3 cubic yard or more in volume.
- 3.    Materials which cannot be excavated by equipment, which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers.

4. Materials which cannot be excavated with a trackhoe, trenching machine, dragline, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.
  5. Maximum rock size for pipe zone material and one (1) foot above pipe zone shall not be larger than six (6) inches in diameter. Maximum rock size for trench backfill starting one (1) foot above the pipe shall not be larger than 1/4 cubic yard in volume or greater than two (2) feet in any direction.
- D. Undercutting
1. Excavation of rock and unsuitable earth below the bottom of a foundation, structure, or pipe to be constructed or installed.
- E. Subgrade
1. Undisturbed bottom of excavation.
- F. Pipe Bedding
1. Material required from invert of pipe to bottom of trench.
- G. Pipe Zone Backfill
1. Material required from invert of pipe to top of pipe.
- H. Pipe Cover
1. Material required from top of pipe to top of trench.
- I. Topsoil
1. Earth containing sufficient organic materials to support the growth of grass, free from rocks, roots and debris.

1.03 QUALITY ASSURANCE

- A. Owner reserves the right to hire an independent testing laboratory to perform specified services and necessary field density tests to ensure that proper compaction is obtained.

1.04 JOB CONDITIONS

- A. Maintain bench marks, monuments, and other reference points. Replace any disturbed or destroyed bench marks, monuments, or other reference points.
- B. Selected information from subsurface investigations performed by other consultants may be shown on the Drawings. Should the Contractor encounter

subsurface or latent conditions at the site materially differing from those shown on the Drawings he shall immediately give notice to the Engineer of such conditions before they are disturbed. The Engineer will thereupon investigate the conditions; and if he finds that they materially differ from those shown on the Drawings or indicated in the Specifications, he will make such changes in the Drawings, the Specifications, or the Drawings and Specifications as he may find necessary. Any increase or decrease of cost resulting from such changes will be adjusted in the manner provided in the GENERAL CONDITIONS.

1.05 BURNING OF MATERIALS

- A. The Contractor shall obtain approval from the State or local authorities having jurisdiction over the Air Pollution Control.
- B. Burning shall be strictly controlled. Fires shall be attended at all times.

1.06 DISPOSAL OF CLEARING DEBRIS

- A. The Contractor shall dispose of construction debris resulting from clearing, grubbing, excavation, rock removal, demolition, dewatering and pavement replacement removal, in a landfill approved by the Engineers.
- B. Materials used for silt barriers shall be removed and disposed of upon acceptance of restoration of grounds.

1.07 EXCAVATED MATERIALS IN PAVED ROADS

- A. Materials excavated in areas of pavement shall be removed by the Contractor from the job site during the excavation process.
- B. Materials excavated shall be disposed of in a landfill approved by the Engineers.

1.08 EROSION CONTROL AND PREVENTION OF STREAM POLLUTION

- A. The Contractor shall control soil erosion and prevent pollution of streams, storm drains, and watercourses by means of installing silt fences, silt barriers and sediment pools or other means which can be required by the Engineers, state, local or federal agencies involved. The Contractor shall comply with the Owner's Stormwater Permit and Title 33 of the CFR Part 330, Appendix A regarding erosion control and the protection of floodplains and wetlands.
- B. The Contractor shall comply with all applicable local, State, and Federal codes and Agencies in controlling erosion and preventing stream pollution.

1.09 OWNERSHIP - ANYTHING OF VALUE EXCAVATED

- A. Excavated materials having value will become the property of the Owner as determined by the Engineers and Owner.



**PART 2 PRODUCTS****2.01 PIPE BEDDING, BACKFILL AND FOUNDATION BACKFILL**

- A. Pipe trench backfill for ductile iron pipe and shall adhere to Type 2 laying condition, as per AWWA C150, with four (4) inches loose bedding material.
- B. Pipe Bedding
  - 1. Native soil excavated from the trench, free of rocks, foreign materials, and frozen earth.
- C. Pipe Zone Backfill
  - 1. Native soil material free from rocks, foreign material, and frozen earth, lightly consolidated to top of pipe.
  - 2. Topsoil is not acceptable as pipe zone backfill.
  - 3. Imported material will only be required where native material is inadequate.
- D. Pipe Cover
  - 1. Native soil material free from rocks, foreign material, and frozen earth, compacted as necessary to prevent settlement and erosion.

**1.01 STRUCTURE FOUNDATION**

- A. Structure Bedding
  - 1. Crushed limestone or crushed dolomite meeting or exceeding minimum standards for gradation of the AHD #57.
  - 2. Crushed limestone or crushed dolomite shall meet or exceed the minimum standards for deleterious substances as follows:

		<u>Maximum Allowable Percentage by Weight</u>
a.	Coal and lignite	0.25%
b.	Clay lumps	0.25%
c.	Material passing #200 sieve	1.00%
d.	Thin or elongated pieces	1.00%
e.	Other deleterious material	2.00%
f.	Maximum total of a,b,c, and e	6.00%

3. Crushed limestone or crushed dolomite shall be free of foreign material when placed in pipe trench.
- B. Structure Foundation Backfill
1. Crushed limestone or crushed dolomite meeting or exceeding minimum standards for gradation of the AHD #1 for conditions of excessive undercutting rock or soil.
  2. Spoil rock or blasted rock from quarry in sized (4) four inches to four (4) feet for conditions of sinkholes or voids filled with soupy saturated materials.
  3. Type of materials and mixtures of various sized materials shall be as directed by the Engineers.

## 1.02 EARTH BACKFILL

- A. Backfill shall be earth of such gradation and moisture content that the soil will compact to the specified density and remain stable.
- B. Pipe cover material shall consist of durable particles ranging in size from fine to coarse (No. 200 to one (1) inch) in a substantially uniform combination. Bedding material may be used for cover material in locations other than under paving, sidewalks, driveways or as directed by the Engineers.
- C. Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

### Group Symbols

### Typical Names

GW.....	Well-graded gravel and gravel-sand mixtures, little or no fines
GP.....	Poorly graded gravel and gravel-sand mixtures, little or no fines
GM.....	Silty gravel, gravel-sand-clay mixtures
GC.....	Clayey gravel, gravel-sand-clay mixtures
SW.....	Well-graded sand and gravelly sands, little or no fines
SP.....	Poorly graded sands and gravelly sands, little or no fines
SM.....	Silty sands, sand-silt mixtures
SC.....	Clayey sands, sand-clay mixtures
ML.....	Inorganic silts, very fine sands, rock floor, silty or clayey fine sands.
CL.....	Inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, Lean clays.

- D. Materials which are unsuitable for backfill include rocks greater than eight (8) inches in their largest dimension, and pavement spoil, rubbish, construction debris, wood, metal, plastics, and the following soils, classified by the Unified Soil Classified System, ASTM D-2487:

<u>Group Symbols</u>	<u>Typical Names</u>
OL.....	Organic silts and organic silty clays of low plasticity
MH.....	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH.....	Inorganic clays of high plasticity, fat clays
OH.....	Organic clays of medium to high plasticity
PT.....	Peat, muck, and other highly organic soils

### **PART 3      EXECUTION**

#### **3.01    EXISTING STRUCTURES, PIPING, AND WIRING**

- A. All poles, fences, sewer, gas, water, or other pipes, cables, wires, conduits, and manholes, buildings, and structures shall be supported and protected from injury by the Contractor.
- B. The Contractor shall proceed with caution during excavation so the exact location of underground utilities and structures, both known and unknown, may be determined. The Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.
- C. Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of underground structures, the Contractor shall make exploration and excavations for such purpose.
- D. Wherever sewer, gas, water, or other pipes or conduits cross the excavation, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes and conduits shall be subject to the approval of the Engineer.
- E. When utility lines that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Utility Company in ample time for the necessary measure to be taken to prevent interruption of the service.
- F. The Contractor shall conduct the Work in such a way that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the Work, unless he shall have first obtained the property owner's

written consent thereto and shall have shown said written consent to the Engineer.

- G. All excavated material shall be piled in a manner that will avoid obstructing walkways and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility drainage ways shall be kept clear or other satisfactory provisions made for drainage.

### 3.02 CLEARING

- A. Clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site.
- B. Do not remove or damage trees that do not interfere with the finished Work. Completely remove trees required to be removed, including stumps and roots. Properly treat damaged trees which can be saved.

### 3.03 STRIPPING AND STOCKPILING OF TOPSOIL

- A. Strip topsoil and vegetation from the excavated areas. Stockpile clean topsoil in location designated by the Engineer.
- B. Do not intermix grass, weeds, roots, root mat, brush, and stones larger than three (3) inches with stockpiled topsoil.

### 3.04 DEWATERING

- A. Provide sufficient dewatering equipment and make proper arrangements for the disposal of water from dewatering operation. Dewatering shall not damage property, create nuisances, or interfere with other Work. Do not use sanitary sewers for the disposal of water from dewatering operations.

### 3.05 EXCAVATING

- A. Make excavations to elevations and dimensions necessary to permit erection of forms and inspection of foundation and to install piping. Completely remove unsuitable material.
- B. Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees in excavation Work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.
- C. Contractor shall be responsible for the determination of the angle of repose of the soil in which the excavating is to be done. Excavate all slopes to at least the angle of response except for areas where solid rock allows for line drilling or pre-splitting.
- D. It is the Contractor's responsibility to control the Work such that sides, slopes, and faces of all excavations shall meet accepted OSHA requirements by scaling,

benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes, which may be adversely affected by weather or moisture content.

- E. The Contractor should flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
- F. The Contractor should shore or otherwise support sides of excavations in hard or compact soil in compliance with all OSHA, State, and local safety codes.
- G. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from excavation.
- H. The Contractor shall provide protection against slides and cave-ins, as required by OSHA, State and local codes.
- I. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized adjacent to excavations.
- J. The limits of excavation for structures shall be the external dimensions of the structure plus the space necessary for the construction and removal of the forms and construction of masonry Work.
- K. The width of trenches for pipe shall provide a clearance as required by OSHA, State and local codes.
- L. The Contractor is reminded to test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible.
- M. The Contractor is reminded to provide ladders where employees are required to be in excavations as required by OSHA, State and local codes.
- N. The Contractor is reminded to provide adequate barriers and physically protect excavations. Barricade or cover all wells, pits, shafts, and similar excavations. Backfill temporary wells, shafts, and similar excavations upon completion of exploration and similar operations.

### 3.06 SHEETING

- A. The Contractor has the option of sheeting excavations.
- B. Supporting system, such as piling, cribbing, shoring, and bracing, shall be designed by a qualified Contractor's representative and meet accepted OSHA requirements.

- C. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning should be in good, serviceable conditions. Timbers should be sound, free from large or loose knots, and of proper dimensions.
- D. Brace the side of the excavation as necessary to resist the extra pressure due to superimposed loads.
- E. Provide shoring, bracing, or underpinning as necessary to ensure the safety of adjoining buildings or walls. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent contractor's representative and the protection effectively maintained.
- F. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining, or removing of the same. This includes damage to trees, sidewalks, and to other property on the project site, as well as on private grounds.
- G. Drive sheeting ahead of excavation. Do not remove sheeting until the excavation backfill has reached within two (2) feet of the top of the excavation, except that the lower course of sheeting may be removed from a double sheeted excavation. When sheeting is drawn, completely fill all cavities remaining in or adjoining the excavation. When sheeting is left in place, completely fill all cavities behind such sheeting.

3.07 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

- A. Suitable excavated material required for filling and backfilling operations may be stockpiled on the job site.
- B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as excavations are back-filled. Dispose of excess excavated material in a suitable, approved location.

3.08 SUBGRADE

- A. Compact the existing disturbed earth below subgrades which will support structures. Compact existing earth with a vibratory compactor, and maintain moisture content within + or - two (2%) percent of optimum moisture content during compaction. Compact existing earth to not less than ninety-five (95%) percent of the Modified Proctor Density, as determined by ASTM D1557.
- B. Do not construct foundations, footings, slabs, or piping on loose soil, mud, or other unsuitable soil.
- C. Fill excess cuts under foundations, footings, and slabs with structure foundation backfill.

- D. Fill excess cuts under piping with compacted pipe foundation bedding.

3.09 TEMPORARY PLUGS

- A. Prevent foreign matter from entering pipe while it is being installed.
- B. Do not place debris tools, clothing, or other material in this pipe.
- C. Close the open ends of pipe by watertight plugs when pipe laying is not in progress.
- D. Remove any earth or other material that enters pipe, lateral pipe, or appurtenances through any open end.
- E. Remove earth and other materials at no additional cost to the Owner.

3.10 BACKFILLING EXCAVATIONS UNDER PAVEMENTS, FOUNDATIONS, AND STRUCTURES

- A. Owner reserves the right to employ an independent testing laboratory to perform field density tests to ensure proper compaction.
- B. Remove debris and other unsuitable materials from excavations before backfilling is started.
- C. Backfill excavations in areas to be paved with pipe bedding material. Place pipe bedding material in layers six (6) inches loose thickness. Compact each lift of backfill to not less than ninety-five (95%) percent of the maximum dry density as determined in accordance with AASHTO T99, Method A (Std. Proctor). Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavation by approved rollers.
- D. Backfill excavations and fill beneath footings or structures with pipe bedding material. Backfill directly over and around structures with pipe bedding material. Place backfill in lifts no greater than six (6) inches in loose depth. Backfill and fill shall be within + or - two (2%) percent optimum moisture content. Compact backfill and fill to not less than ninety-five (95%) percent of the Modified Proctor Density, as determined by ASTM D1557.
- E. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the Owner.
- F. Do not use the following materials for backfill:
  - 1. Unsuitable materials
  - 2. Materials which are too wet or too dry to be compacted to the densities specified in this Article.

- G. Do not place fill over wet or muddy subgrade.
- H. Place backfill and fill in a manner which will not overload foundations or structures. Place backfill and fill evenly on all sides of foundations and structures. Do not use equipment that will overload foundations or structures during filling or backfilling.
- I. Do all cutting, filling, and grading necessary to bring the entire area around foundations and outside of structures to the following subgrade levels:
  - 1. To finished grade for areas not to be paved with drives or walks.

### 3.11 BACKFILLING PIPING TRENCHES

- A. Do not backfill trenches and excavations until all utilities have been inspected by the Engineer and until all underground utilities and piping systems are installed in accordance with the requirements of the Specifications and the Drawings.
- B. Place and tamp bedding and backfill in a manner which will not damage pipe coating, wrapping, or encasement.
- C. Bedding procedures shall be as specified in the Section for the applicable pipe material.
- D. Place pipe backfill material in eight (8) inch layers from the top of bedding to depths as required for particular application. Compact pipe backfill material to the density required to allow backfill material over the pipe to be compacted to the density specified in this Article.
- E. Do not use the following materials for backfill:
  - 1. Unsuitable materials
  - 2. Materials which are too wet or dry to be compacted to the densities specified in this Article.
- F. Do not place fill over wet or muddy subgrade.
- G. Backfill trenches across paved roadways with pipe bedding material, compacting each lift to ninety-five (95%) percent of the Modified Proctor Density. Backfill trenches across gravel roadways, driveways, utility crossings, along driveways, and in areas to be paved, or subjected to traffic with pipe bedding material. Compact each lift of backfill to equivalent of not less than eighty-five (85%) percent of the Modified Proctor Density. Place backfill in six (6) inch loose lifts. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling.



- H. Backfill trenches not requiring pipe bedding material with suitable pipe cover material as required by the Engineers. Place and compact backfill to produce an adequate foundation for seeding. The top twelve (12) inches of backfill shall not contain stones or other objects larger than one (1) inch in maximum dimension. Mound backfill above finish grade to allow for settlement. Fill and restore any settlement of the backfill. Grade area to be restored to finish grade after settlement of backfill.

**3.12 CLEANUP AND MAINTENANCE**

- A. Cleanup the job site as backfilling is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure, components and appurtenances. Restore items moved, damaged, or destroyed during construction.
- B. Maintain the job site until the Work has been completed and accepted. Fill excavations, which settle when settlement is visible. Restore items damaged by construction or improper restoration.
- C. Control soil erosion, stream and drain pollution resulting from silt or soil runoff or any material from construction operations. Use silt fences, silt barriers and sedimentation pools as required. Submit plan to control soil erosion, stream and drain pollution before clearing site.

**END OF SECTION**

**SECTION 02270**  
**SLOPE PROTECTION AND EROSION CONTROL**

**PART 1 GENERAL**

**1.01 WORK INCLUDED**

- A. The Contractor shall do all work and take all measures necessary to control soil erosion resulting from construction operations, shall prevent the flow of sediment from the construction site, and shall contain construction materials (including excavation and backfill) within his protected working area so as to prevent damage to adjacent property.
- B. The Contractor shall not employ any construction method that violates a rule, regulation, guideline or procedure established by Federal, State or local agencies having jurisdiction over the environmental effects of construction. The Contractor shall be responsible for obtaining all associated permits.
- C. Pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage and other harmful waste shall not be discharged into or alongside of any body of water or into natural or man-made channels leading thereto.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Temporary Slope Protection and Erosion Control: Bales may be hay or straw, and shall be reasonably clean and free of noxious weeds and deleterious materials. Filter fabric for sediment traps shall be of suitable materials acceptable to the Engineer.
- B. Permanent Slope Protection and Erosion Control: On slopes 2H:1V and steeper, and where shown on the drawings place Type A Dumped Rock Fill with a 24-inch minimum thickness over non-woven geotextile filter fabric.

**PART 3 EXECUTION**

**3.01 METHODS OF CONSTRUCTION**

- A. The Contractor shall use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of water diversion structures, diversion ditches and settling basins.
- B. Construction operations shall be restricted to the areas of work indicated on the Drawings and to the area which must be entered for the construction of temporary or permanent facilities. The Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing,

## SLOPE PROTECTION AND EROSION CONTROL

excavation, borrow and fill operations and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of the wetlands and adjacent watercourses. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.

- C. Excavated soil material shall not be placed adjacent to the wetlands or watercourses in a manner that will cause it to be washed away by high water or runoff. Earth berms or diversions shall be constructed to intercept and divert runoff water away from critical areas. Diversion outlets shall be stable or shall be stabilized by means acceptable to the Engineer. If for any reason construction materials are washed away during the course of construction, the Contractor shall remove those materials from the fouled areas as directed by the Engineer.
- D. For work within easements, all materials used in construction such as excavation, backfill, roadway, and pipe bedding and equipment shall be kept within the limits of the easements.
- E. The Contractor shall not pump silt-laden water from trenches or other excavations into the wetlands, or adjacent watercourses. Instead, silt-laden water from his excavations shall be discharged within areas surrounded by baled hay or into sediment traps to ensure that only sediment-free water is returned to the watercourses. Damage to vegetation by excessive watering or silt accumulation in the discharge area shall be avoided.
- F. Prohibited construction procedures include, but are not limited to, the following:
  - 1. Dumping of spoil material into any streams, wetlands, surface waters, or unspecified locations.
  - 2. Indiscriminate, arbitrary, or capricious operation of equipment in wetlands or surface waters.
  - 3. Pumping of silt-laden water from trenches or excavations into surface waters, or wetlands.
  - 4. Damaging vegetation adjacent to or outside of the construction area limits.
  - 5. Disposal of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete trucks or hydroseeders, or any other pollutant in wetlands, surface waters, or unspecified locations.
  - 6. Permanent or unauthorized alteration of the flow line of any stream.
  - 7. Open burning of debris from the construction work.

## **SLOPE PROTECTION AND EROSION CONTROL**

- G. Any temporary working roadways required shall be clean fill approved by the Engineer. In the event fill is used, the Contractor shall take every precaution to prevent the fill from mixing with native materials of the site. All such foreign fill materials shall be removed from the site following construction.

### **3.02 EROSION CHECKS**

The Contractor shall furnish and install baled hay or straw erosion checks in all locations indicated on the Drawings, surrounding the base of all deposits of stored excavated material outside of the disturbed area, and where indicated by the Engineer. Checks, where indicated on the Drawings, shall be installed immediately after the site is cleared and before trench excavation is begun at the location indicated. Checks located surrounding stored material shall be located approximately 6 ft. from that material. Bales shall be held in place with two 2 in. by 2 in. by 3 ft. wooden stakes. Each bale shall be butted tightly against the adjoining bale to preclude short circuiting of the erosion check.

**END OF SECTION**

## SECTION 02361 - TERMITE CONTROL

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

##### A. Section Includes:

- 1. Soil and wood treatment with termiticide.

##### B. Related Sections:

- 1. Division 6 Section "Rough Carpentry" for wood preservative treatment by pressure process.

#### 3. UNIT PRICES (Not Used)

#### 4. SUBMITTALS

##### A. Product Data: For each type of termite control product.

- 1. Include the EPA-Registered Label for termiticide products.

##### B. Qualification Data: For qualified Installer.

##### C. Product Certificates: For termite control products, from manufacturer.

##### D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

- 1. Date and time of application.
- 2. Moisture content of soil before application.
- 3. Termiticide brand name and manufacturer.
- 4. Quantity of undiluted termiticide used.
- 5. Dilutions, methods, volumes used, and rates of application.
- 6. Areas of application.
- 7. Water source for application.

##### E. Wood Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

## TERMITE CONTROL

1. Date and time of application.
2. Termiticide brand name and manufacturer.
3. Quantity of undiluted termiticide used.
4. Dilutions, methods, volumes used, and rates of application.
5. Areas of application.

### 5. QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products from single manufacturer.

### 6. PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Apply wood treatment after framing, sheathing, and exterior weather protection is completed but before electrical and mechanical systems are installed.

### 7. WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
  1. Warranty Period: Five years from date of Substantial Completion.
- B. Wood Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied wood termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite damage is discovered during warranty period, repair or replace damage caused by termite infestation and treat replacement wood.
  1. Warranty Period: 12 years from date of Substantial Completion.

8. MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

2.PRODUCTS

1. SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

- 1. Products: Subject to compliance with requirements, provide one of the following:
  - a. BASF Corporation, Agricultural Products; Termidor.
  - b. Bayer Environmental Science; Premise 75.
  - c. FMC Corporation, Agricultural Products Group; Talstar.
  - d. Syngenta; Demon TC.
- 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

2. WOOD TREATMENT

- A. Borate: Provide an EPA-Registered borate temiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution for spray application and a gel solution for pressure injection, formulated to prevent termite infestation in wood. Provide quantity required for application at the label volume and rate for the maximum diffusible borate concentration allowed for each specific use, according to product's EPA-Registered Label.

- 1. Products: Subject to compliance with requirements, provide the following:
  - a. Nisus Corp.; Bora-Care, Jecta, or Tim-Bor.
  - b. NovaGuard Technologies, Inc.; Armor-Guard or Shell-Guard.

3.EXECUTION

1. EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

## TERMITE CONTROL

- B. Proceed with application only after unsatisfactory conditions have been corrected.

### 2. PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

### 3. APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

### 4. APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
  - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
  - 3. Masonry: Treat voids.
  - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.



- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

5. APPLYING WOOD TREATMENT

- A. Application: Mix wood treatment solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of borate, according to manufacturer's EPA-Registered Label, so that wood framing, sheathing, siding, and structural members subject to infestation receive treatment.
  - 1. Framing and Sheathing: Apply termiticide solution by spray to bare wood for complete coverage.
  - 2. Wood Members More Than 4 Inches Thick: Inject termiticide gel solution under pressure into holes of size and spacing required by manufacturer for treatment.
  - 3. Exterior Uncoated Wood Trim and Siding: Apply termiticide solution to bare wood siding. After 48 hours, apply a seal coat of paint as specified in Division 9 painting Sections.

END OF SECTION 02361

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**SECTION 02480  
SEEDING AND MULCHING**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    Furnish and install seed and mulch and do related work necessary to complete work shown or specified.
- B.    The Contractor shall repair or replace lawn areas, trees, and ornamental plants damaged or destroyed during construction of the work included in this Contract, unless otherwise shown on the drawings.

1.02    QUALITY ASSURANCE

- A.    Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the reference thereto. Latest revisions as of the date of bid opening shall apply, unless otherwise shown or specified.
- B.    Package standard products with manufacturer's certified analysis. For other materials, provide analysis by a recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

1.03    SUBMITTALS

- A.    Submittals shall be made in accordance with Section **GENERAL REQUIREMENTS** and the requirements of this section.
- B.    Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.

1.04    PRODUCT DELIVERY, STORAGE, AND HANDLING

- A.    The Contractor shall be responsible for the delivery, storage, and handling of products.
- B.    Promptly remove damaged products from the job site. Replace damaged products with undamaged products.
- C.    Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

1.05 JOB CONDITIONS

- A. Do not sow seed during adverse weather conditions. Do not broadcast seed during high wind. Do not sow seed when the moisture content of the soil is too low or too high for seed germination.
- B. Proceed with and complete seeding and mulch work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

**PART 2 PRODUCTS**

2.01 SEEDING AND MULCHING

- A. Topsoil: Topsoil shall be a natural, friable soil, representative of product soils in the vicinity. It shall be well-drained, free from admixture of subsoil and foreign matter, objects larger than two (2) inches in diameter, toxic substances, and any other deleterious material that may be harmful to plant growth and be a hindrance to grading, planting, and maintenance operations. Soil excavated on site may be used provided it meets the requirements of topsoil.
- B. Seed shall meet the requirements of these Specifications and comply with the Alabama Seed Law Act No. 424, General Acts, 1963 Vol. 2, Page 931, latest revision. The type of quick growing seed used shall be appropriate to provide an early ground cover during the particular season when planting is done. The rate of spread shall be as specified in Section 3.01D.
- C. Mulch shall meet the material requirements of the State of Alabama Department of Transportation Standard Specifications for Highway's and Bridges, latest revision.
- D. For areas requiring sod it shall be Tifton Bermuda free of weeds and other undesirable grasses. 118 minimum ½ yard cuts.
- E. Fertilizer: Commercial plant food containing eight (8%) percent nitrogen, eight (8%) percent available phosphate, and eight (8%) percent potassium, uniform in composition, dry, free-blowing, and delivered in containers bearing manufacturer's guaranteed analysis.
- F. For areas requiring erosion control matting see Section 02490 EROSION CONTROL MATTING.

2.02 EQUIPMENT

- A. The seed spreader shall be an approved mechanical hand spreader or other approved type of spreader.

- B. The mulching equipment shall be of a type capable of cutting the specified materials uniformly into the soil and to the required depth. Harrows will not be allowed.
- C. Cultipacker, traffic roller, or other suitable equipment will be required for rolling the grassed areas.

**PART 3 EXECUTION**

**3.01 GRADING, SEEDING AND MULCHING**

- A. Pre-Finish Grading: Complete rough grading to grades indicated on the Drawings or to accomplish adequate drainage patterns required by the site layout. Rough grading shall allow for the addition of materials needed to accomplish finish grading. Fill areas required during subgrade preparation shall be compacted to eighty-five (85%) percent of the relative maximum density. Topsoil shall be spread over the prepared rough grade using a rubber-tired tractor with grader blade or equivalent.
- B. Fertilizing: Apply commercial fertilizer at the rate of nine hundred twenty (920) pounds per one-acre or at a rate determined from soil tests, distributing uniformly with a rotary mechanical spreader. Apply soil additives such as lime if the soil pH requires adjustment.
- C. Finish Grading: After placing topsoil and applied materials, rake the topsoil to a uniform grade so that all areas drain, as indicated on the grading plan or as required to complete drainage patterns. Lightly compact with a cultipacker before planting grass. Remove all trash from the area prior to planting grass.
- D. Seeding
  - 1. Seeding and mulching operations will not be permitted when wind velocities exceed fifteen (15) miles per hour. Seed shall be sown only when the soil is moist and in proper condition to induce growth. No seeding shall be done when the ground is unduly wet or otherwise not in a tillable condition.
  - 2. Whenever a suitable amount of area has been graded, it shall be made ready and grassed as specified in this Section. Grassing shall be incorporated into the project at the earliest practical time in the life of the Contract.
- E. The several operations involved in the work shall proceed in the following sequence: preparation of the ground; seeding; spreading of mulch; cutting-in mulch; and rolling or preparation of the ground; installation of erosion control matting, placing soil; hydroseeding; placing excelsior mat.

SEEDING AND MULCHING

- F. The ground over which the seed is to be sown shall be prepared by diskharrowing and thoroughly pulverizing the soil to a suitable depth. The prepared soil shall be loose and reasonably smooth. It shall be reasonably free of large clods, roots, and other material, which will interfere with the work or subsequent mowing and maintenance operations. Apply lime at two (2) tons per acre, and 8,8,8 commercial fertilizer at nine hundred twenty (920 lbs.) pounds per acre.
- G. While the soil is still loose and moist, the seed shall be scattered uniformly over the grassing area. The rate of spread for the seed mixture shall be per schedule.

August through February	Winter
Kentucky 31	30 lbs/acre
Reseeding Crimson Clover	15 lbs/acre
Bermuda Grass (Unhulled)	30 lbs/acre
Perennial Ryegrass	30 lbs/acre
March through July	Spring
Kentucky 31	30 lbs/acre
Kobe Lespedeza (Var. Tenn)	30 lbs/acre
Bermuda Grass (Cynodon Ductylon)	20 lbs/acre
	(Hulled)

- H. Approximately two (2) inches, loose thickness of mulch material shall be applied uniformly over the seeded area, and the mulch material cut into the soil with equipment specified, to produce a loose mulched thickness of three (3) to four (4) inches. Care shall be exercised that the materials are not cut too deeply into the soil.
- I. Immediately after completion of the seeding, the entire mulched area shall be rolled thoroughly with the equipment specified. At least two (2) trips of the entire area will be required.
- J. Maintenance:
  - 1. Water to keep surface soil moist. Repair washed out areas by filling with topsoil, liming, fertilizing, and seeding. Replace mulch on banks when washed or blown away. Mow grass to two (2) inches after grass reaches at least three (3) inches in height, and mow frequently enough to keep grass from exceeding 3 ½ inches.
  - 2. If a satisfactory stand of grass has not been established in eight (8) weeks, the Contractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately. A satisfactory stand of grass is defined as having no bare spots larger than three (3) square feet and not more than

## SEEDING AND MULCHING

ten (10%) percent of total area with bare spots larger than one (1) square foot.

3. The seeded areas shall be watered to provide optimum growth conditions for the establishment of the grass. In no case, however, shall the period of maintaining such moisture be less than two weeks after the planting. Manual watering shall continue at least every four (4) days until the end of the growing season.
- K. See Section 02490 for installation of EROSION CONTROL MATTING where required.
- L. The Contractor shall maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include filing, leveling, and repairing of any washed or eroded areas. Replant any areas in which the establishment of the grass stand does not develop satisfactorily.
- M. Clean-up the job site following seeding and mulching. Remove rubbish, excess materials, temporary structures, and equipment. Leave the work in a neat and presentable condition.
- N. Install Tifton Bermuda Sod in all swales, ditches, all slopes 3:1 or greater, within 10' of each building structure and within 3' of all walkways and driveways.

## PART 4 PAYMENT

### 4.01 GENERAL

- A. Payment for all work in this Section will be included as part of the lump sum bid amount or unit prices stated in the Proposal.

END OF SECTION

**SECTION 02490**  
**EROSION CONTROL MATTING**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    Furnish and install erosion control matting and do related work necessary to complete work shown or specified.

1.02    SUBMITTALS

- A.    Submittals shall be made in accordance with Section **GENERAL REQUIREMENTS** and the requirements of this section.

1.03    PRODUCT DELIVERY, STORAGE, AND HANDLING

- A.    The Contractor shall be responsible for delivery, storage, and handling of products.
- B.    Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

**PART 2      PRODUCTS**

2.01    MATERIALS

- A.    Synthetic Mat: Three-dimensional structure of entangled nylon monofilaments melt-bonded at their intersections, crush resistant, pliable, resilient, water-permeable and highly resistant to chemicals and environmental degradation; equal to Enkamat 7020, as manufactured by Akzo Industrial Systems Company of Asheville, NC.
- B.    Wooden Stakes: Wedge-shaped stakes, ¾ inch x 2 ½ inch x 12 inch.

**PART 3      EXECUTION**

3.01    INSTALLATION OF EROSION CONTROL MATTING

- A.    Prepare slope face by disking. Ensure uniform grading. Remove minor surface irregularities to facilitate placement of over lying matting.
- B.    Prepare 16 inch deep anchor slot at the top of the slope. Roll matting down slope after staking terminal edge in anchor trench.
- C.    Pull matting snugly to the surface and stake at three (3) feet on center.



## EROSION CONTROL MATTING

- D. Overlap adjoining strip of matting 4 inches and anchor at the top and toe of the slope. Continue until prepared slope is covered with matting.
- E. Inspect installed matting, ensuring soil filling within entire matting structure. Roll surface so that soil is pushed into matting. Fill any remaining voids with loose soil to the top of the mat.
- F. Hydroseed entire slope face covered with soil filled matting in uniform pattern.
- G. Place exterior mat on the top of the erosion control matting with the terminal edge being anchored in the same slot as the erosion control matting at the top and toe of the slope. Backfill the top and toe anchor slots with soil after securing matting in place.
- H. Each roll of the area covered with excelsior mat should be over-lapped four (4) inches and the entire area staked at three (3) feet on center.

END OF SECTION

**SECTION 02515**  
**ROADS AND DRIVEWAYS**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    Work necessary to complete the roads and driveways, including asphalt paving, and drainage structures.

1.02    GENERAL

- A.    See CONDITIONS OF THE CONTRACT and Section GENERAL REQUIREMENTS, for information and requirements that apply to the Work specified herein and are mandatory for this Project.

1.03    SUBMITTALS

- A.    Submittals shall be made in accordance with Section GENERAL REQUIREMENTS, and the requirements of this Section.
- B.    Provide the following submittals:
  - 1.    Certification, test results, and source for asphalt concrete material.
  - 2.    Product cut sheets for cast drainage structures and grating.

1.04    SYSTEM DESCRIPTION

- A.    Paving: Designed for movement and parking of trucks up to thirty-thousand (30,000) Lbs.

1.05    QUALITY ASSURANCE

- A.    Perform Work in accordance with the current edition of the State of Alabama Department of Transportation Standard Specifications for Highway Construction ("Standard Specifications"). In case of conflict, the Standard Specifications shall prevail.

**PART 2      PRODUCTS**

2.01    PAVEMENT MATERIALS

- A.    Asphalt concrete shall conform to Section 416 of the Standard Specifications.
- B.    Aggregate shall meet the requirements of Section 801, 802, and 416 Standard Specifications.

- C. Filler, if required, shall meet the requirements of Section 805 of the Standard Specifications.
- D. The asphalt cement to be mixed with the mineral aggregates at the central plant shall be AC-20 paving asphalt conforming to the requirements of Section 804 of the Standard Specifications.
- E. The job-mix formula shall indicate the gradation of each of the aggregate constituents to be used in the mixture and shall establish the exact proportion of each constituent to be used to produce a combined gradation of aggregate within the appropriate limits stated above.

**2.02 BASE COURSE MATERIALS**

- A. Materials for base course shall conform to Type B crushed aggregate as specified in Section 825 of the Standard Specifications.

**2.03 CATCH BASINS AND DRAINAGE CULVERTS**

- A. Catch basins shall be as shown on the Drawings or pre-cast units conforming to ASTM C478 except that dimensions shown on the Drawings shall take precedence.
- B. Culvert pipes shall be bell and spigot reinforced concrete conforming to ASTM C76 and meeting the requirements for Class IV reinforcing. Joints shall be rubber gasketed type furnished by the pipe manufacturer.

**PART 3 EXECUTION**

**3.01 BASE CONSTRUCTION**

- A. Construct base course at the location and to the grades and cross sections shown on the Drawings. A prime coat shall be applied to the base course in accordance with Section 401 of the Standard Specifications.
- B. Once the drive area is at grade, the area shall be thoroughly proofrolled. Any soft or loose areas shall be undercut and replaced with compacted fill.
- C. The base shall be compacted to a minimum of 98 percent maximum dry density as determined by a Standard Proctor at a moisture content that is within 2 percentage points of the optimum moisture content.

**3.02 ASPHALT PAVEMENT CONSTRUCTION**

- A. Asphalt for prime coat shall not be applied when the ground temperature is lower than fifty (50) degrees F without permission of the Engineer. Asphalt concrete shall not be placed when the atmosphere temperature is lower than

forty (40) degrees F nor during heavy rainfall nor when the surface upon which it is to be placed is thirty-two (32) degrees F or lower.

- B. Lay asphalt concrete over the base course to the compacted depth shown on the Drawings. The method of proportioning, mixing, transporting, laying, processing, rolling the material, and the standards of workmanship shall conform to the applicable requirements of Section 410 of the Standard Specifications. At no time shall the coarse aggregate segregated from the mix from hand spreading or raking of joints be scattered across the paved mat.
- C. Roll each lift of the asphalt concrete and compact to the density specified in the referenced Standard Specifications. Asphalt or asphalt stains, which are noticeable upon surfaces of concrete or materials, which will be exposed to view shall be promptly and completely removed.
- D. Where the asphalt pavement is to be connected with an existing roadway surface, the Contractor shall modify the existing roadway profile to produce a smooth riding connection between new and existing paving. Where it is necessary to remove existing asphalt surfaces, burn or chip the existing surface to provide a minimum 2 1/2-inch depth of asphalt concrete. The edges of meet line cuts shall be straight and vertical. Existing asphalt edges shall be painted with tack coat before placing new asphalt.
- E. The completed surface of the asphalt pavement shall be of uniform texture, smooth, uniform as to crown and grade, and free from defects of all kinds. The completed surface shall not vary more than 1/8-inch from the lower edge of a ten (10)-foot straightedge placed on the surface parallel to the centerline. The transverse slope shall not vary more than 1/4-inch in ten (10)-feet from the rate of transverse slope shown on the Drawings.

### 3.03 CATCH BASINS AND DRAINAGE STRUCTURES

- A. Construct inlets, catch basins, and headwalls at the locations shown and in accordance with the Drawings. Chamfer corners of all structures.
- B. Compact upper twelve (12)-inches of the subgrade for pre-cast units to ninety-five (95%) percent relative compaction.
- C. Set frames and grates at elevations indicated or as determined in the field and in conformance with the Drawings.
- D. The Contractor shall prevent sediments or debris from entering the catch basins, inlets, and headwalls during the construction period by placing erosion control devices around the catch basins, inlets, and at the upstream headwalls. Upon completion, clean each structure of all silt, debris, and foreign matter.

**3.04 CULVERTS**

- A. Place culverts and drain pipes at grade shown on the Drawings. Do not permit mud and foreign material to get into the pipe. After completion, completely flush or clean all parts of the system. Culvert entrances shall not be blocked by any mud or silt and ditch grades downstream of culverts shall not be greater than the pipe invert.

**END OF SECTION**

**SECTION 02825**  
**ALUMINUM GATE SYSTEM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes: Ornamental modular gate panels fabricated with extruded aluminum louvers and flat aluminum bars, including extruded aluminum fence posts and aluminum louver gates. Gate shall match aluminum fence panels. Two (2) gates required.
- B. Related sections:
  - 1. Cast-in-Place Concrete: Concrete footings for support of fence posts.

**1.2 REFERENCES**

- A. ASTM International (ASTM):
  - 1. ASTM B117 - Operating Salt Spray (Fog) Apparatus.
  - 2. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
  - 3. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 4. ASTM D822 - Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
  - 5. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
  - 6. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

**1.3 SUBMITTALS**

- A. Provide in accordance with Section 01001 - General Requirements.
  - 1. Product data for components and accessories.
  - 2. Shop drawings showing layout, dimensions, spacing of components, interface with electric gate operator, and anchorage and installation details.
  - 3. Copy of warranty specified in Paragraph 1.4 for review by Architect.

**1.4 WARRANTY**

- A. Provide 10-year warranty for factory finish against cracking, peeling, and blistering under normal use.

- B. The cantilever slide gate and operator system shall be warranted by the manufacturer against manufacturing defects for a period of (3) three years from date of sale. The truck assembly shall be warranted against manufacturing defects by the manufacturer for a period of (5) five years from date of sale.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360. 1.
- B. Fortress TYM-2000 Heavy Metal Gate System manufactured by Tymetal Corp., 2549 State Route 40, Greenwich, NY 12834 (800) 328 4283.

### **2.2 MATERIALS**

- A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.
- B. Sheet aluminum: ASTM B209, Alloy 6063, Temper T-6.
- C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing additives.

### **2.3 GATES**

- A. Provide gates of type and size indicated on Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.
- B. Type: Cantilevered horizontal sliding gate.
  - 1. Construction: Welded frame fabricated from extruded aluminum tubing with aluminum fixed louver panels to match fencing material. Frame configuration shall be as indicated on Drawings and approved shop drawings. Frame shall be designed for a 2000 lb load minimum.
  - 2. Nominal size:
    - a. Gate opening: 16 foot wide by 6 foot high.
  - 3. Cantilever mechanism: Aluminum top track and wheeled carriers and bottom roller guides supported by brackets attached to support posts.
- C. Coordinate provision of gate with electric operator specified to ensure size, weight, and design of gate is compatible with operator.

### **2.4 VEHICULAR SLIDE GATE OPERATOR**

- A. The slide gate operator shall open and close cantilever, overhead, or track gates, to provide convenience and security. Model adapted to function with coded cards and

## ALUMINUM GATE SYSTEM

sensing loops. The operator utilizes 115 Volt AC single phase power. Control voltage in each case is 5 Volt DC.

- B. The gate operator includes a controller with integrated radio receiver, plug-in loop detector capability, surge protection, and easy to read labeling.
- C. Capacity:
  - 1. The gate operator shall be rated to operate a gate weighing up to 2000 lbs.
- D. The gate operator shall be UL 325 compliant.
- E. Design Criteria:
  - 1. Operation shall be by means of a one (1) horsepower (minimum) single phase instant reversing motor, transferring power to a four inch diameter pulley, to a right angle oil bath gear reducer using another four inch diameter pulley and V-belt. Power is then transferred through a sliding collar disconnect system to the output drive shaft equipped with a #40 drive sprocket and roller chain which attaches to the gate with heavy-duty gate attachment brackets. Intermediate chain supports with anti-catch design shall also be supplied.
  - 2. The operator shall open the gate at a rate of approximately 11 inches per second.
    - 1. The #40 chain shall be coated with "Armor Coat" corrosive resistant chain coating. Corrosive resistance exceeds nickel plating.
    - 2. The unit shall be mounted on a concrete pad as recommended by the manufacturer.
- F. Components:
  - 1. Standard mechanical components shall include as a minimum.
    - a. 3/16 inch thick, weather resistant UV-stabilized polyethylene one piece cover, which is fully removable and lockable.
    - b. Heavy-duty, plated frame with mounting legs for pad mounting standard.
    - c. Pedestal to raise operator from ground level and protect from high water.
    - d. 20:1 right-angle oil bath gear reducer.
    - e. Arctic package with immersion heater.
    - f. One inch solid steel output drive shaft.
    - g. Spring loaded manual disconnect.
    - h. Steel "critter" plate to prevent entry of ground pests.
  - 2. Standard electrical components shall include as a minimum:
    - a. 1 HP motor (minimum) with thermal overload protection in 115 VAC single phase.
    - b. Solid state logic controls featuring 15 diagnostic L.E.D. indicators and auto-close timer (one second to 9 minutes).



- c. Inherent, fully adjustable motor over-current sensing to detect obstructions via precision 24 turn potentiometer, with separate adjustments for opening and closing directions.
- d. Controller housed in zinc plated control box with separate box provided for connection of field power.
- e. Power On/Off switch; 115 VAC duplex outlets included.
- f. Contacts for opening, closing and reversing accessories, as well as contact and non-contact obstruction sensing devices. 24 VAC and 24 VDC available on terminal strip to power accessory devices, provided by non-circuit board mounted transformer with minimum 40VA rating.
- g. Four adjustable limits with precision snap-action type limit switches to control gate position, mounted inside a separate four switch limit box.
- h. Master/slave or stand alone capable with dip switch selection. Three wire twisted pair shielded cable required.

3. Optional accessories, contact, non-contact, and control devices:

- a. Control devices: programable handheld fob. Provide 8 programable fobs
- b. Provide vehicle detection exit control and non-contact sensors to prevent accidental closure on objects/vehicles that block the gate path.

G. Factory Inspection and Testing

- 1. Manufacturer shall test each operator at factory to assure smooth, quiet operation.
- 2. Manufacturer shall test all control inputs to ensure proper function.

2.3 ACCESSORIES

- A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.

2.4 FACTORY FINISH

- A. Aluminum fence panels and posts shall receive powder coatings manufactured from fluorocarbon polymer resins shall exceed the requirements of AAMA 2605.
- B. Color: Selected by OWNER from manufacturer's standard range.

**PART 3 - EXECUTION**

3.1 PREPARATION

- A. Prior to fabrication, field verify required dimensions.
- B. Coordinate fence and gate installation with provision of gate operator to ensure proper power supply and that conduit and wiring are concealed.
- C. Cast concrete footings in accordance with Section 03300 Cast-in-Place Concrete as detailed on Drawings and approved shop drawings.
  - 1. Minimum footing diameter:

- a. Terminal and gate posts: 12 inches.
  - b. Intermediate line posts: 10 inches.
- 2. Allow 12-inches minimum embedment of posts.
- 3. Allow 6 inches minimum concrete beneath post bottom.
- D. Provide setting holes for embedment of fence/gate posts.

### 3.2 INSTALLATION

- A. Install gate in accordance with manufacturer's installation instructions and approved shop drawings.
- B. Install posts plumb and in concrete and grouting solid.
- C. Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.
- D. Secure fence and gate panels with standard stainless steel bolts after posts have been set in footings.
- E. Gates:
  - 1. Install gates and adjust hardware for smooth operation.
  - 2. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings.
  - 3. Provide concrete surface for length of operation of V-wheeled rolling gate. Anchor track to concrete with countersunk fasteners.
  - 4. After installation, test gate and operator. Open and close a minimum of five times. Correct deficiencies and adjust.
  - 5. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.
  - 6. The gate and installation shall conform to ASTM F 1184 standards for aluminum cantilever slide gates, Type II, Class 2. See 1.02 C.
- F. The gate system is to comply with ASTM F2200 and UL 325. See 1.02 B and 1.02 A.
- G. Obstruction Sensing Systems:
  - 1. The inherent motor current sensors are part of the gate operator system and may not be removed or bypassed.

## **ALUMINUM GATE SYSTEM**

2. The installing contractor shall be responsible to ensure that appropriate external secondary entrapment protection devices be installed for the specific site conditions to protect against all potential entrapment zones. Proper operation of these safety devices shall be verified and training as to the operation and maintenance of these devices for the users and owners shall be documented.

**END OF SECTION**

**SECTION 02900  
LANDSCAPE WORK**

**PART 1        GENERAL**

1.01    RELATED DOCUMENTS

- A.     Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, shall apply to work of this Section.

1.02    REQUIREMENTS & CODES

- A.     The following are minimum requirements and shall govern, except that all local, state, and/or federal codes and ordinances shall govern when their requirements are in excess hereof.
- B.     The Landscape Contractor shall be a registered Landscape Contractor in the State of Alabama.

1.03    DESCRIPTION OF WORK

- A.     Extent of landscape development work is shown on the Plans and in the Schedules.
- B.     Subgrade elevations, excavation, filling and grading required to establish elevations shown on the Plans are not specified herein and are specified in other Sections.

1.04    QUALITY ASSURANCE

- A.     Subcontract landscape development work to a single firm specializing in landscape or lawn work. The use of general labor or part-time labor for landscape or lawn work shall not be allowed.
- B.     General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulation applicable to landscape materials.
- C.     Do not make substitutions. If specified landscape material is not obtainable, submit to Landscape Architect proof of non-availability together with proposal for use of equivalent material.
- D.     Analysis and Standards: Package all standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agricultural Chemists, wherever applicable.
- E.     Trees, Shrubs, Groundcovers, & Plants: Provide trees, shrubs, groundcovers & other plants of quantity, size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of the American Standard for Nursery Stock (latest edition) as compiled by the American Association of Nurserymen. Provide healthy, vigorous stock, grown in a recognized nursery in

## LANDSCAPE WORK

accordance with good horticultural practice and free of disease, insects, eggs or larvae and defects such as knots, sunscald, injuries, abrasions, or disfigurement.

- F. Sizes: Provide all plant material of sizes shown or specified. Trees and shrubs of larger size may be used if acceptable to the Landscape Architect and if sizes of roots and root balls are increased proportionately.
- G. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and label with numbers to assure symmetry in planting.
- H. Inspection: The Landscape Architect may inspect plant material either at place of growth or at the site before planting, for compliance with requirements for genus, species, variety, size and quality. The Landscape Architect retains the right to further inspect all plant material for size and condition of root balls and/or root systems, insects, injuries, and latent defects and shall have the right to reject any or all unsatisfactory or defective material at any time during the progress of the work. All rejected plant material shall be removed immediately from the project site.
- I. Plant cultivars specified shall be adhered to without exception. Wrong cultivars or species shall be regarded as incorrect plant material, shall be rejected, and shall be replaced by the Landscape Contractor at his expense.
- J. Approval: The Landscape Architect shall approve the staked layout of areas of planting and the location of all plant material prior to the start of planting. No plant material shall be planted until its layout has received said approval. Any plant material planted without said approval shall be subject to removal and re-planting at the Contractor's expense as determined by the Landscape Architect.

### 1.05 SUBMITTALS

- A. Certification: Submit certificates of inspection as required by governmental authorities. Submit manufacturer or vendor certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.
- B. Planting Schedule: Submit proposed planting schedule indicating dates for each type of landscape work during normal seasons for such work in the area of the site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing and after documentation of reasons for delays.
- C. Maintenance Instructions: Submit typewritten instructions recommending procedures to be established by the Owner for maintenance of landscape work for a period of one (1) full year. Submit instructions prior to expiration of required maintenance period(s).

### 1.06 DELIVERY, STORAGE, & HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site.

## LANDSCAPE WORK

- B. Sod: Time delivery of sod so that it will be placed within 24 hours after stripping. Protect sod against drying and breaking of stacked blocks.
- C. Trees & Shrubs: Provide freshly dug trees and shrubs (when B & B). Do not prune prior to delivery. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark, break branches, or destroy natural shape. Provide protective covering during delivery. Do not lift any plant material by trunk or stem. Do not drop balled & burlapped stock during delivery. Any B & B stock dropped on the ball shall not be used.

Deliver trees and shrubs and other plant material after preparations for planting have been completed and then plant immediately. If planting is delayed more than six (6) hours after delivery, set all plant material in the shade, protect from weather and mechanical damage, and keep roots moist. Do not remove container-grown stock from containers until ready to plant.

Label at least one tree and shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

### 1.07 JOB CONDITIONS

- A. Proceed with and complete landscape work as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required.
- B. Utilities: Determine the location of underground utilities, irrigation lines, drain lines, etc. and perform work in a manner to avoid possible damage. Hand excavate as required. Any damage to said utilities and/or lines by the Landscape Contractor shall be repaired by the same Landscape Contractor at his expense.
- C. Excavation: When conditions detrimental to plant growth are encountered (such as rubble fill, adverse drainage conditions, or obstructions), notify the Landscape Architect before planting.
- D. Planting Time: Plant or install all plant materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance period(s) to provide maintenance from date of substantial completion.

Plant trees and shrubs after final grades are established and prior to planting of native grasses, unless otherwise acceptable to the Landscape Architect.

- E. Soil Tests: The Landscape Contractor shall obtain soil tests from various areas in the designated planting areas and shall present results to the Landscape Architect prior to the beginning of planting operations. The results of said soil tests shall be used to determine exact fertilizer requirements if different from specified amounts. Do not plant any plant material until said soil tests results been acquired.

### 1.08 SPECIAL PROJECT WARRANTY

- A. Warranty trees, shrubs, groundcovers, other plant material, and lawns for a period of one (1) year from the date of the Final Acceptance. Warranty shall be against defects including death and unsatisfactory growth, except for defects resulting from neglect by

## LANDSCAPE WORK

the Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond the control of the Landscape Contractor as determined by the Landscape Architect.

- B. Remove and replace trees, shrubs, groundcovers, other plant material, and lawn areas found to be dead or in unhealthy condition during the warranty period. Make replacements during growth season following the end of the warranty period. Replace trees, shrubs, groundcovers, other plant material, and lawn areas which are in doubtful condition at the end of the warranty period unless, in the opinion of the Landscape Architect, it is advisable to extend the warranty period for a full growing season.

All replacement stock shall be subject to the same warranty requirements as the original stock. The Landscape Contractor at his expense shall repair any damage due to replacement operations.

- C. At the end of the warranty period, the Landscape Architect and the Landscape Contractor shall make joint inspections. All trees, shrubs, groundcovers, other plant material, and lawn areas not in a healthy growing condition shall be removed and replaced with plant material and lawn of a like kind and size before the close of the next planting season at the expense of the Landscape Contractor.

Only one (1) replacement (per tree, shrub, groundcover, other plant material, and lawn area) shall be required at the end of the warranty period, except for losses or replacements due to failure to comply with specified requirements.

## PART 2 PRODUCTS

### 2.01 TOPSOIL

- A. Topsoil is to be stockpiled for re-use in landscape work. If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required to complete landscape work.
- B. Provide new topsoil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, and other litter and free of roots, stumps, stones larger than 2" in any dimension, and other extraneous or toxic matter harmful to plant growth.
- C. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at the project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4". Do not obtain topsoil from bogs or marshes.

### 2.02 SOIL AMENDMENTS

- A. Fertilizer: Use a complete fertilizer of neutral character, delivered to the site in original unopened containers, each bearing the manufacturer's guaranteed analysis.
  - 1. Trees, shrubs, groundcovers: "Woodace" planting tablets, 14-4-6. Number of tablets shall be as follows:
    - a. 3 gal: 5 tablets
    - b. 10 gal: 12 tablets
    - c. 15 gal: 16 tablets
    - d. Larger pots: per Land. Arch. instruction

## LANDSCAPE WORK

2. Sodded & Seeded Lawns: Balanced granular fertilizer (13-13-13), slow acting. Provide percentage of nitrogen required to provide the following minimum rates of actual nitrogen:

TYPE	ACTUAL NITROGEN
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Bermuda	1 lb. per 1,000 SF (40 lbs. per acre)
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- B. Mycorrhiza inoculants:
  1. Trees, shrubs, groundcovers: "Diehard Transplant" with hydrogel and soil conditioners (see Plant Schedule notes). Application rates per manufacturer's recommendations.
- C. Lime: Natural limestone containing not less than 85% of total carbonates. Broadcast rate shall be 40 lbs. per 1,000 SF (1,800 lbs. per acre).
- D. Pine Bark Mix: Ground pine bark (not shavings), composted, and mixed with sand ("Dodd's Potting Mix" or approved equivalent).
- E. Sand: Clean, washed sand, free of toxic materials.

### 2.03 PLANT MATERIALS

- A. Quality: Provide trees, shrubs, groundcovers, and other plant material of size, genus, species, and variety shown and scheduled for landscape work. Comply with recommendations and requirements of the American Standard for Nursery Stock (latest edition) as compiled by the American Association of Nurserymen.
- B. Deciduous trees: Provide deciduous trees of height and caliper as shown on the Plant Schedule and with branching configuration recommended for type and species required. Provide single-stem trees except where special forms are listed. Balled & burlapped (B&B) deciduous trees shall not be used.
- C. Evergreen trees: Provide evergreen trees of height and caliper as shown on the Plant Schedule and with branching configuration recommended for type and species required. Provide single-stem trees except where special forms are listed. Balled & burlapped (B&B) evergreen trees shall not be used.
- D. Deciduous shrubs: Provide container-grown deciduous shrubs of the height and spread as shown on the Plant Schedule. Balled & burlapped (B&B) deciduous shrubs shall not be used.
- E. Evergreen shrubs: Provide container-grown evergreens of sizes shown on the Plant Schedule. Dimensions indicate minimum spread for spreading and semi-spreading type evergreens and height for other types: globe, dwarf, cone, pyramidal, broad upright, and columnar. Provide normal quality evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown or listed. Balled & burlapped (B&B) evergreen shrubs shall not be used.



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- F. Groundcover: Provide well established, two (2) year old plants, well-rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required for the pot size for two (2) year old stock shown or listed.

### 2.04 GRASS MATERIALS

- A. Sod: Provide strongly rooted, inspected and found free of diseases, not less than two (2) years old and free of weeds and undesirable native grasses.
  - 1. Provide only sod capable of growth and development when planted (viable, not dormant).
  - 2. Sod shall be machine-cut at a uniform minimum soil thickness of 5/8" at the time of cutting. Measurement for thickness shall exclude top growth and thatch. Thatch shall be a maximum of 1/2", uncompressed.
  - 3. Individual pieces of sod shall be cut to the supplier's standard width and length. Broken pads, torn pads, or pads with uneven ends shall not be acceptable.
  - 4. Provide Certified sod & seed of type specified on the Plan.
- B. Seed: Provide fresh, clean, new-crop seed complying with tolerance for priority and germination established by Official Seed Analysis of North America.
  - 1. Provide seed mixture composed of grass species, proportions, and minimum percentages of purity, germination, and maximum percentage of weed seed, and at rates as specified on the Plan.

### 2.05 MISCELLANEOUS LANDSCAPE MATERIALS

- A. Mulch: Provide organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs, groundcovers, and other plants. Type of mulch specified on the Plan.
- B. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions (where specified).
- C. Anti-Erosion Mulch: Provide clean, seed-free salt hay or threshed straw of wheat, rye, oats, or barley.
- D. Pre-Emergent Herbicide: Ronstar®, or approved equal. Provide a minimum of two (2) applications. First application: prior to mulching. Second application: 60-90 days after planting or as per manufacturer's recommendations.

## PART 3 PREPARATION

### 3.01 PREPARATION OF PLANTING SOIL MIX

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

## LANDSCAPE WORK

- B. Planting Soil Mix shall be: 1 part bark/sand mix with 3 parts existing soil plus mycorrhiza inoculant as specified on Plan. If clay is present at project site, add gypsum to Planting Soil Mix per Landscape Architect's recommended rate.
- C. For pit and trench-type backfill, mix Planting Soil Mix prior to backfilling and stockpile at site.
- D. For planting beds, mix Planting Soil Mix either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

### 3.02 PREPARATION FOR TREES & SHRUBS

- A. Layout individual tree and shrubs locations and bed areas of massed planting. Stake locations and outline and secure Landscape Architect's approval before starting any planting work. Make minor adjustments as needed and as deemed necessary by the Landscape Architect.
- B. No plant material shall be planted until the Landscape Architect has approved the layout. Any plant material planted without said approval shall be subject to removal and replanting at the Contractor's expense as determined by the Landscape Architect.

### 3.03 PREPARATION OF PLANTING BEDS

- A. Preparation procedure for planting beds shall be as follows:
  - 1. Roto-till existing subgrade to a depth of 12". Remove any rubbish or extraneous matter. If clay is present, add gypsum per Landscape Architect's recommended rate.
  - 2. Add 6" of planting soil mix and roto-till into existing tilled soil until all is mixed.

### 3.04 PREPARATION FOR PLANTING LAWNS

- A. Prior to beginning the work, verify that the site grading and preparation have been properly completed where necessary for this work.
- B. Loosen subgrade of lawn areas to a minimum depth of 4". Remove sticks, roots, rubbish, stones over 1 1/2" in any dimension, and any other extraneous matter. Limit preparation to areas to be planted promptly after said preparation.
- C. Conduct soil tests. Add sufficient lime to obtain Ph of 6.8-7.0. Mix lime with dry soil prior to mixing in of fertilizer. Prevent lime from contacting roots of acid-loving plants.
- D. Add fertilizer, amendments, and mycorrhiza inoculant rates shown in Section 2.2 or per manufacturer's recommendations. Mix thoroughly into upper 2" of topsoil. Roll entire surface with a hand roller weighing not more than 100 pounds per foot of width. During rolling, fill with additional topsoil all depressions caused by settlement, re-grade the surface, and re-roll until a smooth and even finish to the required grade is obtained. Rake out all clods, roods, and stones over 1/2" or larger.

Do not install sod or seed without application of mycorrhiza inoculant.

- E. A second application of fertilizer shall be applied at a later time as directed by the Landscape Architect.
- F. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create muddy soil condition.
- G. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.
- H. Allow for sod thickness in all sod areas.

**PART 4 EXECUTION**

**4.01 EXCAVATION FOR TREES & SHRUBS**

- A. Excavate planting pits, beds, and trenches with vertical sides and bottom of pits with centers slightly raised to provide drainage. Loosen subsoil in the bottom of the pit. Scarify the sidewalls of pit to alleviate glazing.
- B. For trees, make planting pits a minimum of 24" wider than the container width and 6" deeper than container depth.
- C. For shrubs, make planting pits a minimum of 12" wider than container width and 6" deeper than container depth.
- D. After excavation, fill pits with water and allow percolation prior to planting.
- E. All planting pits for trees, shrubs, and groundcovers shall be to the dimensions specified above and shown on the Plans. All plant materials found to be in undersized planting pits shall be removed and the pits re-dug to correct sizes. Only after the Landscape Architect has approved said re-dug pits shall plants be replanted.

**4.02 PLANTING TREES & SHRUBS**

- A. All planting shall be performed by personnel familiar with accepted horticultural procedures of planting and shall be under the constant supervision of a qualified job captain.
- B. Planting procedure for trees & shrubs shall be as follows:
  - 1. Set container stock on a 6" layer of compacted planting soil mix, in the center of the pit or trench, plumb, and at the same elevation as adjacent finished landscape grade unless otherwise noted.
  - 2. When set, place additional soil mix around base and sides of ball. Work each layer to settle soil mix and to eliminate voids and air pockets. Add fertilizer tablets during this stage.
  - 3. When pit is 2/3 full with soil mix, water thoroughly before placing remainder of soil mix. Repeat watering until soil mix is saturated. Water again after placing final layer of soil mix.

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4. Build up a 4" high saucer of soil mix around individual trees or shrubs to allow for mulching.
  5. If planting massed shrubs, follow procedure shown on the Plans and specified in Section 3.3.
  6. Apply specified pre-emergent herbicide over entire area to be mulched and/or over entire bed area of massed shrubs and groundcovers.
  7. Mulch pits, trenches, and massed bed areas. Provide not less than 4" of thickness of mulch and work lightly into top of soil mix.
- C. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by the Landscape Architect, do not cut tree leaders and remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character and accomplish their use in the landscape design.

Remove from the site and replace any excessively pruned or malformed stock resulting from improper pruning

- D. Guy and stake trees immediately after planting as specified and shown on the Plans.

### 4.03 PLANTING GROUNDCOVERS

- A. Space groundcover plants on centers as specified in the Plant Schedule.
- B. Dig holes at least twice the size of the container and backfill with planting soil mix. Work soil around roots to eliminate air pockets and add fertilizer tablets. Leave a slight saucer indentation around each plant to hold water.
- C. Water thoroughly after planting, taking care not to cover the crowns of plants with wet soil.
- D. Apply specified pre-emergent herbicide over entire bed area.
- E. Mulch entire bed area between groundcover plants to a depth of not less than 4".

### 4.04 SODDING NEW LAWNS

- A. Lay sod within 24 hours from time of cutting. Do not plant dormant sod. Do not lay sod on frozen ground.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod pieces and do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod. Remove excess to avoid smothering of adjacent grass.
- C. Roll sod with a hand roller a minimum of two (2) times in directions at right angles to each other.

## LANDSCAPE WORK

- D. On slopes 3:1 or greater, anchor sod with 6" metal sod staples. Drive staples flush with soil line of sod.
- E. Water sod thoroughly with a fine spray immediately after planting.

### 4.05 SEEDING NEW LAWNS

- A. Do not use wet or moldy seed or seed otherwise damaged in transit or storage.
- B. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5 MPH. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
- C. Sow not less than the quantity of seed specified on the Plant Schedule.
- D. Rake seed lightly into top 1/8" of soil, roll lightly, and water with a fine spray.
- E. Protect entire seeded slopes against erosion with erosion netting, hay, or other methods acceptable to the Landscape Architect.
- F. If lawn areas are seeded October 1 thru December 31, add Annual Rye seed to grass seed at the rate of 2 lbs. per 1,000 SF (80 lbs. per acre).

### 4.06 TREATING EXISTING LAWNS

- A. All existing lawns to remain (not damaged by construction and/or landscape operations) shall have fertilizer and lime treatment as specified.
- B. Fertilizer: Balanced granular fertilizer (13-13-13), at the rate of 1 lb. of actual nitrogen per 1,000 SF (40 lbs. actual nitrogen per acre)
- C. Lime: 40 lbs. per 1,000 SF (1,800 lbs. per acre).
- D. Any bare spots in existing lawn areas shall be over seeded with Common Bermuda seed at the rate of 2 lbs. per 1,000 SF (80 lbs. per acre).
  - 1. If lawn areas are over seeded October 1 thru December 31, add Annual Rye seed to grass seed at the rate of 2 lbs. per 1,000 SF (80 lbs. per acre).
  - 2. Protect entire seeded slopes against erosion with erosion netting, hay, or other methods acceptable to the Landscape Architect.

### 4.07 RECONDITIONING EXISTING DAMAGED LAWNS

- A. Recondition all existing lawn areas damaged by Landscape Contractor's operations, including storage of materials & equipment, movement of vehicles, and minor re-grading. Said reconditioning shall be at the expense of the Landscape Contractor.
- B. Provide fertilizer, sod, and soil amendments as specified for new lawns and as required to provide a satisfactory reconditioned lawn. Provide new topsoil as required to fill low spots and meet new finish grades.

## LANDSCAPE WORK

- C. Water newly planted areas and keep moist until new grass is established.

### 4.08 CLEANUP & PROTECTION

- A. During landscape work, keep pavements clean and work area in an orderly condition.
- B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed by the Landscape Architect.
- C. Any existing areas disturbed by the Landscape Contractor's work shall be restored to original condition at his/her expense.

## PART 5 IRRIGATION SYSTEM

### 5.01 IRRIGATION SYSTEM

- A. The Landscape Contractor shall be responsible for a irrigation system for all landscaped, sodded, and seeded areas of the project site. The system shall be warrantied for a period of one (1) year from the date of Final Acceptance.
- B. Furnish and install a complete underground sprinkler irrigation system to provide efficient and even irrigation (WITH MINIMUM OVERSPRAY ONTO SIGNS, PAVED OR NON-PLANTED AREAS AND NO OVERSPRAY ONTO BUILDINGS) of all planting areas shown on the Drawings and as specified in the Specifications, complete and ready for operation. The work included in this Specification (whether mentioned or not) shall consist of all labor, tools, materials, tests, permits and other related items necessary for the installation and operation of the irrigation system.
- B. The Landscape Contractor shall include in his bid all materials, labor, and equipment necessary for the installation of the system. The underground sprinkler irrigation system shall be constructed using the sprinkler heads, valves, piping, fittings, programmable controller, and wiring, as required for a fully operational automatic irrigation system.
- C. The layout and type of system shall be at the discretion of the Landscape Contractor and shall be in-ground with zone control as required to provide adequate pressure and coverage of new landscaped areas.
- D. As a part of the guarantee under this contract, the Contractor shall be responsible for the deactivating and draining of the system prior to the onset of the freezing season and for reactivating the system at the onset of the spring growing season; each task must be accomplished once during the one (1) year guarantee. In the event the system is completed in a season when the system will not be in use, the Contractor will winterize the system upon completion of testing (and approval by the Landscape Architect) and reactivate the system in the spring. The Contractor shall, upon completion of the winterizing phase, submit a letter to the Owner's Representative and the Landscape Architect certifying that the system was winterized and drained and indicate the date that such action was accomplished. The Contractor shall be liable for any damage resulting from failure to comply. The Contractor shall notify both the Owner's Representative and

the Landscape Architect twenty-four (24) hours prior to the work so that a Landscape Architect can be present during the winterizing and reactivating phases of work.

### 5.02 TESTS

- A. Where indicated on the Drawings and/or as specified in the Specifications, tests are to be witnessed by the Landscape Architect. The Contractor shall give advance notice of twenty-four (24) hours in writing to the Landscape Architect before proceeding with tests.
  - 1. Pressure Test: All system joints, connections, couplings, valves and all other junction points shall be left exposed until completion and acceptance of the pressure test. All leaks, however minor, shall be repaired and corrected. The Landscape Architect shall be present during the test. The total sprinkler irrigation system shall be pressure tested for acceptance.
  - 2. Performance Coverage Tests: Upon completion of the system installation and after the flushing and pressure tests are completed, the Contractor shall operate the system in the presence of the Landscape Architect. The automatic system shall be cycled to the satisfaction of the Landscape Architect. The Landscape Architect may request that up to five (5) percent of the total nozzles and five (5) percent of the heads may also be relocated at no extra cost to the Owner.

### 5.03 SLEEVING

- A. Sleeving beneath drives and streets shall be PVC Class 200 pipe with solvent welded joints.
- B. Sleeving diameter: equal to twice that of the pipe or wiring bundle.

### 5.04 PIPE AND FITTINGS

- A. Mainline Pipe and Fittings:
  - 1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.
  - 2. Use Class 200, SDR-21, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 200 in the case of small nominal diameters which are not manufactured in Class 200.
  - 3. Use solvent weld pipe for mainline pipe with a nominal diameter less than 3-inches or where a pipe connection occurs in a sleeve. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.

B. Lateral Pipe and Fittings:

1. For drip irrigation laterals downstream of zone control valves, use UV radiation resistant polyethylene pipe manufactured from Prime Union Carbide G-resin 7510 Natural 7 manufactured by Union Carbide or a Union Carbide Licensee with a minimum of 2% carbon black, and minimum nominal pipe ID dimension of 0.810" for 3/4 inch pipe.

Use PVC/compression line fittings compatible with the drip lateral pipe. Use tubing stakes to hold above-ground pipe in place.

C. Specialized Pipe and Fittings:

1. Copper pipe: Use Type "K" rigid conforming to ASTM Standard B88.
2. Use wrought copper or cast bronze fittings, soldered or threaded per the installation details. Use a 95% tin and 5% antimony solder.
3. Use a dielectric union wherever a copper-based metal (copper, brass, bronze) is joined to an iron-based metal (iron, galvanized steel, stainless steel).
4. Assemblies calling for pre-fabricated double swing joints shall utilize LASCO Unitized swing joints or approved equal. Swing joints shall be rated at 315 psi, and use O-ring and street elbow construction.
5. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 80 threaded fittings.
6. Joint sealant:
7. Use only Teflon-type tape pipe joint sealant on plastic threads. Use nonhardening, nontoxic pipe joint sealant formulated for use on water-carrying pipes on metal threaded connections.

5.05 MAINLINE COMPONENTS

- A. Main System Shutoff Valve: As per local practice and in compliance with local code.
- B. Winterization Assembly: As per local practice and in compliance with local code.
- C. Backflow Prevention Assembly: As presented in the installation details.
- D. Quick Coupling Valve Assembly: Double swing joint arrangement as presented in the installation details.
- E. Irrigation Meter: Provided and installed by OWNER

5.06 DRIP IRRIGATION COMPONENTS

- A. Remote Control Valve (RCV) Assembly for Drip Laterals: As presented in the installation details. Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Use standard Christy I.D. tags with hot-stamped black letters on a yellow background. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.



B. Drip Emitter Assembly:

1. Barb-mounted, pressure compensating emitter device as presented in the installation details. The device shall be Rain Bird XB-20.
2. Install emitter types and quantities on the following schedule:
  - a. *Ground cover plant:* 1 single outlet emitter each or 1 single outlet emitter per square foot of planting area, whichever is less.
  - b. *Shrub:* 2 single outlet emitters each.
  - c. *Tree:* 8 single outlet emitters each.
3. Use 1/4-inch diameter flexible plastic tubing to direct water from emitter outlet to emission point. Length of emitter outlet tubing shall not exceed five feet. Secure emitter outlet tubing with tubing stakes.

C. Flush Cap Assembly: Locate at the end of each drip irrigation lateral pipe. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.

5.07 CONTROL SYSTEM

A. Irrigation Controller Unit:

1. Toro DDC 53808 or approved equal. Unit shall be mounted on the ground level of the operations building on the exterior east side of the bathroom wall. Provide conduit for control wire and power supply in the concrete slab.

5.08. SPRAY HEADS

- A. Pop-up spray heads shall have a pressure regulating device set at the pressure for optimal performance as recommended by the nozzle manufacturer. The regulator shall be integrated in the base of the stem. A manufacturer installed check valve shall be included to reduce low head drainage.
- B. Heads shall seal in the operating position at 10 PSI or less, and the water used in the flush mode shall not exceed 0.05 gpm. Head shall have a ratcheting feature for adjusting the direction of spray.
1. Pop-up spray heads for turf areas shall have a minimum pop-up height of 6-inches.
  2. 12-inch pop-up height heads will be used in shrubs, ground cover, and flower beds, but drip irrigation shall be used when possible
- High efficiency stream or spray nozzles are required on all heads to improve the distribution uniformity and overall efficiency.

5.08 ROTARY HEADS

- A. Use an internal drive, closed case rotor with wiper seals and spring retraction. Pop-up stem surface diameter shall be less than 2 inches, and a minimum pop-up height of 4 inches. All heads shall have check valves built into the bottom of the body.
- B. Use high efficiency, multi-stream rotary nozzles for areas that range from 15 feet to 30 feet wide. Single stream rotors may be used in areas larger than 30 feet. Use nozzles for

single stream rotors that provide matched precipitation rates. Radius reduction for single stream rotary heads shall be avoided as much as possible and shall not exceed 25 percent of the maximum or as indicated in manufacturer's catalog.

**PART 6 MAINTENANCE**

**6.01 MAINTENANCE TIME**

- A. Begin maintenance immediately after planting. Maintain landscape for a minimum of sixty (60) days from date of Final Acceptance or as required to establish an acceptable growth of new landscape plants.
- B. Begin maintenance immediately after planting. Maintain all grassed areas for a minimum of sixty (60) days from date of Final Acceptance or as required to establish healthy stable turf, firmly knitted to the soil and free of any areas of erosion, washout damage, or bare spots. Re-grade, re-roll, and/or re-sod or re-seed as needed to establish a smooth, acceptable lawn.

**6.02 WATERING & FERTILIZING**

- A. Water those areas not covered by irrigation system as necessary to prevent wilting or browning and to promote growth.
- B. Fertilize as necessary to maintain healthy, vigorous turf. A minimum of two (2) applications shall be required:
  - 1. First Application - at time of planting
  - 2. Second Application - prior to the end of the maintenance period or as directed by the Landscape Architect.

**6.03 MOWING**

- A. Mowing: At no time shall the turf in sodded and seeded areas exceed 3" in height. No more than 1/3 of the total height of the leaf blade shall be removed at any one mowing.
- B. Mowing height for Bermuda grass shall be 1 1/2" (with a reel or rotary mower).

**6.04 INSECT & DISEASE CONTROL**

- A. Apply chemical controls as necessary to prevent attacks and infestations and as approved by the Landscape Architect.

**6.05 WEEDING**

- A. Weed all planting beds and mulched areas around trees and shrubs as necessary to prevent weed spread until Final Acceptance.

**PART 7 INSPECTION & ACCEPTANCE**

**7.01 FIRST INSPECTION**

- A. When landscape work is completed, the Landscape Architect will make an initial inspection to determine acceptability.

**7.02 FOLLOW-UP INSPECTION**

- A. Where inspected landscape work does not comply with requirements, replace rejected work and continue maintenance until a follow-up inspection by the Landscape Architect is found to be acceptable. Remove rejected plant material promptly from project site.

**END OF SECTION**

**SECTION 033000  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. SECTION INCLUDES:**

<u>Section</u>	<u>Title</u>
1.2	References
1.3	Work Included
1.4	Submittals
1.5	Quality Assurance
1.6	Delivery, Storage, and Handling
2.1	General
2.2	Concrete Materials
2.3	Forms
2.4	Reinforcement
2.5	Concrete Mix Design
3.1	Measuring Materials
3.2	Mixing and Transporting
3.3	Concrete Appearance
3.4	Placing and Compacting
3.5	Curing and Protection
3.6	Removal of Forms
3.7	Inspection and Field Testing
3.8	Concrete Finishing
3.9	Failure to Meet Requirements
3.10	Patching and Repairs
3.11	Concrete Schedule

**1.2 REFERENCES**

- A.** Drawings and general provisions of the Contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.
- B.** American Society for Testing and Materials (ASTM)
1. C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
  2. C33 - Standard Specification for Concrete Aggregates
  3. C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

## CAST-IN-PLACE CONCRETE

4. C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
5. C94 - Standard Specification for Ready-Mixed Concrete
6. C143 - Standard Test Method for Slump of Hydraulic Cement Concrete
7. C150 - Standard Specification for Portland Cement
8. C171 - Standard Specification for Sheet Materials for Curing Concrete
9. C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
10. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
11. C260 - Standard Specification for Air-Entraining Admixtures for Concrete
12. C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
13. C494 - Standard Specification for Chemical Admixtures for Concrete
14. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
15. C1017 - Standard Specification for Chemical Admixtures for use in Producing Flowing Concrete

### C. American Concrete Institute (ACI)

1. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
2. ACI 305R - Hot Weather Concreting
3. ACI 306.1 - Standard Specification for Cold Weather Concreting
4. ACI 318 - Building Code Requirements for Structural Concrete
5. ACI 350R - Environmental Engineering Concrete Structures

### D. Where reference is made to one of the above Standards, the revision in effect at the time of bid opening shall apply.

## 1.3 WORK INCLUDED

- A. The Contractor shall, under this item, furnish all materials, tools, labor, and equipment to place all cast-in-place concrete, including all reinforcing steel and formwork, in the structures shown on the Contract Drawings, and such other concrete as may be found necessary to fully complete the Work indicated under this Contract, or as directed by OWNER.

## 1.4 SUBMITTALS

- A. Submit for approval all working drawings and schedules of materials and methods proposed to be followed in the execution of the Work under this item.

**1. Mix Design**

- a. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type and manufacturer of cement. Provide either 1) or 2) below for each mix proposed.
  - 1) Standard deviation data for each proposed concrete mix based on statistical records.
  - 2) The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. Provide the cylinder strength for the average of the 28 day cylinder strength test results for each mix. Provide results of 7 and 14 day tests.

**2. Product Data**

- a. Sources of cement, pozzolan and aggregates.
- b. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
- c. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM Standards.
- d. Water-reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
- e. High-range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range and conformity to ASTM standards. Identify proposed locations of use.
- f. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.
- g. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate and conformity to ASTM Standards. Identify proposed locations of use.

**3. Samples**

- a. Fine and coarse aggregates if requested by the Engineer.

**4. Certificates**

- a. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.
- b. Certify admixtures are suitable for use in contact with potable water after 30 days of concrete curing.
- c. Certify curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

**5. Test and Evaluation Reports**

- a. Fine aggregates – sieve analysis, physical properties, and deleterious substance.
  - b. Coarse aggregates – sieve analysis, physical properties, and deleterious substances.
  - c. Cements – chemical analysis and physical properties for each type.
  - d. Pozzolans – chemical analysis and physical properties.
  - e. Proposed concrete mixes – compressive strength, slump and air content.
  - f. Shrinkage Test Results – In accordance with ASTM C157 as modified hereinafter.
6. Field Quality Control Submittals
- a. Field test reports.
  - b. Concrete Delivery/Batch Tickets:
    - 1) For each batch of concrete before unloading at Site.
    - 2) In accordance with ASTM C94/C94M, Section 14 including requirements 14.2.1 through 14.2.10.
    - 3) Indicate the amount of mixing water withheld, and maximum amount that may be permitted to be added at Project Site.
7. Special Procedure Submittals
- a. Detailed plan for cold weather curing and protection of concrete placed and cured in weather below 40 degrees F.
  - b. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F.
  - c. If Contractor chooses to use self-consolidating concrete: Detailed plan of modified procedures for handling, placing, and finishing.

## 1.5 QUALITY ASSURANCE

- A. Comply with ACI 318, the recommendations of ACI 350R and other stated requirements, codes and standards. The most stringent requirement of the codes, standards and this Section apply when conflicts exist.
- B. Use only one source of cement and aggregates on any one structure. Provide concrete of uniform color and appearance.
- C. A minimum of 14 days in advance of placing concrete, discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops and curing. Propose methods of hot and cold weather concreting as required. Discuss the properties and techniques of batching and placing plasticized concrete prior to the placement of any concrete containing a high-range water-reducing admixture (plasticizer). Include the plasticizer manufacturer in the discussions.

- D. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. Make all changes ordered at the Contractor's expense.
- E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, provide all materials, labor, and equipment, at the Contractor's expense, necessary to perform new acceptance tests as were originally required using the new materials prior to their incorporation in the work. If the tests are specified to be conducted by others, the costs of these tests shall be borne solely by the Contractor.
- F. Qualifications
  - 1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or an approved equivalent program.
  - 2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in the jurisdiction of the Work. Requirements may be waived if the individual is Contractor's Licensed Design Engineer.
  - 3. Installers: Unless otherwise permitted, at least one person on the finishing crew must be certified as an ACI Flatwork Finisher, or equivalent.
- G. Preconstruction Testing
  - 1. Have the following materials tested to verify conformity with this Specification Section and the stated ASTM Standards.
    - a. Fine aggregates for conformity with ASTM C33 – sieve analysis, physical properties, and deleterious substances.
    - b. Coarse aggregates for conformity with ASTM C33 – sieve analysis, physical properties, and deleterious substances.
    - c. Cements for conformity with ASTM C150 – chemical analysis and physical properties.
    - d. Pozzolans for conformity with ASTM C618 – chemical analysis and physical properties.
    - e. Proposed concrete mix designs – compressive strength, slump and air content.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
  - 1. Cement: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set.
  - 2. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3-ft in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.



3. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.
4. Admixtures: Store in closed containers to avoid contamination, evaporation or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.
5. Pozzolan: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination.
6. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
7. Liquid Curing Compounds: Store in closed containers.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired. Such reference is not intended to indicate a restrictive preference on the part of OWNER for that particular manufacturer or product, or to prohibit the use of equivalent products or equally qualified manufacturers.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

### 2.2 CONCRETE MATERIALS

#### A. Cementitious Materials

##### 1. Portland Cement

- a. In accordance with requirements of ASTM C150.
- b. Brand: Subject to approval of Engineer. Use one brand throughout the Work.
- c. Alkalies: Maximum 0.60 percent.
- d. Nonhydraulic above grade structures: Type I or Type II.
- e. Hydraulic and below grade structures and sewers: Type II

##### 2. Supplementary Cementitious Materials

- a. Fly Ash (Pozzolan): Class F or Class N fly ash in accordance with ASTM C618, except as modified herein:
  - 1) Produced from process that does not use hazardous or potentially hazardous materials.

- 2) ASTM C618, Table 1, Loss on Ignition: Maximum 3 percent.
- 3) ASTM C618, Table 2, Water Requirement: Maximum 100 percent of control.
- 4) ASTM C618, Table 3, Effectiveness in Controlling Alkali-Silica Reaction: Maximum 100 percent expansion of test mixture as a percentage of low-alkali cement control at 14 days.
- 5) ASTM C618, Table 3, Expansion of Test Mixture: Evaluate results using either Procedure A or Procedure B as follows:
  - a) Procedure A after 6-month sulfate exposure, maximum 0.10 percent.
  - b) Procedure B, expansion of test mixture as a percentage of sulfate resistance cement control, after at least 6-month exposure, maximum 100 percent.
- 6) Where fly ash is specified to be used with Type I cement, have fly ash meet one of the following requirements:
  - a) CaO: Maximum 15 percent.
  - b) Test cementitious materials as follows:
    - (1) In accordance with ASTM C1012.
    - (2) Furnish test data confirming fly ash in combination with cement used meets strength requirements, is compatible with air-entraining agents and other additives, provides increased sulfate resistance equivalent to or better than Type II cement.
    - (3) Conduct tests using proposed fly ash and cement samples together with control samples using Type II cement without fly ash.
  - b. Slag Cement: In accordance with ASTM C989, Grades 100 or 120.
3. Tricalcium Aluminate
  - a. Content of Cementitious Materials: Maximum 8 percent.
- B. Aggregates: Furnish from one source.
  1. Natural Aggregates
    - a. Free from deleterious coatings and substances and conforming to requirements of ASTM C33, except as modified herein.
    - b. Free from materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
  2. Nonpotentially Reactive: In accordance with ASTM C33, Appendix XI, Paragraph X1.1.
  3. Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.
  4. Fine Aggregates

- a. Clean, sharp, and natural sand.
  - b. ASTM C33.
  - c. Material Passing 200 Sieve: 4 percent maximum.
  - d. Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 20 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
5. Coarse Aggregates
- a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
  - b. Materials Passing 200 Sieve: 0.5 percent maximum.
  - c. Limit deleterious substances in accordance with ASTM C33, Table 3 for exposed concrete.
- C. Admixtures: Unless otherwise permitted, furnish from one manufacturer.
- 1. Characteristics
    - a. Compatible with other constituents in mix.
    - b. Free of chlorides and alkalis (except for those attributable to water).
    - c. Do not use admixtures known to be toxic after concrete has cured for 30 days.
    - d. Furnish type of admixtures as recommended by manufacturer for anticipated temperature ranges.
    - e. Proportion and mix in accordance with manufacturer's recommendations.
  - 2. Air-Entraining Admixture: ASTM C260
  - 3. Water-Reducing Admixture: ASTM C494/C494M, Type A or Type D.
  - 4. Retarding Admixture: ASTM C494/C494M, Type B.
  - 5. High Range Water Reducing Admixture (Superplasticizer): ASTM C494/C494M, Type F or G. Use only when approved by Engineer.
  - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II. Use only when approved by Engineer.
    - a. Use of viscosity modifier if intent is to achieve self-consolidating concrete.
  - 7. Do not use calcium chloride as an admixture.
- D. Water and Ice: Use potable water for mixing water for concrete and water used to make ice, unless alternative sources of water are permitted.
- 1. Water from alternative sources: Comply with requirements of ASTM C1602/C1602M and contain less than:
    - a. 1,000 ppm of chlorides.
    - b. 3,000 ppm sulfate as SO<sub>4</sub>.

- c. 600 ppm alkalis as ( $\text{Na}_2\text{O} + 0.658 \text{ K}_2\text{O}$ ).
- d. 50,000 ppm total solids by mass.

## 2.3 FORMS

- A. The Contractor shall furnish all labor and materials for all forms required for the construction of the Work.
- B. Either metal or wood forms may be used.
- C. All forms shall be true to the required shape, clean, of sufficient strength, and well braced so that they shall maintain their proper position during the placing and vibrating of the concrete.

## 2.4 REINFORCEMENT

- A. All steel reinforcement bars, wire, and dowel bars shall be in accordance with GDOT Standard Specifications for Construction of Road and Bridges, latest edition, Section 853.
- B. Steel reinforcement shall be designed, detailed, fabricated and placed in conformance with all applicable requirements of ACI 318, and the CRSI Manual of Standard Practice.
- C. No concrete shall be placed until all steel reinforcement to be covered has been inspected in place and approved by OWNER or the Engineer.

## 2.5 CONCRETE MIX DESIGN

- A. Use an independent testing laboratory acceptable to the Engineer for development of mix designs and testing.
- B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper workability, durability, strength, appearance and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.
- C. Base the design mix on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data is not available, be developed by a testing laboratory, acceptable to the Engineer, engaged by and at the expense of the Contractor. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318.

## CAST-IN-PLACE CONCRETE

- D. The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16 percent greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.
- E. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the above paragraphs.
- F. Entrained air, as measured by ASTM C231, as shown in Table 1.
1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.
- G. Slump of the concrete as measured by ASTM C143, as shown in Table 1. If a high-range water-reducer (plasticizer) is used, measure the slump before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.
- H. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

**TABLE 1**  
**CONCRETE MIX REQUIREMENTS**

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Cementitious Content (4)
B	2500	C150 Type II	C33	57	440 min.
A	3000	C150 Type II	C33	57	480 min.
AA	4000	C150 Type II	C33	57	560 min.
AAA	5000	C150 Type II	C33	56	600 min.

## CAST-IN-PLACE CONCRETE

Class	W/C Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range Inches
B	0.62 max	--	3.5 to 5	Yes	*	1-4
A	0.54 max	--	3.5 to 5	Yes	*	1-3
AA	0.44 max	25% max	3.5 to 5	Yes	*	3-5
AAA	0.40 max	--	3.5 to 5	Yes	*	3-5

### NOTES:

- Minimum compressive strength in psi at 28 days
- ASTM designation
- Size Number in ASTM C33
- Cementitious content in lbs/cu yd
- W/C is Water-Cementitious ratio by weight
- AE is percent air-entrainment
- WR is water-reducer admixture
- HRWR is high-range water-reducer admixture
- \*HRWR used at contractor's option

## PART 3 EXECUTION

### 3.1 MEASURING MATERIALS

- Compose concrete of portland cement, fine aggregate, coarse aggregate, water and admixtures as specified. Use a batch plant acceptable to the Engineer for concrete production. Batch all constituents, including admixtures, at the plant except a high-range water-reducer may also be added in the field.
- Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Have scales certified by the local Sealer of Weights and Measures within 1 year of use.
- Measure the amount of free water in fine aggregates within 0.3 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.
- Dispense admixtures either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.
  - Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.

2. Inject multiple admixtures separately during the batching sequence.

## 3.2 MIXING AND TRANSPORTING

- A. Provide ready-mixed concrete produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.
- B. Transport ready-mix concrete to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Engineer. Incorporate added water by additional mixing of at least 35 revolutions. Meter all added water with the amount of water added shown on each delivery ticket.
- D. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.
- E. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Use metal or metal-lined non-aluminum discharge chutes with slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- F. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.
- G. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.
- H. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Provide a printed record of the weight of cement and each aggregate as batched individually on each ticket. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.
- I. Temperature and Mixing Time Control
  1. In cold weather, do not allow the as-mixed temperature and concrete temperature at the time of placement in the forms to drop below 40 degrees F.
  2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.

3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.
4. Do not exceed the values shown in Table 2 for the maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms.

TABLE 2  
MAXIMUM TIME TO DISCHARGE OF CONCRETE

<u>Air or Concrete Temperature (whichever is greater)</u>	<u>Maximum Time</u>
80 to 90 Degrees F (27 to 30 Degrees C)	45 Minutes
70 to 79 Degrees F (21 to 26 Degrees C)	60 Minutes
40 to 69 Degrees F (5 to 20 degrees C)	90 Minutes

- a. If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

### 3.3 CONCRETE APPEARANCE

- A. Remix concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste. If this does not correct the condition, reject the concrete. If the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed, obtain changes in the concrete mix only by adjusting one or more of the following:
  1. The gradation of aggregate.
  2. The proportion of fine and coarse aggregate.
  3. The percentage of entrained air, within the allowable limits.
- B. Provide concrete for the work that results in a homogeneous structure which, when hardened, will have the required strength, durability and appearance. Provide mixtures and workmanship such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10-ft away, shall be pleasing in appearance, and at 20-ft shall show no visible defects.

### 3.4 PLACING AND COMPACTING

- A. Placing



## CAST-IN-PLACE CONCRETE

1. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, excess water, dirt and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can assure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.
2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.
4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.
5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.
6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.
7. Slabs
  - a. After suitable bulkheads, screeds and jointing materials have been positioned, place the concrete continuously between construction joints beginning at a bulkhead, edge form, or corner. Place each batch into the edge of the previously placed concrete to avoid stone pockets and segregation.
  - b. Avoid delays in casting. If there is a delay in casting, thoroughly spade and consolidate at the edge of that previously placed and the concrete placed after the delay to avoid cold joints. Then bring concrete to correct level and strike off with a straightedge. Use bullfloats or darbies to smooth the surface, leaving it free of humps or hollows.
  - c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.
8. Formed Concrete

- a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottom of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4-ft. Place concrete for walls in 12 to 24-inch lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7-ft and the maximum free fall of concrete not exceeding 15-ft.
  9. Perform underwater concreting in conformity with the recommendations of ACI 304R. The tremie system shall be used to place underwater concrete. Use tremie pipes in the range of 8 to 12-inch in diameter and space at not more than 16-ft on centers nor more than 8-ft from an end form. Where concrete is being placed around a pipe, provide at least one tremie pipe on each side of each pipe. Where the tremie system is not practical, direct pumped concrete for underwater placement may be used subject to approval of the system including details by the Engineer.
- B. Compacting
1. Consolidate concrete by vibration, puddling, spading, rodding or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings and into corners of forms. Continuously perform puddling, spading, etc, along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.
  2. Place and compact all concrete with mechanical vibrators. Obtain approval of the number, type and size of the units from the Engineer in advance of placing operations. Do not order concrete until sufficient approved vibrators (including standby units in working order) are on the job.
  3. A minimum frequency of 7000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30-in apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.
  4. Concrete Slabs: Consolidate concrete for slabs less than 8-in thick with vibrating screeds; slabs 8 to 12-in thick with internal vibrators and (optionally) with vibrating screeds. Always place vibrators into concrete vertically and do not lay horizontally or over.
  5. Walls and Columns: Use internal vibrators (rather than form vibrators) unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. Insert the vibrators vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.
  6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete. Do not use vibrators to move or transport concrete in the forms. Continue vibration until:

- a. Frequency returns to normal.
- b. Surface appears liquefied, flattened and glistening.
- c. Trapped air ceases to rise.
- d. Coarse aggregate has blended into surface, but has not disappeared.

### 3.5 CURING AND PROTECTION

A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Curing Methods

1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Use the following curing methods.
  - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
  - b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
  - c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Apply curing compound as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Comply with the manufacturer's application recommendations.
2. Specified applications of curing methods.
  - a. Slabs for Water Containment Structures: Water curing only.
  - b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing or liquid membrane curing.
  - c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
  - d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Water curing.
  - e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed prior to 7 days. Water cure exposed horizontal surfaces of formed walls or columns for 7 days or until next placement of concrete is made.

- f. Concrete Joints: Water cured or sheet material cured.
- C. Protect finished surfaces and slabs from the direct rays of the sun to prevent checking and crazing.
- D. Cold Weather Concreting:
  - 1. "Cold weather" is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. Calculate the average daily temperature as the average of the highest and the lowest temperature during the period from midnight to midnight.
  - 2. Conform cold weather concreting to ACI 306.1 and the additional requirements specified herein. Record temperatures at the concrete placement at 12 hour intervals (minimum).
  - 3. Discuss a cold weather work plan with the Engineer. Discuss the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete. Also discuss the procedures to be implemented upon abrupt changes in weather conditions or equipment failures. Do not begin cold weather concreting until the work plan is acceptable to the Engineer. Approval of the work Plan by the Engineer shall not relieve the Contractor of their sole responsibility for the quality of the concrete work produced.
  - 4. During periods of cold weather, protect concrete to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.
    - a. Degree-days are defined as the total number of 24 hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (eg: 5 days at an average 70 degrees F = 350 degree-days).
    - b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
  - 5. Salt, manure or other chemicals shall not be used for protection.
  - 6. Do not terminate the protection period for concrete being water cured during cold weather until at least 24 hours after water curing has been terminated.
- E. Hot Weather Concreting
  - 1. "Hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lbs/sqft/hr.
  - 2. Concrete placed during hot weather, shall be batched, delivered, placed, cured and protected in compliance with the recommendations of ACI 305R and the additional requirements specified herein.

## CAST-IN-PLACE CONCRETE

- a. Do not exceed 90 degrees F for the temperature of concrete being placed. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set or cold joints.
  - b. Take all necessary precautions to promptly deliver, to promptly place the concrete upon its arrival at the job and to provide vibration immediately after placement.
  - c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.
3. Provide the Engineer with a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Do not begin hot weather concreting until the work plan is acceptable to the Engineer. Approval of the work plan by the Engineer shall not relieve the Contractor of their sole responsibility for the quality of the concrete work produced.

### 3.6 REMOVAL OF FORMS

- A. Except as otherwise specifically authorized by the Engineer, do not remove forms before the concrete has attained a strength of at least 30 percent of its specified design strength, nor before reaching the following number of day-degrees of curing (whichever is the longer):

<u>TABLE 3</u> MINIMUM TIME TO FORM REMOVAL	
<u>Forms for</u>	<u>Degree Days</u>
Beams and slabs	500
Walls / Vertical surfaces	100

(See definition of degree-days in Paragraph 3.5.D above).

- B. Do not remove shores until the concrete has attained at least 70 percent of its specified design strength and has achieved sufficient strength to support safely its own weight and construction live loads.

### 3.7 INSPECTION AND FIELD TESTING

- A. The batching, mixing, transporting, placing and curing of concrete are subject to the inspection of the Engineer at all times. Advise the Engineer of readiness to proceed at least 24 hours prior to each concrete placement. The Engineer or OWNER will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing steel and the alignment, cleanliness and tightness of formwork. Do not place concrete without the inspection and acceptance of the Engineer or OWNER.

- B. Sets of field control cylinder specimens will be taken by the Engineer or OWNER Materials Testing Representative during the progress of the work, in compliance with ASTM C31. Take a minimum of one set of concrete test cylinders per day, one set for each 150 cubic yards of concrete, or one set for each 5,000 sq ft of surface area for slabs or walls of each class of concrete placed each day.
  - 1. A "set" of test cylinders consists of five cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The other two may be used for special tests at 3 days or to verify strength after 56 days if 28-day test results are low.
  - 2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7-day strengths (where proper relation between seven and 28-day strengths have been established by tests), change proportions, water content, or temperature conditions to achieve the required strengths.
- C. Cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations, and furnish material and labor required for the purpose of taking concrete cylinder samples. Provide an appropriate number of curing boxes acceptable to the Engineer.
- D. Slump tests will be made in the field immediately prior to placing the concrete. Make such tests in accordance with ASTM C143. Reject concrete if the slump is greater than the specified range.
- E. Air Content: Test for air content shall be made on a fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173. If lightweight aggregates or aggregates with high absorptions are used, the latter test method shall be used.
- F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.
- G. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. Perform coring and collect core samples at the locations indicated by the Engineer and repair all core holes. The testing of the cores will be at the expense of OWNER. OWNER will pay for collection and repair of cores if the test results meet the required specifications.

### 3.8 CONCRETE FINISHING

- A. Walls
  - 1. Type W-1 (Ordinary Wall Finish)
    - a. Patch tie holes.

- b. Surface tolerance Class C as specified in ACI 117.
  - c. Knock off projections larger than ½-inch.
  - d. Patch defective areas.
2. Type W-2 (Smooth Wall Finish)
- a. Patch tie holes.
  - b. Surface tolerance Class B as specified in ACI 117.
  - c. Grind off projections larger than ¼-inch.
  - d. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.
3. Type W-3 (Smooth Rubbed Wall Finish)
- a. Surface tolerance Class A as specified in ACI 117.
  - b. Remove projections larger than 1/8-inch.
  - c. Only water curing will be permitted on walls being rubbed.
  - d. Perform rubbing while green concrete can be physically worked and smoothed without adding other materials, if structurally possible, the day following placement. Finish no later than 3 days after placement has been completed.
  - e. Remove forms at such a rate that finishing, form tie filling, removal of projections, and patching can be completed on same day forms are removed while curing wall.
  - f. After pointings have set sufficiently to permit working on surface, thoroughly saturate entire surface with water for period of 3 hours and rub until uniform surface is obtained.
  - g. Rub either by hand with carborundum stone of medium-coarse grade or abrasive of equal quality, or mechanically operated carborundum stone.
  - h. Obtain Engineer approval of mechanically operated carborundum stones before concrete finishing.
  - i. Do not use cement grout, other than cement paste drawn from the concrete itself by rubbing process.
  - j. Finishing past formed by rubbing by either brushing or floating as follows:
    - 1) Brushing:
      - a) Carefully strike with clean brush.
      - b) Brush in long direction of surface being finished.
    - 2) Floating:
      - a) Spread uniformly over surface and allow to reset.
      - b) Finish by floating with canvas, carpet face, or cork float, or rub down with dry burlap.

- k. Continue water curing of wall during finishing operation in areas not being rubbed.
- l. Move water curing onto rubbed areas as soon as water will not erode rubbed surface.

B. Slabs

1. General

- a. Finish slab concrete per the requirements of ACI 302.1R.
- b. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
- c. Do not use “jitterbugs” or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer or mortar, which will be weak and cause cracks or delamination, to accumulate.
- d. Do not dust surface with dry materials.
- e. Use evaporation retardant.
- f. Round off edges of slabs with steel edging tool, except where cove finish is shown. Use a steel edging tool with a 1/4-inch radius for slabs subject to wheeled traffic.

2. Type S-1 (Steel Troweled Finish)

- a. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation. Use evaporation retardant.
- b. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
- c. Use sufficient pressure on wood floats to bring moisture to surface.
- d. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
- e. Burnish surface with an additional troweling. Final troweling shall produce ringing sound from trowel.
- f. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
- g. Power Finishing:
  - 1) Approved power machine may be used in lieu of hand finishing in accordance with directions of machine manufacturer.
  - 2) Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.
  - 3) Do first steel troweling for slab S-1 finish by hand.

3. Type S-2 (Wood Float Finish)



- a. Finish slab to receive fill and mortar setting bed by screeding with straightedges to bring surface to required finish plane.
  - b. Wood float finish to compact and seal surface.
  - c. Remove laitance and leave surface clean.
  - d. Coordinate with other finish procedures.
4. Type S-3 (Underside Elevated Slab Finish)
  - a. When forming is removed, grind off projections on underside of slab and patch defective areas.
5. Type S-4 (Broomed Finish)
  - a. Finish as specified for Type S-1 floor finish, except omit final troweling and finish surface by drawing fine-hair broom lightly across surface.
  - b. Broom in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope, except for round roof slab.
6. Type S-5 (Sidewalk Finish)
  - a. Slope sidewalk down  $\frac{1}{4}$ -inch per foot away from structures, unless otherwise shown.
  - b. Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
  - c. Broom surface at right angles to direction of traffic or as shown.
  - d. Lay out sidewalk surface in blocks, as shown or as directed by Engineer, with grooving tool.
- C. Beams and Columns
  1. General: Inject cracks with crack repair epoxy. Patch and repair defective areas.
  2. Type B-1: Match wall Type W-1.
  3. Type B-2: Match wall Type W-2.
  4. Type B-3:
    - a. Repair rock pockets.
    - b. Fill air voids.
    - c. Match wall Type W-3.
  5. Type C-1: Match wall Type W-1.
  6. Type C-2: match wall Type W-2.
  7. Type C-3:
    - a. Repair rock pockets.
    - b. Fill air voids.
    - c. Match wall Type W-3.

## 3.9 FAILURE TO MEET REQUIREMENTS

- A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer has the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer has the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer has the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements confer with the Engineer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.
- B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.
- C. Should the strength of test cylinders fall below 60 percent of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.
- D. Any concrete found to be defective from any cause whatsoever, at any time prior to Final Acceptance of the Work, shall be removed and replaced, or repaired at the expense of the Contractor.

## 3.10 PATCHING AND REPAIRS

- A. It is the intent of this Section to require quality work, including adequate forming, proper mixture and placement of concrete and curing, so completed surfaces will require no patching.
- B. Repair defective concrete and honeycombed areas using methods complying with industry standards which meet the approval of the Engineer.
- C. As soon as the forms have been stripped and the concrete surfaces exposed, remove fins and other projections; fill recesses left by the removal of form ties; and repair surface defects which do not impair structural strength. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.

## CAST-IN-PLACE CONCRETE

- D. Immediately after removal of forms remove plugs and break off metal ties. Promptly fill holes upon stripping as follows: Moisten the hole with water, followed by a 1/16-in brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.
- E. When patching exposed surfaces use the same source of cement and sand as used in the parent concrete. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

### 3.11 CONCRETE SCHEDULE

- A. The following (Table 4) are the general applications for the various concrete classes and design strengths:

TABLE 4  
CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	3,000	Thrust blocking, slabs, curbs, and pavements
AA	4,000	Walls, beam systems, columns, and all other structural concrete
AAA	5,000	Pre-stressed concrete

**END OF SECTION 03300**

## SECTION 036000 GROUTING

### PART 1 GENERAL

#### 1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install grout complete as shown on the Drawings and as specified herein.

#### 1.02 RELATED WORK

#### 1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 0130, shop drawings and product data showing materials of construction and details of installation for:
  - 1. Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.
  - 2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.
  - 3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.
  - 4. Concrete grout. The submittal shall include data as required for concrete and for fiber reinforcement as delineated in these Specifications. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.
- B. Laboratory Test Reports
  - 1. Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.
- C. Certifications
  - 1. Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.
- D. Qualifications
  - 1. Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which they will supply.

**1.04 REFERENCE STANDARDS**

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacing and Polymer Concretes
  - 2. ASTM C579 - Standard Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts and Monolithic Surfacing and Polymer Concretes
  - 3. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
  - 4. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- B. U.S. Army Corps of Engineers Standard (CRD)
  - 1. CRD C-621 - Corps of Engineers Specification for Nonshrink Grout
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

**1.05 QUALITY ASSURANCE**

- A. Qualifications
  - 1. Grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.
- B. Pre-installation Conference
  - 1. Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days prior to its scheduled date.
- C. Services of Manufacturer's Representative
  - 1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required, to correct installation problems.
- D. Field Testing
  - 1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc, for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
  - 2. The field testing of Concrete Grout shall be as specified for concrete in Section 03300.

**1.06 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.
- B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.
- C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.
- D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.
- E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

**1.07 DEFINITIONS**

- A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.
- B. Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

**2.02 MATERIALS**

- A. Nonshrink Cementitious Grout
  - 1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.
    - a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; MasterFlow 100 by Master Builders Solutions;; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp. or equal.
    - b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders Solutions; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by

Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp. or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy-based grout shall be a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of  $30 \times 10^{-6}$  when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Solutions; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co. or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 033000 except as specified herein. It shall be proportioned with cement, pozzolan, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 2900 psi at 28 days, or 2500 psi nominal strength. Coarse aggregate size shall be 3/8-in maximum. Slump should not exceed 5-in and should be as low as practical yet still retain sufficient workability.
2. Synthetic reinforcing fibers shall be added to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.
- B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may effect the bond or performance of the grout.

- C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.
  - 1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.
- D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.
- E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.
- F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.
- G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.
  - 1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.
- H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.
- I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

### 3.02 INSTALLATION - GENERAL

- A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.
- B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.
- C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to



minimize differential heating or cooling of baseplates and grout during the curing period.

- D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.
- E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.
- F. Reflect all existing underlying expansion, control and construction joints through the grout.

### 3.03 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

- A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.
- B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.
- C. Placements greater than 3-in in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.
- D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.
- F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.
- G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION - NONSHRINK EPOXY GROUTS

- A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.
- B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.
- C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.
- E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.
- F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION - CONCRETE GROUT

- A. Screed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.
- B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Wash the slab using a strong jet of water. Flushing of debris into drain lines will not be permitted.
- C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout. Saturation may be maintained by ponding, by the use of soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just prior to placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-in thick cement paste. (A bonding grout composed of 1 part portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.)
- D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.
- E. Provide grout control joints as indicated on the Drawings.

- F. Finish and cure the concrete grout as specified for cast-in-place concrete.

**3.06 SCHEDULE**

- A. The following list indicates where the particular types of grout are to be used:
  - 1. General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
  - 2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
  - 3. Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
  - 4. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.

**END OF SECTION 03600**

## SECTION 04 20 00

### UNIT MASONRY

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Concrete block.
- B. Common Brick.
- C. Reinforcement and Anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

##### 1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 04 05 11 - Masonry Mortaring and Grouting.
- C. Section 07 41 13 - Manufactured Sheet Metal Roofing: Cap flashings over masonry work.
- D. Section 07 90 05 - Joint Sealers: Backing rod and sealant at control and expansion joints.

##### 1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.
- B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2008.
- C. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2013.
- F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- H. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
- I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
- J. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

K. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

#### 1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.
- C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

#### 1.05 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.
  - 1. Maintain one copy of each document on project site.

#### 1.06 MOCK-UP

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories and structural backup in mock-up.
- B. Locate where directed.
- C. Mock-up may not remain as part of the Work.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

### **PART 2 PRODUCTS**

#### 2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
  - 2. Special Shapes: Provide non-standard blocks configured for corners and lintels.
  - 3. Load-Bearing Units: ASTM C90, lightweight.
    - a. Type I - Moisture-controlled; lightweight.
      - 1) Integral Color Split face with vertical splits, at locations indicated on the drawings. Color to be selected by Architect.

#### 2.02 BRICK UNITS

- A. See Section 01 21 00 - Allowances.
- B. Facing Brick: ASTM C216, Type FBS, Grade SW.
  - 1. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

- C. Building (Common) Brick: ASTM C62, Grade SW; solid units.

## 2.03 MORTAR AND GROUT MATERIALS

- A. Mortar and grout: As specified in Section 04 05 11.

## 2.04 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: Deformed billet bar type, specified in Section 03 20 00; size as indicated on drawings; uncoated finish.
- B. Single Wythe Joint Reinforcement: Ladder type; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/A 153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
  - 1. Manufacturers:
    - a. Dur-O-Wal.
    - b. Hohmann & Barnard, Inc.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Type 1 - Two-Piece Wall Ties (for attachment to metal studs and sheathing): Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.
  - 1. Manufacturers:
    - a. Dur-O-Wal: [www.dur-o-wal.com](http://www.dur-o-wal.com).
    - b. Heckmann Building Products, Inc: [www.heckmannbuildingprods.com](http://www.heckmannbuildingprods.com).
    - c. Hohmann & Barnard, Inc: [www.h-b.com](http://www.h-b.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Type 2 - Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
  - 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
  - 2. Wire ties: triangular shape, 0.1875 inch thick.
  - 3. Vertical adjustment: Not less than 2 inches.

## 2.05 FLASHINGS

- A. Copper/Kraft Paper Flashings: 5 oz/sq ft sheet copper bonded to fiber reinforced asphalt treated Kraft paper. Provide Copperseal manufactured by Wasco.
- B. Lap Sealant: Butyl type as specified in Section 07 90 05.

## 2.06 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
  - 1. Manufacturers:
    - a. Dur-O-Wal: [www.dur-o-wal.com](http://www.dur-o-wal.com).

- b. Heckmann Building Products, Inc.
  - c. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
  - 1. Mortar Diverter: Panels designed for installation at flashing locations.
    - a. Manufacturers:
      - 1) Mortar Net USA, Ltd; Mortar Net with Insect Barrier: [www.mortarnet.com/#sle](http://www.mortarnet.com/#sle).
      - 2) Substitutions: See Section 01 60 00 - Product Requirements.
- C. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- D. Weeps: Molded PVC grilles, insect resistant.
- E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## 2.07 LINTELS

- A. Structural steel as shown on Drawings.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### 3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### 3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

### 3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

- C. Brick Units:
  - 1. Bond: Running.
  - 2. Coursing: Three units and three mortar joints to equal 8 inches.
  - 3. Mortar Joints: Concave.

### 3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, or bitumen dampproofing is applied.

### 3.06 WEEPS/CAVITY VENTS

- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing.

### 3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

### 3.08 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Reinforce joint corners and intersections with strap anchors 16 inches on center.



### 3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- F. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- G. Reinforce joint corners and intersections with strap anchors 16 inches on center.

### 3.10 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of openings.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches horizontally and 16 inches vertically.
- F. Reinforce joint corners and intersections with strap anchors 16 inches on center.

### 3.11 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
  - 1. Extend flashings full width at such interruptions and at least 8 inches into adjacent masonry or turn up at least 8 inches to form watertight pan at non-masonry construction.
  - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
  - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.
- C. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

### 3.12 LINTELS

- A. Refer to Structural Drawings.

### 3.13 GROUTED COMPONENTS

- A. Lap splices minimum 48 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

### 3.14 CONTROL JOINTS

- A. Do not continue horizontal joint reinforcement through control joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
- D. Size control joint in accordance with Section 07 90 05 for sealant performance.
- E. Form expansion joint as detailed.

### 3.15 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames, fabricated metal frames, and block-outs for openings and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### 3.16 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

#### 3.17 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

#### 3.18 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.

#### 3.19 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.
- E. Remove all efflorescence that occurs during the 1 year guarantee period.

#### 3.20 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

**SECTION 042230**  
**REINFORCED UNIT MASONRY**

**PART 1 GENERAL**

**1.01 REFERENCE**

- A. The following is a list of standards which may be referenced in this Section:
1. American Concrete Institute (ACI): 530.1/ASCE 6/TMS 602, Building Code Requirements for Masonry Structures and Specifications for Masonry Structures and Related Commentaries.
  2. ASTM International (ASTM):
  3. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  4. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    - a. C33, Standard Specification for Concrete Aggregates.
    - b. C90, Standard Specification for Loadbearing Concrete Masonry Units.
    - c. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
    - d. C144, Standard Specification for Aggregate for Masonry Mortar.
    - e. C150, Standard Specification for Portland Cement.
    - f. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
    - g. C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
    - h. C270, Standard Specification for Mortar for Unit Masonry.
    - i. C404, Standard Specification for Aggregates for Masonry Grout.
    - j. C476, Standard Specification for Grout for Masonry.
    - k. C652, Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale).
    - l. C744, Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
    - m. C1314, Standard Test Method for Compressive Strength of Masonry Prisms.
    - n. E514, Standard Test Method for Water Penetration and Leakage through Masonry.
  5. Brick Institute of America (BIA).
  6. International Code Council (ICC):
    - a. International Building Code (IBC), Chapter 21.
    - b. ICC Evaluation Service (ICC-ES) Reports.
  7. National Concrete Masonry Association (NCMA).

**1.02 SUBMITTALS**

A. Action Submittals:

1. Shop Drawings:
  - a. Information illustrating horizontal joint reinforcement and preformed control joint materials proposed.
  - b. Grout proportions.
  - c. Mortar proportions.
  - d. Letter of certification stating grout aggregates and mortar sand meet requirements of ASTM C33, including nonreactivity.

B. Informational Submittals:

1. Method of placing grout.
2. Certified field test results within 5 days of performing specified tests.
3. Letter from water repellent admixture manufacturer verifying masonry unit manufacturer's proper use of product.
4. Certified test reports showing compliance with specified performance tests.
5. Method and materials for removal of efflorescence.

1.03 QUALITY ASSURANCE

- A. Masonry Unit Manufacturer: Qualified by manufacturer of water repellent admixture to use product.
- B. Efflorescence: Protect masonry construction to prevent efflorescence. Provide measures to prevent moisture from entering incomplete walls. Remove all efflorescence prior to applying water repellents.
- C. Comply with the requirements and criteria of the National Concrete Masonry Association (NCMA), Brick Institute of America (BIA), ASTM C90, ASTM C216, and ACI 530.1 for masonry finish and appearance, dimension tolerances, tolerances of construction, joint tolerances, and wall plumb tolerances.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Keep lime and other ingredients dry.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Temperature: Do not lay masonry when ambient temperature is below 32 degrees F on a rising temperature, or below 40 degrees F on a falling temperature, or when there is a probability of such conditions occurring within 48 hours, unless written approval of procedures for protection from freezing is obtained from Engineer.
- B. Moisture Protection: Protect masonry construction from loss of moisture during curing period of 7 days when ambient air temperature is 90 degrees F or greater and when relative humidity is less than 50 percent.

**PART 2 PRODUCTS**

**2.01 COMPRESSIVE STRENGTH OF MASONRY**

- A. Minimum 28 Day Compressive Field Strength ( $f'm$ ) of Completed Assemblage: 1,900 psi.

**2.02 MASONRY UNITS**

A. General:

1. Furnish or cut special shapes for corners, jambs, lintels, and other areas shown or required.
2. Special units shall match color and texture of standard units
3. Where units are placed so end of unit is exposed, such as at a corner or intersection, exposed end of that block shall have surface to match color and texture of sides of other units.
4. Furnish sound, dry, clean units free of cracks, prior to placing in structure.
5. Vertical Cells to be Grouted: Capable of alignment sufficient to maintain clear, unobstructed continuous vertical cell dimensions in accordance with ACI 530.1, Table 7.
6. Masonry unit size and shape shall allow for all placement patterns to prevent materials, such as grout or poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

B. Concrete Masonry Units (CMU):

1. ASTM C90: Normal weight.
2. Water Repellent Admixture:
  - a. Structural concrete masonry units in weather exposed exterior wall shall be manufactured with integral liquid polymeric admixture to provide resistance to water penetration.
  - b. Manufacturer and Product: W.R. Grace & Co.; Dry-Block Block Admixture.
3. Nominal Size: 16 inches long by 8 inches high by thickness shown on Drawings.
4. Compressive Strength: 1,900 psi minimum, in accordance with ASTM C90, Table 2.
5. Color of Units: Natural.
6. Surface Texture on Exposed Surfaces: Smooth.
7. Surface Texture: Smooth on interior, concealed exterior, and surface 1 foot below finished grade.

**2.03 MORTAR AND GROUT MATERIALS**

- A. Cement: ASTM C150, Type II, portland cement.
- B. Lime: ASTM C207, Type S hydrated.
- C. Aggregates:

## REINFORCED UNIT MASONRY

1. Mortar: ASTM C144, sand.
2. Grout: ASTM C404.
- D. Water: Fresh, clean, and potable.
- E. Mortar Plasticizer Admixture:
  1. May be used instead of lime.
  2. Manufacturer and Product: American Colloid Co.; Easy/Spred Plasticizer.
- F. Water Repellent Admixture: Mortar for structural and textured concrete masonry units in weather exposed exterior walls shall include an integral liquid polymeric admixture to provide resistance to water penetration.
- G. Grout Admixture:
  1. Controlled expansion additive.
  2. Manufacturer and Product: Sika Corporation, Lyndhurst, NJ; Grout Aid.

### 2.04 REINFORCEMENT

- A. Horizontal Joint Reinforcement:
  1. Two parallel, ASTM A82, No. 9 wires, galvanized in accordance with ASTM A153/A153M, weld connected to No. 9 perpendicular cross wire at 16 inches, maximum, on center.
  2. Reinforcement: Clean and free from loose rust, scale, and coatings that reduce bond.
  3. Furnish special manufactured corner and wall intersection pieces.
  4. Manufacturer: Dur O Wal, Inc., Aurora, IL.

### 2.05 PREFORMED CONTROL JOINTS

- A. Solid Rubber Cross-Shape Extrusions as Manufactured by:
  1. Dur O Wal, Inc., Aurora, IL; Regular Rapid Control Joint.
  2. Sonneborn-Contech Co., Oakland, CA; Sonneborn Control Joint.
  3. Hohmann and Barnard, Inc; #RS Standard.

### 2.06 MORTAR MIXES

- A. Minimum average mortar 28-day compressive strength 1,900 psi.
- B. Proportions:
  1. In accordance with ASTM C270, Type S.
  2. Mortar plasticizer admixture may be substituted for lime. Batch in accordance with ICC, Current Reports for specified mortar type and strength.
- C. Mixing:
  1. Machine mix in approved mixers.

## REINFORCED UNIT MASONRY

2. Keep mixer drums clean and free of debris and dried mortar.
3. Mix by placing 1/2 water and 1/2 aggregate in operating mixer.
4. Add cement.
5. Add remaining aggregate and water and mix for at least 2 minutes.
6. Add lime and continue mixing as long as needed to secure a uniform mass, but no less than 3 minutes after addition of lime.
7. Time addition of admixture in accordance with manufacturer's instructions. Procedure used for adding it to mix shall provide good dispersion.
8. Follow manufacturer's instructions for mortar plasticizer admixture.
9. Follow manufacturer's instructions for water repellent admixture.
10. Review compatibility with other mortar admixture.

### 2.07 GROUT MIXES

- A. Proportions: Conform to ASTM C476 for coarse grout and as follows:
  1. Compressive Strength: Minimum 2,000 psi at 28 days.
  2. For Pouring:
    - a. Fluid consistency (suitable for pouring without segregation) meeting requirements of ASTM C476
    - b. Conform to IBC Table 2103.10, except as noted.
  3. For Pumping: Fluid consistency with minimum seven sacks of cement in each cubic yard.
- B. Mixing:
  1. Onsite: Follow procedure specified in Article Mortar Production.
  2. Transit-Mixed Grout: Meet requirements of ASTM C476.
  3. Add approved grout expansion admixture in accordance with manufacturer's recommendations. Premix admixture with water and add resulting solution to grout mix and thoroughly mix. Do not exceed quantity of admixture recommended by manufacturer.

### 2.08 WATER REPELLENT MASONRY SEALER

- A. Characteristics:
  1. Water-based blend of silanes and siloxanes.
  2. VOC compliant.
  3. 12 percent solids/active content by weight, with density of 8.2 pounds per gallon.
- B. Manufacturer and Product: W. R. Grace & Co.; Infiniseal DB Sealer.

## PART 3 EXECUTION



3.01 PREPARATION

- A. Prepare surface contact area of foundation concrete for initial mortar placement by one of following methods:
  - 1. Sandblasting foundation and reinforcing dowels after concrete has fully cured to remove laitance and spillage and to expose sound aggregate.
  - 2. Water blasting foundation and reinforcing dowels after concrete has partially cured to remove laitance and spillage and to expose sound aggregate.
  - 3. Green cutting fresh concrete with high pressure water and hand tools to remove laitance and spillage from foundation and reinforcing dowels and to expose sound aggregate.
- B. Clean surfaces of loose material prior to initial mortar placement.
- C. Prevent surface damage to foundation concrete that will be exposed to view outside of contact area.

3.02 LAYING MASONRY UNITS

- A. General:
  - 1. Conform to building code applicable to this Project and as supplemented by these Specifications.
  - 2. Do not start laying masonry units unless foundation wall is plumb within 1/4 inch in 10 feet or not straight within 5/16 inch in 10 feet.
  - 3. Finish Tolerances (Measured on Interior Surfaces):
    - a. Maximum permissible variation from plumb of masonry wall or of line of joints in masonry wall: 1/16 inch per foot of height and 1/4 inch in total height of wall.
    - b. Maximum permissible variation from horizontal line along base of wall or for lines of horizontal joints: 1/16 inch per block and 1/4 inch per 50 feet of wall with proportionately greater tolerance for longer walls up to 1/2 inch in total length of wall.
  - 4. Place units with chipped edges or corners such that chipped area is not exposed to view.
- B. Wall Units:
  - 1. General:
    - a. If necessary to move a unit after once set in-place, remove from wall, clean, and set in fresh mortar.
    - b. Toothing of masonry units is not permitted.
  - 2. Running Bond:
    - a. Unless otherwise shown, layup walls in straight, level, and uniform courses using a running bond pattern.
    - b. Place units for continuous vertical cells and mortar joints to prevent materials, such as grout or poured insulation, from escaping from cell being filled to adjacent cells where material is not intended to be placed.

## REINFORCED UNIT MASONRY

3. Stack Bond: Layup walls in straight, uniform courses with vertical joints aligned and plumb
4. Corners: Lay standard masonry bond for overlapping units and grout solid.
5. Intersecting Walls: Bond with reinforcement, not with masonry bond.

C. Special Shapes:

1. Provide and place such special units as corner block, doorjamb block, lintel block fillers, and similar blocks as may be required.
2. Use required shapes and sizes to work to corners and openings, maintaining proper bond throughout wall.

### 3.03 BUILT-IN ITEMS

- A. Position door frames, windows, vents, louvers, and other items to be built in wall, and construct wall around them unless items can be installed after the masonry opening has been constructed.
- B. Install masonry anchors to secure items to wall.
- C. Fill spaces around items with mortar or grout.
- D. Do not place electrical, instrumentation, or water conduits in a cell containing reinforcement, unless approved in writing by Engineer. Pipes, sleeves, and conduits shall not be placed closer than three diameters, center-to-center, nor shall they impair strength of construction.

### 3.04 MORTAR JOINTS

A. General:

1. Straight, clean, with uniform thickness of 3/8 inch.
2. Horizontal and vertical mortar joints shall have full mortar coverage on face shells.
3. Vertical Head Joints:
  - a. Butter well on each unit for a width equal to face shell of unit, shove tightly so mortar bonds well to both units.
  - b. Solidly fill joints from face of block to at least depth of face shell.
4. As units are laid, remove excess mortar from grout space of cells to be filled.
5. Place mortar before initial setting of cement takes place. Do not retemper mortar that has started to set or is not used within one hour. Retempering of colored mortar is not allowed.
6. Remove mortar containing water repellent admixture from face of masonry, before it sets.

B. Exposed Joints:

1. Tool joints exposed to view after final construction, unless otherwise noted or shown.
2. Cut joints flush and as mortar takes its initial set tool to provide a concave joint.
3. Perform tooling when mortar is partially set but still sufficiently plastic to bond.
4. Perform tooling with tool that compacts mortar, pressing excess mortar out rather than dragging it out.
5. Rake out joints that are not tight at time of tooling, point, and then tool.
6. Rake and tool joints at split-face surfaces, interior and exterior.

C. Concealed Joints: Strike flush with no further treatment required.

### 3.05 CONTROL JOINTS

A. Preformed Control Joints:

1. Omit mortar from vertical joints.
2. Place rubber control joint material as wall is built.
3. After wall is grouted, cured, and cleaned, install backing rod and sealant.
4. Place and tool sealant to match depth of typical joint.

### 3.06 REINFORCING

A. Foundation Dowels

1. Size, number, and location of foundation dowels shall match vertical wall reinforcing, unless otherwise noted.
2. When foundation dowel does not line up as intended, with vertical core, do not slope more than 1 horizontal to 6 verticals to bring it into alignment.

B. Vertical Reinforcing:

1. Use deformed bars.
2. Hold in position near the ends of bars by wire ties to dowels or by reinforcing positioners.
3. Lap reinforcing bars as shown, where spliced and wire tie together.
4. Minimum Bar Clearance: One bar diameter from masonry and from additional parallel bars in same grout space.
5. Hold in position at maximum intervals of 160 bar diameters by reinforcing positioners.

C. Horizontal Reinforcing:

1. Use deformed bars.
  2. Lay on webs of bond beam units and place as wall is built.
  3. Lap reinforcing bars as shown, where spliced and wire tie together.
  4. Minimum Bar Clearance: One bar diameter from masonry and from additional parallel bars in same grout space.
  5. Terminate reinforcing bars 2 inches clear from control joints as shown.
- D. Horizontal Joint Reinforcement:
1. Use for stack bond.
  2. Provide in addition to typical wall reinforcing steel.
  3. Space maximum 16 inches apart, vertically.
  4. Lap ends 6 inches minimum.
  5. At control joints make reinforcement discontinuous.
  6. Use manufactured corner and other wall intersection pieces.

### 3.07 MORTAR PRODUCTION

- A. General:
1. Mix ingredients 3 to 5 minutes after all ingredients are introduced.
  2. Provide volumetric control by using batching box or similar measuring device. Do not use shovel to introduce materials directly into batch.
  3. Keep sand damp and loose.
  4. Use cool mix water.

### 3.08 GROUTING

- A. General:
1. Do not mix, convey, or place with equipment constructed of aluminum.
  2. Secure vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedment's in place; inspect and verify before placing grout.
  3. Grout beams over openings in one continuous operation.
  4. Maintain vertical alignment in cells to provide a clear, unobstructed, continuous vertical cell measuring not less than 2 inches by 3 inches.
  5. Place grout as soon as possible after mortar has set to reduce shrinkage cracking of vertical joints.
  6. Vertical Reinforcement:
    - a. First wire tie to foundation dowels, then build wall around it.
    - b. Provide reinforcing positioners or approved cross bracing to secure top of steel in-place.

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- c. Do not drop in vertical steel after block is laid, unless reinforcing positioners are provided in the course above previously grouted course.
- B. Grouting Requirements:
  - 1. Slump: 8 inches to 11 inches.
- C. Do not start grouting until wall has cured for 24 hours, minimum.
  - 1. Partial Grouting Requirements:
    - a. Walls Not Requiring Solid Grouting: Fill cells containing reinforcing steel, anchor bolts, and other embedded items as shown with grout.
    - b. Construct cells to be filled to confine grout within cell.
    - c. Cover tops of unfilled vertical cells under a bond beam with metal lath to confine grout fill to bond beam section.
  - 2. Form horizontal construction joints between pours by stopping grout pour 1 1/2 inches below a mortar joint, except at a bond beam; stop pour 1/2 inch below top of masonry unit.
  - 3. Partial Grouting: Limit pours to less than 6 feet in height.
  - 4. Fully embed horizontal steel with grout in an uninterrupted pour.
  - 5. Do not construct wall more than one course above top of grout pour prior to placing grout.
  - 6. Vibration:
    - a. Use internal "pencil" type, low energy vibrator to thoroughly consolidate grout and reduce amount of air voids. Do not use concrete vibrators.
    - b. After waiting sufficient time to permit grout to become plastic, but before it has taken any set, reconsolidate grout.
    - c. Waiting period will vary depending upon weather conditions and block absorption rates, but under "normal" weather conditions with average masonry units the waiting period should be between 30 to 60 minutes.
  - 7. Cleanouts:
    - a. Provide for grout pours over 5 feet in height.
    - b. Provide of sufficient size to permit cleaning of cell, positioning of reinforcing, and inspection at bottom of every vertical cell containing reinforcing.
    - c. Location: Concealed from view after final construction, unless otherwise approved by Engineer.
    - d. After wall has been inspected and approved and prior to grouting, cap cleanouts in a manner that will seal them from grout leakage and provide a flush finish.

### 3.09 WATER REPELLENT MASONRY SEALER

- A. Apply to all weather exposed exterior concrete masonry walls.
- B. Repoint loose, cracked, or disintegrating mortar at least 7 days prior to application. Ensure joint sealants and caulking are fully cured and wall surfaces are clean, dry, and

## REINFORCED UNIT MASONRY

free of chemical cleaners, efflorescence, dirt, oils, mortar smears, and other surface contaminants.

- C. Follow manufacturer's recommendations for weather conditions during application.
- D. Test a 5 foot by 5-foot wall area to assure proper coverage, desired water repellency properties, and desired surface appearance when sealer is fully dried.
- E. Apply with spray, brush, or roller following manufacturer's recommendations, at a coverage rate of 50 to 150 square feet per gallon, as determined by testing. Use two coat applications where recommended by manufacturer.

### 3.10 FIELD QUALITY CONTROL

- A. Special Inspection of masonry in accordance with IBC Section 1704.5.
- B. Masonry shall be tested in accordance with ASTM C1314, Method B, as modified by ACI 530.1/ASCE 6
- C. Masonry test prisms, when required, shall be constructed onsite with same materials and workmanship to be used for Project.
- D. Provide adequate facilities for safe storage and proper curing of masonry prisms, mortar samples, and grout samples, as applicable, onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
- E. Masonry Testing:
  - 1. Unit Strength Method:
    - a. Method and frequency for mortar, grout, and masonry unit sampling and testing in accordance with ACI 530.1/ASCE 6/TMS 602, Section 1.6.2.
    - b. Provide masonry units for test samples required.
- F. Corrective Action:
  - 1. If compressive strength tests made prior to construction of permanent structure fail to meet Specifications, adjustments shall be made to mix designs for mortar, or grout, or both, as needed to produce specified strength. Masonry units shall also be tested to verify compliance to requirements of ASTM C90, Type 1.
  - 2. If strength tests performed on materials representative of in-place construction fail to meet Specifications, prisms or cores shall be cut from constructed walls in sufficient locations to adequately determine strength in accordance with ACI 530.1/ASCE 6/TMS 602.

### 3.11 CLEANING

- A. Immediately after completion of grouting, clean masonry surfaces of excess mortar, grout spillage, scum, stains, dirt, and other foreign substances using clean water and fiber brushes.
- B. Clean walls not requiring painting or sealing so there are no visible stains.

### 3.12 PROTECTION OF INSTALLED WORK

- A. Do not allow grout and mortar stains to dry on face of exposed masonry.

## **REINFORCED UNIT MASONRY**

- B. Protect tops of walls at all times. Cover tops of walls with waterproof paper when rain or snow is imminent and when the Work is discontinued.
- C. Adequately brace walls until walls and roof are completed.
- D. Provide sufficient bracing to protect walls against damage from elements, including wind and snow.
- E. Protect masonry against freezing for minimum 72 hours after being laid.
- F. Protect masonry from damage until final acceptance of the Work. Damaged units will not be accepted.

**END OF SECTION**

**SECTION 05120  
STRUCTURAL STEEL**

**PART 1      GENERAL**

1.01    SECTION INCLUDES

- A.      Structural steel framing members, base plates and angles.

1.02    SUBMITTALS

- A.      Submittals shall be made in accordance with Section GENERAL REQUIREMENTS, and the requirements of this Section.
- B.      Shop Drawings: Indicate sizes, spacing, and locations of structural members, bolted connections, and welded connections.

1.03    QUALITY ASSURANCE

- A.      Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- B.      Perform design under direct supervision of a Professional Structural Engineer licensed in the State of Alabama.
- C.      Shop Drawings shall be stamped by a Professional Engineer registered in the State of Alabama.

**PART 2      PRODUCTS**

2.01    MATERIALS

- A.      Structural Steel Members: ASTM A36.
- B.      Bolts, Nuts, and Washers: ASTM A325.
- C.      Anchor Bolts: ASTM A307.
- D.      Welding Materials: AWS D1.1; type required for materials being welded.
- E.      Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- F.      Shop and Touch-up Primer: SSPC 15, Type 1, Red Oxide.



- G. Finish Paint shall be in accordance with **Section 09900 PAINTING**.

2.02 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.03 FINISH

- A. Perform preparation and coating of structural steel in accordance with **Section PAINTING**.
- B. Prepare structural component surfaces in accordance with SSPC SP 2.
- C. Shop prime and finish paint structural steel members. Do not prime surfaces that will be field welded. See **Section 09900 PAINTING** for finish coat. Finish coat color to be selected by owner.

**PART 3 EXECUTION**

3.01 EXECUTION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 ERECTION

- A. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.
- B. Field weld components indicated on drawings.
- C. Do not field cut or alter structural members without approval of Engineer.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Grout under base plates.

3.03 FIELD QUALITY CONTROL

- A. Field inspection of members, connections, and torquing.

**END OF SECTION**

**SECTION 05210  
STEEL JOISTS**

**PART 1      GENERAL**

1.01    RELATED DOCUMENTS

- A.    General and Supplementary Conditions of the Contract and Division 1, General Requirements, apply to this section of the work.

1.02    DESCRIPTION OF WORK

- A.    Extent of work is shown on drawings.

1.03    QUALITY ASSURANCE

- A.    Manufacturer to be member of Steel Joist Institute.
- B.    Comply with SJI "Standard Specifications, Load Tables and Weight Tables" for:
  - 1.    K-Series Open Web Steel Joists.
- C.    Qualify welding processes and operators per AWS "Standard Qualification Procedure".
- D.    Joists welded in place are subject to inspection and testing.

1.04    SUBMITTALS

- A.    Manufacturer's complete and current specifications, installation instructions and certification of compliance.
- B.    Shop drawings showing layout of joist units, special connections, jointing and accessories. Include mark, number, type, location and spacing of joists and bridging.
- C.    Provide templates or location drawings for installation of anchor bolts.
- D.    Reproduction of Contract Documents for use as Erection Drawings will not be permitted.

1.05    DELIVERY, STORAGE AND HANDLING

- A.    Comply with SJI "Specifications". Handle and store joists to prevent deformation of members and excessive stresses.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Steel: Comply with SJI "Specifications".
- B. Steel Prime Paint: Comply with SJI "Specifications".

**2.02 FABRICATION**

- A. Fabricate Steel Joists per SJI "Specifications".
- B. Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
- C. Provide extended ends on joists where shown, complying with manufacturer's standards and requirements of applicable SJI "Specifications" and load tables.
- D. Provide ceiling extensions in areas having ceiling attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1" of finished wall surface unless otherwise indicated.
- E. Provide horizontal or diagonal bridging for "open web" joists, per SJI "Specifications".
- F. Provide bridging anchors for ends of bridging lines terminating at walls or beams.
- G. Provide end anchorage's to secure joists to adjacent construction, per SJI "Specifications".
- H. Before shop painting fabricated joists and accessories, remove loose scale, heavy rust, and other foreign materials. Apply one shop coat of primer paint by spraying. Dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.
- I. Finish coat of all steel joists shall be painted in accordance with Section 09900 Painting. Finish coat shall be selected by the owner.

**PART 3 EXECUTION**

**3.01 ERECTION**

- A. Place and secure steel joists per SJI "Specifications", final shop drawings and specifications.

## STEEL JOISTS

- B. Do not place joists until supporting work is in place and secured. Place joists on supporting work; adjust and align, accurately located and spaced before permanently fastening.
- C. Provide temporary bridging, connections, and anchors to ensure lateral stability during construction.
  - 1. Where “open web” joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.
- D. Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
- E. Field-weld joists to supporting steel framework per SJI “Specifications” for type of joists used. Coordinate welding sequence and procedure with placing of joists.
- F. After joist installation, paint field bolt heads and nuts, and welded areas, abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces clean with solvent before painting. Use same type of paint as used for shop painting.

END OF SECTION

## SECTION 05500 - METAL FABRICATIONS

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:
  - 1. Steel framing and supports for operable partitions.
  - 2. Loose Steel Lintels
  - 3. Shelf angles.
  - 4. Metal ladders.
  - 5. Loose bearing and leveling plates.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels.
  - 2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- C. Related Sections include the following:
  - 1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
  - 2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
  - 3. Division 5 Section "Structural Steel."
  - 4. Division 6 Section "Rough Carpentry Miscellaneous Carpentry" for metal framing anchors.

#### 3. PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 4. SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal fabrications.
  - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  - 2. Provide templates for anchors and bolts specified for installation under other Sections.
  - 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Samples for Verification: For each type and finish of extruded tread.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.

## 5. QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."

## 6. PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

## 7. COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

## 2.PRODUCTS

### 1. MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.
  - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2. METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

### 3. FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- F. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

### 4. NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

## 5. FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1) 2 (A4).
- D. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.



2. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) 2 (A4) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

## 6. MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
  1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 7. FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
  - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## 8. MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.

## 9. LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

## 10. SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.

## 11. METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.

B. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BASIS OF DESIGN: Precision Ladders, LLC.
  - b. Rainbow Attic Stairs
  - c. Other Approved Equal
1. Meets A.N.S.I. for "Commercial Use"
2. 500 pound load capacity
3. Steel Frame
4. Extruded aluminum treads and siderails
5. Clear tread area of 5 3/16" x 16 1/2"
6. Can be operated from above as well as below
7. Operated via wireless wall-mounted keypad
8. 24v DC motor, ultra-quiet operation, variable speed smooth start
9. stand-by power system will allow stair to be operated for up to 10 full cycles within a 24 hour period in the event of a power outage
10. Custom-made for ceiling heights from 8' 0" - 13' 6"

## 12. LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

## 13. FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

## 14. STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 15. ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

## 3.EXECUTION

## 1. INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
2. INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS
- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.
3. INSTALLING BEARING AND LEVELING PLATES
- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

4. ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

## SECTION 05521 - PIPE AND TUBE RAILINGS

### 1. GENERAL

#### 1. SUMMARY

- A. This Section includes the following:
  - 1. Steel pipe and tube railings.
- B. See Division 5 Section "Metal Stairs" for steel tube railings associated with metal stairs.
- C. See Division 10 Section "Access Flooring" for railings included with access flooring.

#### 2. PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 3. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) 200 lbf (0.89 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
    - b. Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
    - c. Infill load and other loads need not be assumed to act concurrently.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 3. SUBMITTALS

- A. Product Data: For mechanically connected railings, grout, anchoring cement, and paint products.
- B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
  - a. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples: For each exposed finish required.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

## 2.PRODUCTS

### 1. METALS

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
- B. Steel and Iron:
  1. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
  2. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
  3. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  4. Plates, Shapes, and Bars: ASTM A 36/A 36M.
  5. Castings: Either gray or malleable iron, unless otherwise indicated.
    - a. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
    - b. Malleable Iron: ASTM A 47/A 47M.

### 2. MISCELLANEOUS MATERIALS

- A. Fasteners: Provide concealed fasteners, unless unavoidable or standard for railings indicated.
  1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Anchors: Provide cast-in-place chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488.



- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. Shop Primers: Provide primers that comply with Division 9 painting Sections.
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- F. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer compatible with finish paint systems indicated, and complying with SSPC-Paint 5.
- H. Grout and Anchoring Cement: Factory-packaged, nonshrink, nonmetallic grout complying with ASTM C 1107; or water-resistant, nonshrink anchoring cement; recommended by manufacturer for exterior use.

### 3. FABRICATION

- A. General: Fabricate railings to comply with design, dimensions, and details indicated, but not less than that required to support structural loads.
- B. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings.
- D. Form changes in direction by bending or by inserting prefabricated elbow fittings.
- E. Form curves by bending in jigs to produce uniform curvature; maintain cross section of member throughout bend without cracking or otherwise deforming exposed surfaces.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

### 4. FINISHES

- A. Steel and Iron:
  - 1. Galvanized Railings: Hot-dip galvanize exterior railings, after fabrication, to comply with ASTM A 123/A 123M. Provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
  - 2. Shop-Primed Galvanized Railings: After galvanizing, clean railings, treat with metallic-phosphate process, and apply primer to comply with SSPC-PA 1.

3. Shop-Primed Steel Finish: Prepare to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" and apply primer to comply with SSPC-PA 1.

### 3.EXECUTION

#### 1. INSTALLATION

- A. General: Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation.
  1. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- B. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Anchor posts in concrete by inserting into preset steel pipe sleeves formed or core-drilled holes and grouting annular space.
- D. Anchor posts to metal surfaces with oval flanges.
- E. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- F. Attach handrails to wall with wall brackets.
  1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt predrilled hole for exposed bolt anchorage.
  2. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs.
  3. For steel-framed partitions, fasten to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
  4. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.
- G. Adjusting and Cleaning:
  1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
  2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05521END OF SECTION 05521

**SECTION 05530-A**  
**ALUMINUM GRATING AND STAIR TREADS**

**PART 1      GENERAL**

**1.01    WORK INCLUDED**

- A.    This Section covers the Work necessary to furnish and install, complete, the fabricated grating, grating supports, and stair treads specified herein.

**1.02    GENERAL**

- A.    Like items provided hereunder shall be the end products of one (1) manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B.    See CONDITIONS OF THE CONTRACT and Section 01001 GENERAL REQUIREMENTS, which contain information and requirements that apply to the Work specified herein and are mandatory for the Project.

**1.03    SUBMITTALS**

- A.    Submittals shall be made in accordance with paragraph SUBMITTALS in Section 01001 GENERAL REQUIREMENTS. In addition, the following specific information shall be provided:
  - 1.    Product Data:
    - a.    Catalog information and catalog cuts.
    - b.    Manufacturer's Specifications, to include coatings.
    - c.    Special handling and storage requirements.
    - d.    Installation instructions.
  - 2.    Shop Drawings:
    - a.    Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other Work.
    - b.    Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement.
    - c.    Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.

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3. Quality Control Submittals:
  - a. Factory test reports.
  - b. Manufacturer's certification of compliance for specified products.
  - c. Fire Retardant: Independent laboratory test report of testing conducted on exact type of grating proposed and dated within two (2) years of submittal date (not a resin test report).
  - d. Manufacturer's report that swaged crossbars, if on grating, meet the requirements of these Specifications.

### 1.04 QUALITY ASSURANCE

#### A. Regulatory Requirements:

1. Fabrication, installation, standard clearances, banding and tolerances as follows:
  - a. Metal Bar Type Grating: In accordance with general recommendations of Metal Bar Grating Manual as published by National Association of Architectural Metal Manufacturers (NAAMM).
  - b. Aluminum: In accordance with the Aluminum Association Standards.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The use of the manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Other manufacturers will be considered in accordance with the GENERAL CONDITIONS.

### 2.02 MATERIALS

- A. Meeting the following ASTM Specifications:
  1. Stainless Steel:
    - a. Bolts: A193, Type 316.
    - b. Nuts: A194, Type 316.
    - c. Bars and Shapes: A276, Type 316.

## ALUMINUM GRATING AND STAIR TREADS

d. Plate, Sheet, Strip: A167, Type 316.

2. Anchor Bolts and Nuts:

a. Stainless: A193, Type 316.

### 2.03 DESIGN AND FABRICATION

- A. Meet minimum dimensional requirements as shown or as specified.
- B. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
- C. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one (1) end is touching either the concrete or the vertical leg of grating support.
- D. Minimum Depth of Grating: As shown.
- E. Minimum bearing of main bars on each support and end clearance of installed grating sections: as specified under Article QUALITY ASSURANCE hereinbefore.
- F. Metal Cross Bar Spacing: Two (2) inch maximum, unless otherwise shown or specified.
- G. Cross Bars:
  - 1. Flush with top of main bar and extend downward a minimum of fifty (50%) percent of the main bar depth.
  - 2. Swaged Cross Bars:
    - a. Within  $\frac{1}{4}$  inch of top of grating with  $\frac{1}{2}$  inch minimum vertical dimension after swaging, and minimum before swaging dimension of  $\frac{5}{16}$  inch square.
    - b. Cross Bar Dimension after Swaging: Minimum  $\frac{1}{8}$  inch wider than the opening at minimum of two (2) corners at each side of each square opening at each side of each square opening in main bar.
    - c. Tightly fit main bars and cross bars allowing no differential movement.
- H. Do not use weld type cross bars.
- I. Banding:

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1. Same material as grating.
  2. Band grating edges and openings in grating as specified under Article QUALITY ASSURANCE herein.
- J. Metals for Embedment or Seat Angles for Partial Embedment. Concrete: Type 316 stainless steel, unless otherwise specified.

### 2.04 GRATING ACCESSORIES

- A. Anchor bolts, bolts, inserts, threaded anchor studs, wedge anchors, expansion anchors, adhesive anchors and as necessary for anchorage of grating to supports:
1. Stainless Steel Type 316 or as otherwise specified under grating type.
  2. Fastener Capability: Firmly secure grating section to supports.
  3. Fastener Clip(s) and Bolt(s): In accordance with grating manufacturer's recommendations, except minimum of four (4) fasteners per grating section and removable from grating walkway surface.
  4. Provide stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, manufactured by:
    - a. Nelson Studs Welding Company, Lorain, OH.
    - b. Omark Industries, KSM Fastenings System Division, Seattle, WA, or Portland, OR.

### 2.05 GRATING SUPPORTS

- A. Seat angles and beams where shown.
- B. Material for aluminum grating supports shall be as herein specified or as shown on the Drawings.
- C. Coordinate dimensions and fabrication with grating to be supported.

### 2.06 FOOT TRAFFIC GRATING

- A. Uniform Service Load: One-hundred (100) psf minimum, unless otherwise shown.
- B. Maximum Deflection:  $\frac{1}{4}$  inch, unless otherwise shown.
- C. Banding:  $\frac{3}{16}$  inch minimum.

## ALUMINUM GRATING AND STAIR TREADS

### D. Aluminum Bar Type Grating:

1. Press-locked rectangular design, as manufactured by:
  - a. IKG/Borden, Clark, NJ, IKG/Borden Type F.
  - b. Or equal.
2. Swage locked grating, rectangular bar type, as manufactured by:
  - a. IKG/Borden, Clark, NJ, IKG/Borden Type FS.
  - b. Seidelhuber Metal Products, Inc., San Carlos, CA.

### E. Stair Treads:

1. Material and Type: Same as grating material and grading type as provided for connecting walkway or work surface.
2. Nosings: Nonslip, abrasive on each tread along one (1) long edge.
3. Carrier Plate or Angle: Provide at each end for connection to stair stringers.
4. Dimensions:
  - a. Length: As shown.
  - b. Width: As shown or manufacturer's standard as close as possible to width as shown.
5. Manufacturers: Same as for grating.

## 2.07 FABRICATION

### A. General:

1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
2. Provide necessary rabbets, lugs, and brackets so Work can be assembled in a neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Weld Connections: Not permitted on grating except at banding bars.

## ALUMINUM GRATING AND STAIR TREADS

### B. Aluminum:

1. Fabricate as shown and in accordance with manufacturer's recommendations as approved.
2. Grind smooth sheared edges exposed in the finished Work.
3. Swage cross bars, if used, with equipment strong enough to deform cross bars as specified herein.
4. Eliminate any loose cross bar intersections on swaged grating.

### C. Footing Traffic Grating: Any single grating section, individual plank, or plank assembly shall not be less than one (1) foot six (6) inches or greater than four (4) feet zero (0) inches in width or weigh more than one hundred pounds.

## PART 3 EXECUTION

### 3.01 PREPARATION

#### A. Electrolytic Protection:

1. Where aluminum will be in contact with dissimilar metals, than stainless steel, or it is to be embedded in masonry or concrete, protect surfaces with bituminous paint.
2. Allow paint to dry before installation of the material.
3. Protect painted surfaces during installation.
4. Should coating become marred, prepare and touch up surface per paint manufacturer's instructions.

### 3.02 INSTALLATION

- A. Provide equipment for lifting and placing as necessary.
- B. Install in accordance with approved shop drawings, and as shown and specified.
- C. Install plumb or level as applicable in locations as shown.
- D. Anchor grating securely to supports to prevent displacement from traffic impact.
- E. Completed Installation: Rigid and neat in appearance.
- F. Commercially Manufactured Products;



## **ALUMINUM GRATING AND STAIR TREADS**

1. Install in accordance with manufacturer's recommendations as approved.
  2. Secure grating to support members with fasteners.
  3. Welding is not permitted.
  4. Fasteners: Field locate and install.
  5. Permit each grating section or plank style grating assembly to be easily removed and replaced.
- G. Clearance between Ends of Grating Sections and Vertical Surfaces of Supports or Concrete Walls: Not to exceed those hereinbefore specified.
- H. Replace grating sections not meeting specified or detailed dimensional requirements.

**END OF SECTION**

**SECTION 055313**  
**BAR GRATINGS**

**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes metal bar gratings and metal frames and supports for gratings.
- B. Related Requirements:
  - 1. Section 05120 "Structural Steel Framing" for structural-steel framing system components.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Clips and anchorage devices for gratings.
  - 2. Paint products.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.

1.05 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.06 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

#### 1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. IKG
- B. Nucor
- C. McNichols

#### 2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  1. Floors: Uniform load of 125 lbf/sq. ft. or concentrated load of 2000 lbf, whichever produces the greater stress.
  2. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
  3. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft..
  4. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft..
  5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
  6. Limit deflection to  $L/360$  or  $1/4$  inch, whichever is less.

#### 2.03 METAL BAR GRATINGS

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
- B. Welded Steel Grating – GW-150
  1. Grating Mark: 19-W4 ( $1\frac{1}{2} \times 3/16$ ) STEEL: 1-by-3/16-inch bearing bars at  $11/16$  inch o.c., and crossbars at 4 inches o.c.
  2. Traffic Surface: Serrated
  3. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. of coated surface.

- C. Pressure-Locked, Stainless-Steel Grating [MBG-<#>]: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
  - 1. Grating Mark P-11-4 (1 x 3/16) STAINLESS STEEL: 1-by-3/16-inch bearing bars at 11/16 inch o.c., and crossbars at 4 inches o.c.
  - 2. Traffic Surface: [Plain] [Serrated] [Knurled] [Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive] [As indicated].
  - 3. Finish: [Mill finish] [Abrasive blasted] [Electropolished].
- D. Pressure-Locked, Rectangular-Bar Aluminum Grating [MBG-<#>]: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.
  - 1. Grating Mark P-7-4 (1 x 1/8) ALUMINUM: 1-by-1/8-inch bearing bars at 7/16 inch o.c., and crossbars at 4 inches o.c.
  - 2. Traffic Surface: [Plain] [Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive] [As indicated].
  - 3. Aluminum Finish: Mill finish
  - 4. Pressure-Locked, Aluminum I-Bar Grating [MBG-<#>]: Fabricated by swaging crossbars between bearing bars.
  - 5. Grating Mark P-11-4 (1 I-Bar) ALUMINUM: 1-inch I-bar bearing bars at 11/16 inch o.c., and crossbars at 4 inches o.c.
  - 6. Traffic Surface: [Plain] [Grooved] [Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive] [As indicated].
  - 7. Aluminum Finish: Mill finish

#### 2.04 FERROUS METALS

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A240/ A240M, Type 316L.
- B. Stainless-Steel Bars and Shapes: ASTM A276, Type 316L.

#### 2.05 ALUMINUM

- A. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.
- B. Extruded Bars and Shapes: ASTM B221, alloys as follows:
  - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
  - 2. 6061-T1, for grating crossbars.

#### 2.06 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use.
  - 1. Provide stainless-steel fasteners for fastening aluminum.

2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 2.
  1. Material for Interior and Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

#### 2.07 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with [Section 09 90 00 "Painting and Coating"]
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

#### 2.08 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
  2. Toeplate Height: 4 inches unless otherwise indicated.
- G. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
1. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
  2. Provide no fewer than four weld lugs for each grating section containing rectangular bearing bars 3/16 inch or less in thickness and spaced less than 15/16 inch o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
  3. Provide no fewer than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
- H. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- I. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- J. Do not notch bearing bars at supports to maintain elevation.
- 2.09 GRATING FRAMES AND SUPPORTS
- 2.10 ALUMINUM FINISHES
- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I.
- 2.11 STEEL FINISHES – Non-Stainless Steel
- A. Finish gratings, frames, and supports after assembly.
  - B. Shop prime gratings, frames, and supports unless otherwise indicated.
  - C. Shop prime with primers specified in Section 09900 "Painting"
  - D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION, GENERAL**

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.02 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

### 3.03 ADJUSTING AND CLEANING

- A. Touchup Painting – Non-Stainless Steel: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces – Non-Stainless Steel Only: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

**END OF SECTION 05531**



**SECTION 06100  
ROUGH CARPENTRY**

**PART 1      GENERAL**

1.01    RELATED DOCUMENTS

- A.    Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, Apply to this Section.

1.02    SUMMARY

- A.    This Section includes the following:
  - 1.    Wood furring, grounds, nailers, and blocking.

1.03    DEFINITIONS

- A.    Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.04    SUBMITTALS

- A.    General: Submit each item in this Article according to the Conditions of the Contract and applicable Specification Sections.

1.05    DELIVERY, STORAGE, AND HANDLING

- A.    Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

**PART 2      PRODUCTS**

2.01    LUMBER, GENERAL

- A.    Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard", and with applicable grading rules of inspection agencies certified by ALSC'S Board of Review.
- B.    Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

- C. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 1. Provide dressed lumber, S4S, unless otherwise indicated.
  - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

**2.02 MISCELLANEOUS LUMBER**

- A. General: Provide lumber for support or attachment of other construction, including cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Pressure-Treated Lumber: Where lumber or plywood is indicated as preservative-treated or is specified herein to be treated, comply with applicable requirements of AWPB Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB quality Mark Requirements.
- D. Pressure-treat above ground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to maximum moisture content, respectively, of 19 percent and 15 percent. Treat items indicated on the drawings and wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
- E. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- F. Grade: For dimension lumber sizes, provide No. 3 or standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPB; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPB of any species.

**2.03 WOOD-BASED STRUCTURAL-USE PANELS, GENERAL**

- A. Structural-Use Panel Standards: Provide either all-veneer, mat-formed, or composite panels complying with DOC PS 2, "Performance Standard for Wood-Based Structural-Use Panels", unless otherwise indicated. Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood", where plywood is indicated.

- B. Trademark: Factory mark structural-use panels with APA trademark evidencing compliance with grade requirements.

2.04 STRUCTURAL-USE PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick.

2.05 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.06 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.
- C. Water-Repellent Preservative: NWWDA-tested and accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

**PART 3 EXECUTION**

**3.01 INSTALLATION, GENERAL**

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. CABO NER-272 for power driven staples, P-nails, and allied fasteners.
  - 2. "Table 1705.1-Fastening Schedule", of the Standard Building Code.
- E. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners with out splitting wood; predrill as required.
- F. Use hot-dip galvanized or stainless steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
- G. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

**3.02 INTERIOR WALLS**

- A. The interior side of exterior walls shall be stripped with 1" x 4" boards 16" O.C. from floor to ceiling. The boards should be anchored to masonry units at the top and bottom and 16" O.C. between. Anchors are to be masonry anchors of 3/16" min. Area between the boards shall be filled with 3/4" styrofoam insulation. The walls shall be covered with 5/8" gypsum board, finished and painted, colors to be selected by the Owner.
- B. The interior wall framing shall be constructed of either 2" x 4" studs or galvanized metal studs. Wall coverings to be 5/8" gypsum board, finished and painted in accordance with Sections 09260 and 09900 with colors selected by the Owner.

**3.03 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS**

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

**END OF SECTION**

## SECTION 06105 - MISCELLANEOUS CARPENTRY

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:

- 1. Framing with dimension lumber.
- 2. Wood blocking, cants, and nailers.
- 3. Wood furring and grounds.
- 4. Wood sleepers.
- 5. Plywood backing panels.

- B. Related Sections include the following:

- 1. Division 2 Section "Termite Control" for site application of borate treatment to wood framing.
- 2. Division 6 Section "Sheathing."
- 3. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.

#### 3. DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

- 1. NeLMA: Northeastern Lumber Manufacturers' Association.
- 2. NHLA: National Hardwood Lumber Association.
- 3. NLGA: National Lumber Grades Authority.
- 4. SPIB: The Southern Pine Inspection Bureau.
- 5. WCLIB: West Coast Lumber Inspection Bureau.
- 6. WWPA: Western Wood Products Association.

#### 4. SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood.
  2. Power-driven fasteners.
  3. Powder-actuated fasteners.
  4. Expansion anchors.
  5. Metal framing anchors.
5. DELIVERY, STORAGE, AND HANDLING
- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

## 2.PRODUCTS

1. WOOD PRODUCTS, GENERAL
- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
  3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  4. Provide dressed lumber, S4S, unless otherwise indicated.

2. WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat all miscellaneous carpentry, unless otherwise indicated. items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawl spaces or unexcavated areas.
  - 5. Wood floor plates that are installed over concrete slabs-on-grade.

3. MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.
  - 6. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.



- C. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

4. PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

5. FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

6. MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
  - 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3.EXECUTION

1. INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- I. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials.

Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

2. WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3. PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06105

## SECTION 06160 - SHEATHING

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:

- 1. Wall sheathing.
- 2. Composite nail base insulated roof sheathing.
- 3. Building paper.
- 4. Building wrap.
- 5. Sheathing joint-and-penetration treatment.
- 6. Flexible flashing at openings in sheathing.

- B. Related Sections include the following:

- 1. Division 6 Section "Rough Carpentry Miscellaneous Carpentry" for plywood backing panels.

#### 3. SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

- 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
- 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- 4. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

- 1. Foam-plastic sheathing.
- 2. Building wrap.

- C. Fastener layout of each sheeting product based on wind zone and wind pressure, as specified on the structural drawings.

#### 4. DELIVERY, STORAGE, AND HANDLING

- A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

### 2.PRODUCTS

#### 1. WALL SHEATHING

- A. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company (The).
    - c. Owens Corning.
    - d. Pactiv, Inc.
  - 3. Thickness: As shown on the Drawings.

#### 2. COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

- A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: Rigid, cellular, polyisocyanurate thermal insulation with oriented strand board laminated to one face complying with ASTM C 1289, Type V.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Atlas Roofing Corporation.
    - b. Cornell Corporation.
    - c. Dow Chemical Company (The).
    - d. Johns Manville; Berkshire Hathaway Inc.
    - e. Rmax, Inc.
  - 3. Polyisocyanurate-Foam Thickness: As shown on the Drawings
  - 4. Oriented-Strand-Board Nominal Thickness: 3/4".

## 3. FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
  - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.
  - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.
- E. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

## 4. SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
- B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

## 5. MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.025 inch (0.6 mm) 0.030 inch (0.8 mm) 0.040 inch (1.0 mm).
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.

- b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing Vycor V40 Weather Barrier Strips.
  - c. MFM Building Products Corp.; Window Wrap.
  - d. Polyguard Products, Inc.; Polyguard 300.
  - e. Protecto Wrap Company; BT-20 XL PS-45.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

### 3.EXECUTION

#### 1. INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
  - 3. Per wind zone requirements on structural drawings.
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

#### 2. WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Screw to cold-formed metal framing.

- b. Space panels 1/8 inch (3 mm) apart at edges and ends.
- 2.

3. FOAM-PLASTIC SHEATHING INSTALLATION

- A. Comply with manufacturer's written instructions.

4. SHEATHING JOINT-AND-PENETRATION TREATMENT

- A. Seal sheathing joints according to sheathing manufacturer's written instructions.
  - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
  - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
  - 3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

5. FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
  - 1. Prime substrates as recommended by flashing manufacturer.
  - 2. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
  - 3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
  - 4. Lap weather-resistant building paper over flashing at heads of openings.
  - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 06160



## SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:
  - 1. Wood cabinets.
  - 2. Solid-surfacing-material countertops.
  - 3. Shop finishing of interior woodwork.
- B. Related Sections include the following:
  - 1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
  - 2. Division 6 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.
  - 3. Division 6 Section "Paneling."
  - 4. Division 9 Section "Interior Stone Facing" for stone countertops.

#### 3. DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
- B. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stairwork are specified in Division 6 Section "Rough Carpentry."

#### 4. SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.
- B. Product Data: For high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material cabinet hardware and accessories handrail brackets and finishing materials and processes.

- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.
  - 4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
  - 5. Apply WI-certified compliance label to first page of Shop Drawings.
- D. Samples for Initial Selection:
  - 1. Shop-applied transparent finishes.
  - 2. Shop-applied opaque finishes.
  - 3. Plastic laminates.
  - 4. PVC edge material.
  - 5. Thermoset decorative panels.
  - 6. Solid-surfacing materials.
- E. Samples for Verification:
  - 1. Lumber with or for transparent finish, not less than 5 inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on 1 side and 1 edge.
  - 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
  - 3. Veneer-faced panel products with or for transparent finish, 8 by 10 inches (200 by 250 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
  - 4. Lumber and panel products with shop-applied opaque finish, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels, for each finish system and color, with 1/2 of exposed surface finished.
  - 5. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
  - 6. Thermoset decorative-panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with edge banding on 1 edge.
  - 7. Solid-surfacing materials, 6 inches (150 mm) square.
  - 8. Corner pieces as follows:
    - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
    - b. Miter joints for standing trim.
  - 9. Exposed cabinet hardware and accessories, one unit for each type and finish.
- F. LEED Submittals:
  - 1. Product Data for Credit EQ 4.1: For installation adhesives, including printed statement of VOC content.

2. Product Data for Credit(s) MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content
    - a. Include statement indicating costs for each product having recycled content.
  - G. Product Certificates: For each type of product, signed by product manufacturer.
  - H. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
  - I. Qualification Data: For Installer fabricator.
5. QUALITY ASSURANCE
- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
  - B. Installer Qualifications: Fabricator of products or Certified participant in AWI's Quality Certification Program.
  - C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.
  - D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
    1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
  - E. Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
    1. Provide WI-certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
    2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.
  - F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
    1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

6. DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

7. PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
  - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

8. COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

2.PRODUCTS

1. WOODWORK FABRICATORS

- A. Available Fabricators: Subject to compliance with requirements, fabricators offering interior architectural woodwork that may be incorporated into the Work include, but are not limited to, the following:

- B. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:

## 2. MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: White oak.
- C. Wood Products: Comply with the following:
  - 1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than <Insert number> percent.
  - 2. Hardboard: AHA A135.4.
  - 3. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
  - 4. Particleboard: ANSI A208.1, Grade M-2 M-2-Exterior Glue.
  - 5. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
  - 6. Softwood Plywood: DOC PS 1, Medium Density Overlay.
  - 7. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
- D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
  - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
- E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
  - 1. See Division 1, "Allowances."
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABA Industries.
    - b. Avonite, Inc.
    - c. E. I. du Pont de Nemours and Company.
    - d. Formica Corporation.
    - e. LG Chemical, Ltd.
    - f. Meganite Inc.; a division of the Pyrochem Group.
    - g. Nevamar Company, LLC; Decorative Products Div.
    - h. Samsung; Cheil Industries Inc.
    - i. Swan Corporation (The).
    - j. Transolid, Inc.
    - k. Wilsonart International; Div. of Premark International, Inc.

3. Type: Standard type, unless Special Purpose type is indicated.
4. Colors and Patterns: As selected by Architect from manufacturer's full range.

### 3. CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware (Scheduled by Describing Products)."
- B. Butt Hinges: 2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
  1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
  2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.
- D. Back-Mounted Pulls: BHMA A156.9, B02011.
- E. Wire Pulls: Back mounted, solid metal, 4 inches (127 mm) long, 1-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.
- F. Catches: Magnetic catches, BHMA A156.9, B03141.
- G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- H. Shelf Rests: BHMA A156.9, B04013; metal.
- I. Drawer Slides: BHMA A156.9, B05091.
  1. Standard Duty (Grade 1, Grade 2, and Grade 3): Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel epoxy-coated steel with polymer rollers.
  2. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
  3. Box Drawer Slides: Grade 1; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
  4. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
  5. Pencil Drawer Slides: Grade 2 Grade 1; for drawers not more than 3 inches (75 mm) high and 24 inches (600 mm) wide.
  6. Trash Bin Slides: Grade 1HD-100 Grade 1HD-200; for trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide.
- J. Door Locks: BHMA A156.11, E07121.
- K. Drawer Locks: BHMA A156.11, E07041.
- L. Grommets for Cable Passage through Countertops: 1-1/4-inch (32-mm) OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "OG SG series" by Doug Mockett & Company, Inc.
  - M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
    1. Match Architect's sample.
  - N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
4. MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
  - B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
  - C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
  - D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    1. Wood Glues: 30 g/L.
    2. Contact Adhesive: 250 g/L.
  - E. Adhesive for Bonding Plastic Laminate: Contact cement or as recommended by manufacturer.
    1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
5. FABRICATION, GENERAL
- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.
  - B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
  - C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
    1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
    2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
1. Seal edges of openings in countertops with a coat of varnish.
- F. Install glass to comply with applicable requirements in Division 8 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.
6. WOOD CABINETS FOR TRANSPARENT FINISH
- A. Grade: Premium.
- B. AWI Type of Cabinet Construction: Reveal overlay, Recessed panel.
- C. Reveal Dimension: 1/4 inch.
- D. Wood Species and Cut for Exposed Surfaces: **white oak**, plain sawn or sliced.
1. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
  2. Vertical Matching of Veneer Leaves: End match.
  3. Veneer Matching within Panel Face: Running match.
  4. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.
- E. Semiexposed Surfaces: Provide surface materials indicated below:
1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
  2. Drawer Sides and Backs: Solid-hardwood lumber, same species indicated for exposed surfaces.
  3. Drawer Bottoms: Hardwood plywood.



- F. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

### 3.EXECUTION

#### 1. PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

#### 2. INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Railings:
  - 1. General: Install rails with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) variation from a straight line.
  - 2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
  - 3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.

3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.
- H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
  2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
  3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
  4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
- I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- J. Refer to Division 9 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.
3. ADJUSTING AND CLEANING
  - A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
  - B. Clean, lubricate, and adjust hardware.
  - C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402END OF SECTION 06402

## SECTION 06651 - SOLID SURFACE FABRICATIONS

### PART 1 — GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following horizontal and trim solid surface product types:
  - 1. Lavatory tops with integral bowls
  - 2. Countertops
- B. Related Sections include the following:
  - 1. Division 5 Section "Metal Fabrications" for Blocking.
  - 2. Division 6 Section "Rough Carpentry" for Blocking.
  - 6. Division 15 Section "Plumbing Fixtures."
  - 7. Division 16 Section "Wiring Devices."

#### 3. DEFINITION

- A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

#### 4. SUBMITTALS

- A. Product data:
  - 1. For each type of product indicated.
- B. Shop drawings:
  - 1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
    - a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
    - b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
    - c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.
- C. Samples:
  - 1. For each type of product indicated.
    - a. Submit minimum 6-inch by 6-inch sample in specified gloss.
    - b. Cut sample and seam together for representation of inconspicuous seam.
    - c. Indicate full range of color and pattern variation.

2. Approved samples will be retained as a standard for work.
- D. Product data:
  1. Indicate product description, fabrication information and compliance with specified performance requirements.
- F. Product certificates:
  1. For each type of product, signed by product manufacturer.
- G. Fabricator/installer qualifications:
  1. Provide copy of certification number.
- H. Manufacturer certificates:
  1. Signed by manufacturers certifying that they comply with requirements.
- I. NSF/ANSI standards:
  1. Refer to [www.nsf.org](http://www.nsf.org) for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.
- J. Maintenance data:
  1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
    - a. Maintenance kit for finishes shall be submitted.
  2. Include in project closeout documents.
5. QUALITY ASSURANCE
  - A. Qualifications:
    1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in- service performance.
  - B. Fabricator/installer qualifications:
    1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.
  - C. Applicable standards:
    1. Standards of the following, as referenced herein:
      - a. American National Standards Institute (ANSI)
      - b. American Society for Testing and Materials (ASTM)
      - c. National Electrical Manufacturers Association (NEMA)
      - d. NSF International
    2. Fire test response characteristics:
      - a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
        - 1) Flame Spread Index: 25 or less.
        - 2) Smoke Developed Index: 450 or less.

- D. Coordination drawings:
  - 1. Shall be prepared indicating:
    - a. Plumbing work.
    - b. Electrical work.
    - c. Miscellaneous steel for the general work.
    - d. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.
  - 2. Content:
    - a. Project-specific information, drawn accurately to scale.
    - b. Do not base coordination drawings on reproductions of the contract documents or standard printed data.
    - c. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
    - d. Provide alternate sketches to designer for resolution of such conflicts.
      - 1) Minor dimension changes and difficult installations will not be considered changes to the contract.
  
- E. Drawings shall:
  - 1. Be produced in 1/2-inch scale for all fabricated items.
  
- F. Drawings must be complete and submitted to the architect within 60 days after award of contract for record only.
  - 1. No review or approval will be forthcoming.
  - 2. Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.
  
- G. Job mock-up:
  - 1. Prior to fabrication of architectural millwork, erect sample unit to further verify selections made under sample submittals and to demonstrate the quality of materials and execution.
  - 2. Mock-up shall be representative of the finished work .
  - 3. Build the mock-up to comply with the contract documents and install in a location as directed by the architect.
  - 4. Notify the architect two weeks in advance of the date of when the mock-up will be delivered.
  - 5. Should mock-up not be approved, re-fabricate and reinstall until approval is secured.
    - a. Remove rejected units from project site.
  - 6. After approval, the mock-up may become a part of the project.
  - 7. This mock-up, once approved, shall serve as a standard for judging quality of all completed units of work.
  
- H. Pre-installation conference:
  - 1. Conduct conference at project site to comply with requirements in Division 1.

6. DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.

1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

7. WARRANTY

A. Provide manufacturer's warranty against defects in materials.

1. Warranty shall provide material and labor to repair or replace defective materials.

2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

8. MAINTENANCE

A. Provide maintenance requirements as specified by the manufacturer.

PART 2 — PRODUCTS

1. MANUFACTURERS

A. Manufacturers:

1. Subject to compliance with requirements, provide the following:

a. Reference Construction Drawings

2. MATERIALS

A. Solid polymer components

1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.

2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.

B. Thickness:

1. 1/2 inch

C. Edge treatment:

1. As indicated on drawings.

D. Backsplash:

1. Applied.

- E. Sidesplash:  
1. Applied.

- F. Performance characteristics:

Property	Typical Value	Test Method
Tensile Modulus	$1.5 \times 10^6$ psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	$1.2 \times 10^6$ psi	ASTM D 790
Hardness	>85	Rockwell "M" Scale
		ASTM D 785
	56	Barcol Impressor
		ASTM D 2583
Thermal Expansion	$3.02 \times 10^{-5}$ in./in./°C ( $1.80 \times 10^{-5}$ in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Meth
High Temperature Resistance	No change	NEMA LD 3-2000

## SOLID SURFACE FABRICATIONS

		Method 3.6
Izod Impact	0.28 ft.-lbs./in. of notch	ASTM D 256
(Notched Specimen)		(Method A)
Ball Impact	No fracture—1/2 lb. ball:	NEMA LD 3-2000
Resistance: Sheets	1/4" slab—36" drop	Method 3.8
	1/2" slab—144" drop	
W	$\Delta E^*_{94}$	ASTM G 155
e	<5 in	
Water Absorption	Long-term	ASTM D 570
	0.4% (3/4")	
	0.6% (1/2")	
	0.8% (1/4")	
Toxicity	99 (solid colors)	Pittsburgh Protocol
	66 (patterned colors)	Test ("LC50" Test)
Flammability	All colors	ASTM E 84,
	(Class I and Class A)	NFPA 255 &
		UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	

† Approximate weight per square foot: 1/4" (6 mm) 2.2 lbs., 1/2" (12.3 mm) 4.4 lbs.  
Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories. NEMA results based on the NEMA LD 3-2000

## AMBIENT CONDITIONS

- A. Section 01500 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.
- B. Store materials in area of installation for 48 hours prior to installation.

## 3. ACCESSORIES



- A. Joint adhesive:
  - 1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.
- B. Sealant:
  - 1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.
- C. Sink/lavatory mounting hardware:
  - 1. Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.
- D. Conductive tape:
  - 1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- E. Insulating felt tape:
  - 1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

#### 4. FACTORY FABRICATION

- A. Shop assembly
  - 1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
  - 2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
    - a. Reinforce with strip of solid polymer material, 2" wide.
  - 3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
  - 4. Rout and finish component edges with clean, sharp returns.
    - a. Rout cutouts, radii and contours to template.
    - b. Smooth edges.
    - c. Repair or reject defective and inaccurate work.

#### 5. FINISHES

- A. Select from the manufacturer's standard color chart.
  - 1. Color: Match Architect Sample
- B. Finish:
  - 1. Provide surfaces with a uniform finish.
    - a. Matte; gloss range of 5–20.

### PART 3 — EXECUTION

#### 1. EXAMINATION

- A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2. INSTALLATION

- A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
  - 1. Provide product in the largest pieces available.
  - 2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
    - a. Exposed joints/seams shall not be allowed.
  - 3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
  - 4. Cut and finish component edges with clean, sharp returns.
  - 5. Rout radii and contours to template.
  - 6. Anchor securely to base cabinets or other supports.
  - 7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
  - 8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
  - 9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.
- B. Backsplashes and applied sidesplashes:
  - 1. Install applied sidesplashes using manufacturer's standard color-matched silicone sealant.
  - 2. Adhere applied sidesplashes to countertops using manufacturer's standard color-matched silicone sealant.
- C. Integral sinks:
  - 1. Provide solid surface materials bowls and/or lavatories sinks with overflows in locations shown on the drawings.
  - 2. Secure sinks and lavatory bowls to tops using manufacturer's recommended sealant, adhesive and mounting hardware to maintain warranty.

## 3. REPAIR

- A. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

## 4. CLEANING AND PROTECTION

- A. Keep components clean during installation.
- B. Remove adhesives, sealants and other stains.

END OF SECTION 06651

## SECTION 07115 - BITUMINOUS DAMPPROOFING

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes cold-applied, emulsified- asphalt dampproofing applied to the following surfaces:
  - 1. Exterior, below-grade surfaces of concrete foundation walls.
  - 2. Exterior face of inner wythe of exterior concrete cavity walls.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.
- B. Material Certificates: For each product, signed by manufacturers.

#### 4. QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

#### 5. PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

## 2.PRODUCTS

### 1. COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Euclid Chemical Company (The).
  - b. Gardner Asphalt Corporation.
  - c. Henry Company.
  - d. Karnak Corporation.
  - e. Koppers Industries, Inc.
  - f. Malarkey Roofing Company.
  - g. Meadows, W. R., Inc.
  - h. Sonneborn, Div. of ChemRex, Inc.
  - i. Tamms Industries.
- C. Trowel Coats: ASTM D 1227, Type II, Class 1.
- D. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
- E. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.
- F. VOC Content: 0.25 lb/gal. (30 g/L) or less.

### 2. PROTECTION COURSE

- A. Protection Course, Asphalt-Board Type: ASTM D 6506, premolded, 1/8-inch- (3-mm-) thick, multi-ply, semirigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on 1 side with polyethylene film.

### 3. MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- C. Patching Compound: Manufacturer's fibered mastic of type recommended by dampproofing manufacturer.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
  - 1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
  - 2. Test for surface moisture according to ASTM D 4263.

#### 2. PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.
- C. Apply patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

#### 3. APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
  - 1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
  - 2. Allow each coat of dampproofing to cure 12 hours before applying subsequent coats.
  - 3. Allow 24 hours drying time prior to backfilling.
- B. Apply dampproofing to footings and foundation walls where opposite side of wall faces building interior.
  - 1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing.
  - 2. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
  - 3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Apply dampproofing to provide continuous plane of protection on exterior face of inner wythe of exterior masonry cavity walls.

1. Lap dampproofing at least 1/4 inch (6 mm) onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
  2. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe, and lap dampproofing at least 1/4 inch (6 mm) onto shelf angles supporting veneer.
- D. Apply dampproofing to provide continuous plane of protection on interior face of above-grade, exterior concrete and masonry walls unless walls are indicated to receive direct application of paint.
1. Continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by delaying construction of intersecting walls until dampproofing is applied.
4. COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING
- A. On Concrete Foundations and Parged Masonry Foundation Walls: Apply 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat, 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m), or 1 trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).
  - B. On Unparged Masonry Foundation Walls: Apply primer and 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat, primer and 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m), or primer and 1 trowel coat at not less than 5 gal./100 sq. ft. (2 L/sq. m).
  - C. On Unparged Masonry Foundation Walls: Apply primer and 1 trowel coat at not less than 5 gal./100 sq. ft. (2 L/sq. m).
  - D. On Unexposed Face of Concrete Retaining Walls: Apply 1 brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
  - E. On Unexposed Face of Masonry Retaining Walls: Apply primer and 1 brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
  - F. On Exterior Face of Inner Wythe of Cavity Walls: Apply primer and 1 brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
  - G. On Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply 1 brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
  - H. On Interior Face of Single-Wythe Exterior Masonry Walls: Where above grade and indicated to be furred and finished, apply primer and 1 brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

5. INSTALLATION OF PROTECTION COURSE

- A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course.
  - 1. Support protection course with spot application of adhesive of type recommended by protection board manufacturer over cured coating.
  - 2. Install protection course on same day of installation of dampproofing (while coating is tacky) to ensure adhesion.

6. CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 07115END OF SECTION 07115

## SECTION 07131 - SELF-ADHERING SHEET WATERPROOFING

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:

- 1. Modified bituminous sheet waterproofing.
- 2. Molded-sheet drainage panels.

- B. Related Sections include the following:

- 1. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

#### 3. SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

- 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

- C. Samples: For the following products:

- 1. 12-by-12-inch (300-by-300-mm) square of waterproofing and flashing sheet.
- 2. 4-by-4-inch (100-by-100-mm) square of drainage panel.

- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

- E. Qualification Data: For Installer.

- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.

- G. Warranties: Special warranties specified in this Section.



4. QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is acceptable to waterproofing manufacturer for installation of waterproofing required for this Project.
- B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

5. DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

6. PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
  - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

7. WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
  - 1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.

2. Warranty Period: 5 years from date of Substantial Completion.
- B. Special Installer's Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.
  1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

## 2.PRODUCTS

### 1. MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Not less than 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
  1. Products: Subject to compliance with requirements, provide Grace, W.R. & Co. Bituthene 3000 or equal from one of the following manufacturers:
    - a. American Hydrotech, Inc.; VM 75.
    - b. American Permaquik Inc.; PQ 7100.
    - c. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
    - d. CETCO Building Materials Group; Envirosheet.
    - e. Grace, W. R. & Co.; Bituthene 3000 or 4000.
    - f. Henry Company; Blueskin WP 200.
    - g. Meadows, W. R., Inc.; SealTight Mel-Rol.
    - h. Nervastral, Inc.; BITU-MEM.
    - i. Pecora Corporation; Duramem 700-SM.
    - j. Polyguard Products; Polyguard 650.
    - k. Progress Unlimited, Inc.; Plastiwrap 60.
    - l. Tamko Roofing Products, Inc.; TW-60.
  2. Physical Properties:
    - a. Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
    - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
    - c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
    - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
    - e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
    - f. Hydrostatic-Head Resistance: 150 feet (45 m) minimum; ASTM D 5385.
    - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
    - h. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

## 2. AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
  - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
  - 1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches (114 mm) wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
  - 2. Detail Strips: 62.5-mil- (1.58-mm-) thick, felt-reinforced self-adhesive strip, 9 inches (229 mm) wide, with release film on adhesive side.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

## 3. MOLDED-SHEET DRAINAGE PANELS

- A. Molded-Sheet Drainage Panel: Comply with Division 2 Section "Subdrainage."
- B. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425-mm) sieve laminated to one side with or without a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a horizontal flow rate not less than 2.8 gpm per ft. (35 L/min. per m).

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
  - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
  - 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  - 3. Verify that compacted subgrade is dry, smooth, and sound; and ready to receive adhesive-coated HDPE sheet.
  - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 2. SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
  - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
    - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
- G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

#### 3. MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.

- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
  - C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
    - 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
  - D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths to provide a minimum of 2 thicknesses of sheet membrane over areas to receive waterproofing.
  - E. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
  - F. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
  - G. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.
  - H. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
  - I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
  - J. Install protection course with butted joints over waterproofing membrane immediately.
    - 1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.
  - K. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
4. MOLDED-SHEET DRAINAGE PANEL INSTALLATION
- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or mechanical fasteners that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

5. FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

6. PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07131

## SECTION 07210 - BUILDING INSULATION

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:
  - 1. Cavity-wall insulation.
  - 2. Concealed building insulation.
  - 3. Exposed building insulation.
  - 4. Vapor retarders.
  - 5. Sound attenuation insulation.
- B. Related Sections include the following:
  - 1. Division 6, Section "Sheathing" for insulated wall sheathing.
  - 2. Division 7 Section[s] "[SBS-Modified Bituminous Membrane Roofing]" for insulation specified as part of roofing construction.
  - 3. Division 7 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
  - 4. Division 9 Section[s] "Portland Cement Plaster" ["Gypsum Board Assemblies"] [and] ["Gypsum Board Shaft-Wall Assemblies"] for installation in metal-framed assemblies of insulation specified by referencing this Section.
  - 5. Division 15 Section "Mechanical Insulation."

#### 3. DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

#### 4. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

## 5. QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Surface-Burning Characteristics: ASTM E 84.
  - 2. Fire-Resistance Ratings: ASTM E 119.
  - 3. Combustion Characteristics: ASTM E 136.

## 6. DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## 2.PRODUCTS

### 1. MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.
  - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.



## 2. GLASS-FIBER BLANKET INSULATION (SOUND BATT)

### A. Manufacturers:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens Corning.

### B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

### C. Faced, Glass-Fiber Blanket Insulation at exposed areas in attic: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with [polypropylene-scrim-kraft] vapor-retarder membrane on 1 face.

### D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-1/2 inches (89 mm) thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F (2.3 K x sq. m/W at 24 deg C)].
2. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
3. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).
4. 6-1/2 inches (165 mm) thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F (3.7 K x sq. m/W at 24 deg C).
5. [9-1/2 inches (241 mm)] thick with a thermal resistance of 30 deg F x h x sq. ft./Btu at 75 deg F (5.2 K x sq. m/W at 24 deg C).

## 3. INSULATION FASTENERS

### A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

#### 1. [Available ]Products:

- a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
- b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
- c. Gemco; Spindle Type.
- d. <Insert manufacturer's name; product name or designation.>

#### 2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.

#### 3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
1. [Available ]Products:
    - a. AGM Industries, Inc.; RC150.
    - b. AGM Industries, Inc.; SC150.
    - c. Gemco; Dome-Cap.
    - d. Gemco; R-150.
    - e. Gemco; S-150.
    - f. <Insert manufacturer's name; product name or designation.>
  2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
    - a. Crawlspace.
    - b. Ceiling plenums.
    - c. Attic spaces.
    - d. Where indicated.
    - e. <Insert location.>
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
1. [Available ]Products:
    - a. AGM Industries, Inc.; TACTOO Adhesive.
    - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
    - c. Gemco; Tuff Bond Hanger Adhesive.
- D. Wire Mesh: 20 Gauge, 1" hex pattern.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 2. PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3. INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
- F. Install below roof deck batt insulation. Hold tight to deck with wire mesh. Fasten wire mesh to each bar joist.

### 4. INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder [outside of construction, unless otherwise indicated].
  - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures.

- 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  - E. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
5. PROTECTION
- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

## SECTION 07411 –METAL ROOF PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. This Section includes

1. Factory formed metal roof panels: Standing-seam, hidden fastener, non-insulated
2. Finish must conform to the "Metal Construction Association Certified Premium Painted™" Standard.

#### 1.3 RELATED SECTIONS

A. Division 7 Section "Sheet Metal Flashing and Trim"

#### 1.4 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Wind-Uplift Resistance: Capable of resisting design negative uplift pressures as noted on Structural Engineering Drawings. Provide clips, fasteners, and clip spacing of type indicated and with capability to sustain, without failure, a load equal to 2 times the design negative uplift pressure.

#### 1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory, including each type of underlayment product indicated:

1. Concealed fastener, standing seam metal roof panels and accessories. Underlayment.

B. Shop Drawings: Show layouts of sheet metal roofing, including plans, elevations, and keyed references to termination points. All fastening patterns shall clearly be designated and designed by a professional engineer to meet the wind zone and wind pressure, as specified on the structural drawings.

1. Include details for forming, joining, and securing sheet metal roofing, including pattern of seams, termination points, expansion joints, roof penetrations, edge conditions, special conditions, connections to adjoining work, and accessory items.
- C.Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
1. Roof panels and attachments. Including fastener spacing requirements to meet the wind-uplift resistance.
  2. Purlins and rafters.
  3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.
- D.Samples: For each exposed finish.
- E.Field quality control inspection reports, to be submitted for warranty program level, if applicable.
- F.Product test reports. Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
- G.UL 580, ASTM E 283, ASTM E 331, ASTM E 330, Field Tested, ASTM E 1592, UL 2218, ASTM E 84 Flame Spread Rating, Paint Performance Tests.
- H.Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

## 1.6 QUALITY ASSURANCE

- A.Installer Qualifications: Installer of sheet metal roofing for a minimum of 10 years.
- B.Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Minimum of 10 years factory forming experience.
- C.Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- D.Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.
- E.Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" and NRCA Waterproofing Manual and manufacturer's installation guidelines.
- F.Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance that comply with ASTM E 108 in accordance with UL790.
- G.Pre-installation Conference: A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and

attended by representatives of the Owner, General Contractor, Roofing Contractor, Sheet Metal Contractor, and the Roofing Materials Manufacturer.

H. Construction Inspection: Manufacturer shall conduct on site inspection and formal written report to architect and owner at the following intervals: 50 percent sheet metal roofing installation completion, and final inspection upon completion of roof system. Related to warranty requirements.

#### 1.7 DELIVERY, STORAGE & HANDLING

A. Do not deliver materials of this section to project site until suitable facilities for storage and protection are available.

B. Protect materials from damage during transit and at project site. Store under cover, but sloped to provide positive drainage. Do not expose materials with strippable protective film to direct sunlight or extreme heat.

C. Do not allow storage of other materials or allow staging of other work on installed metal panel system.

D. Upon receipt of delivery of metal panel system, and prior to signing the delivery ticket, the installer is to examine each shipment for damage and for completion of the consignment.

#### 1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.

#### 1.9 SCHEDULING

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Roof Accessories."

B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of decks, purlins and rafters, parapets, walls, and other adjoining work to provide a leakproof, secure, and non-corrosive installation.

C. Pre-installation Conference: A pre-roofing conference is required before any roofing materials are installed. This conference shall be conducted by a representative of the Architect and attended by representatives of the Owner, General Contractor, Roofing Contractor, Sheet Metal Contractor, Roof Deck Manufacturer (if applicable), and the Roofing Materials Manufacturer (if warranty is required of this manufacturer). If equipment of substantial size is to be placed on the roof, the Mechanical Contractor must also attend this meeting.

1. The pre-roofing conference is intended to clarify demolition (for renovation or re-roofing projects) and application requirements for work to be completed before roofing operations can begin. This would include a detailed review of the specifications, roof plans, roof deck information, flashing details, and approved shop drawings, submittal data, and samples. If conflict exists between the specifications and the Manufacturer's requirements, this shall be resolved. If this pre-roofing conference cannot be satisfactorily concluded without further inspection and investigation by any of the parties present, it shall be reconvened at the earliest possible time to avoid delay of the work. In no case should the work proceed without inspection of all roof deck areas and substantial agreement on all points.
2. The following are to be accomplished during the conference:
  - a. Review all Factory Mutual and Underwriters Laboratories requirements listed in the specifications and resolve any questions or conflicts that may arise.
  - b. Establish trade-related job schedules, including the installation of roof-mounted mechanical equipment.
  - c. Establish roofing schedule and work methods that will prevent roof damage.
  - d. Require that all roof penetrations and walls be in place prior to installing the roof.
  - e. Establish those areas on the job site that will be designated as work and storage areas for roofing operations.
  - f. Establish weather and working temperature conditions to which all parties must agree.
  - g. Establish acceptable methods of protecting the finished roof if any trades must travel across or work on or above any areas of the finished roof.
3. The Architect shall prepare a written report indicating actions taken and decisions made at this pre-roofing conference. This report shall be made a part of the project record and copies furnished the General Contractor, and the Owner.

#### 1.10 WARRANTY

A.Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish Warranty Period: 20 years from date of Substantial Completion.

B.Special Installer's Warranty: Specified form in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within 5 years from date of Substantial Completion.

C.Special Weathertight Warranty: Manufacturer's Platinum warranty in which manufacturer agrees to repair or replace roof panel assemblies that fail to remain weathertight within the



specified warranty period. Product Warranty Period: 5 years from date of Substantial Completion.

1. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such guarantees.
- D. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such guarantees.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

A. Basis of Design: Berridge or comparable product

### 2.2 CONCEALED-FASTENER, STANDING SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation. Unless more stringent requirements are indicated, comply with ASTM E 1514.

1. Basis-of-Design Product: Provide Cee-Lock Standing Seam
2. Material: Aluminum - 0.032
  - a. Texture: Smooth
  - b. Pan Coverage: 16 1/2"
  - c. Seam Height: 1 1/2"
  - d. KYNAR 500 PVDF
  - e. Color: As by architect from manufacturer's premium metallic colors

### 2.3 UNDERLAYMENT

B. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil- (1.0-mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied. Provide primer for adjoining concrete or masonry surfaces to receive underlayment.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Grace Ultra** or comparable product by one of the following:
  - a. Carlisle Coatings & Waterproofing, Inc.
  - b. Grace, W. R. & Co. - Conn.

- c. Henry Company.
- d. Johns Manville.
- e. Owens Corning.
- f. Polyguard Products, Inc.
- g. Protecto Wrap Company.

## 2.4 MISCELLANEOUS MATERIAL

A.Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Manufacturer shall provide or authorize all fasteners utilized with the sheet metal roofing system.

1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or screws spaced to resist wind uplift loads.

B.Sealing Tape: Pressure-sensitive, 100 percent solid polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape.

C.Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight.

D.Expansion-Joint Sealant: For hooked-type expansion joints, which must be free to move, provide non-setting, non-hardening, non-migrating, heavy-bodied polyisobutylene sealant.

E.Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat.

## 2.5 ACCESSORIES

A.Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated. All trim and flashing components shall be supplied in a minimum of 12'-0" lengths and shall conform to manufacturer's standard part dimensions and details.

1. 26 ga. SS clip base w/26 ga. SS stem designed to withstand negative-load requirements.
2. Closures: Closed-cell, expanded, cellular, rubber or cross linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
3. Sealants as recommended by manufacturer.
4. Fasteners as recommended by manufacturer.

B.Flashings and Trim: Formed from matching materials as sheet metal roof panel in gauges noted. Provide flashing and trim in heavier gauge materials as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal roofing.

## 2.6 EQUIPMENT

A.Manufacturer must maintain quality control and maintenance procedures of all equipment. Verification of quality control procedures must be validated by a 3<sup>rd</sup> party entity.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Metal Sales Manufacturing Corporation

## 2.7 FABRICATION

A.General: Fabricate sheet metal roofing and components to comply with details shown, manufacturers installation details and recommendations in SMACNA's "Architectural Sheet Metal Manual" and NRCA Waterproofing Manual that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the manufacturer's location to the greatest extent possible.

B.Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.

1. Fold and cleat eaves as required by manufacturer to insure weathertightness and wind uplift resistance.
2. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leak proof construction and wind uplift resistance.

D.Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

E.Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before manufacturer fabrication.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

A.Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
3. For the record, prepare written report for the General Contractor, endorsed by Installer, listing conditions detrimental to performance of work.

B.Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

C.Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A.Lay out and examine substrate before installation of sheet metal roofing. Space fasteners as required to resist design uplift, but not more than 24 inches o.c.

B.Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

## 3.3 UNDERLAYMENT INSTALLATION

C. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at all locations under shingles, also include areas listed below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches (89 mm). Lap ends not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Roll laps with roller. Cover underlayment within seven days.

1. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
2. Sidewalls: Return vertically against sidewall not less than 6 inches.
3. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Return vertically against penetrating element not less than 6 inches.
4. Roof Slope Transitions: Extend 18 inches (450 mm) on each roof slope.

### 3.4 INSTALLATION, GENERAL

A.General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Field cutting of sheet metal roofing by torch is not permitted.
2. Rigidly fasten ridge end of sheet metal roofing and allow for positive panel attachment as per manufacturer's recommendations. All flashing details shall accommodate thermal movement.
3. Provide metal closures at peaks, ridge, gable and hip caps.
4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
5. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.
6. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.

B.Fasteners: Use fasteners of size and length as required for compatibility with substrate.

1. Anchor roof system to structural deck

C.Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.

1. Separate sheet metal roofing from bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction. Interlock and overlap shingles and stagger end joints from shingles above and below according to shingle manufacturer's written instructions.

D.Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

### 3.5 ACCESSORY INSTALLATION

A.General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips,

and similar items.

2. Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual" and NRCA Waterproofing Manual. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B.Coordinate with installation of:

1. Rough Carpentry, as noted in Section 6
2. Sheet Metal Flashing and Trim, as noted in Section 7

C.Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

### 3.6 CLEANING AND PROTECTION

A.Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

### 3.7 FIELD QUALITY CONTROL

A.Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal roof panel installation, including accessories. Report results in writing.

B.Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C.Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 07411

## SECTION 07460 - SIDING

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

##### A. Section Includes:

- 1. Fiber-cement siding.

##### B. Related Sections:

- 1. Division 6 Section "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
- 2. Division 6 Section "Exterior Finish Carpentry" for wood and wood-based sidings and for exterior trim.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Samples for Initial Selection: For siding and soffit including related accessories.

- C. Samples for Verification: For each type, color, texture, and pattern required.

- 1. 12-inch- (300-mm-) long-by-actual-width Sample of siding.
- 2. 24-inch- (600-mm-) wide-by-36-inch- (900-mm-) high Sample panel of siding assembled on plywood backing.
- 3. 12-inch- (300-mm-) long-by-actual-width Sample of soffit.
- 4. 12-inch- (300-mm-) long-by-actual-width Samples of trim and accessories.

- D. Product Certificates: For each type of siding and soffit from manufacturer.

- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

- F. Research/Evaluation Reports: For each type of siding required, from the ICC

- G. Maintenance Data: For each type of siding and soffit and related accessories to include in maintenance manuals.

- H. Warranty: Sample of special warranty.

#### 4. QUALITY ASSURANCE

- A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- B. Source Limitations: Obtain siding and soffit, including related accessories, from single source from single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site

#### 5. DELIVERY, STORAGE, AND HANDLING

- A. Store materials in a dry, well-ventilated, weathertight place.

#### 6. COORDINATION

- A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

#### 7. WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and soffit that fail(s) in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including cracking, deforming
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: 25 years from date of Substantial Completion.

### 2.PRODUCTS

#### 1. FIBER-CEMENT SIDING

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
  - 1. Basis of Design: James Hardie. Or provide comparable provide products by one of the following:
    - a. Cemplank.
    - b. CertainTeed Corp.
    - c. GAF Materials Corporation.
    - d. MaxiTile, Inc; a California corporation.
    - e. Nichiha Fiber Cement.



2. Panel: 48-inch wide sheets with smooth texture.
3. Lap Siding: Basis of Design Hardie Plank smooth texture 7" exposure
4. Factory Priming: Manufacturer's standard acrylic primer.

## 2. ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
  1. Provide accessories made from same material as adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
  1. Moldings and trim.
    - a. See Drawings for sizes
- C. Flashing: Provide aluminum flashing complying with Division 7 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
- D. Fasteners:
  1. For fastening to wood, use [siding nails] [ribbed bugle-head screws] of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
  2. For fastening fiber cement, use [hot-dip galvanized] [stainless-steel] fasteners.

## 3. EXECUTION

### 1. EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 2. PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

### 3. INSTALLATION

- A. General: Comply with siding and soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
  1. Do not install damaged components.
  2. Center nails in elongated nailing slots without binding siding to allow for thermal movement.

- B. Install fiber-cement siding and related accessories.
  - 1. Install fasteners per manufacturer's requirements to meet Wind Load
- C. Install joint sealants as specified in Division 7 Section "Joint Sealants" and to produce a weathertight installation.

4. ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07460

## SECTION 07620 - SHEET METAL FLASHING AND TRIM

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

##### A. Section Includes:

##### 1. Formed Products:

- a. Formed steep-slope roof sheet metal fabrications.
- b. Formed window sill pans.

##### B. Related Sections:

- 1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
- 2. Division 7 Section "Metal Roof Panels" for installing sheet metal flashing and trim with metal roofing.

#### 3. PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Fabricate and install roof edge flashing capable of resisting wind design pressures per structural drawings and according to recommendations in FMG Loss Prevention Data Sheet 1-49:
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) , material surfaces.
- D. Fabricate and install roof edge flashing and copings capable of resisting the following forces:
  - 1. For velocity pressures of all wind zones, see structural drawings.

## 4. SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
  - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
  - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
  - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - 4. Details of termination points and assemblies, including fixed points.
  - 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
  - 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
  - 7. Details of special conditions.
  - 8. Details of connections to adjoining work.
  - 9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
  - 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
  - 3. Accessories and Miscellaneous Materials: Full-size Sample.
  - 4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.
- E. Qualification Data: For qualified fabricator.
- F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- G. Warranty: Sample of special warranty.

5. QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
- D. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
  - 2. Review methods and procedures related to sheet metal flashing and trim.
  - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
  - 4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
  - 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

6. DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

7. WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## 2.PRODUCTS

### 1. SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
  - 1. Exposed Coil-Coated Finishes:
    - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Color: As selected by Architect from manufacturer's full range.
  - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

### 2. UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet at roof: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
  - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
  - 3. Products: Subject to compliance with requirements, provide the following provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
    - b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
    - c. Henry Company; Blueskin PE200 HT.
    - d. Metal-Fab Manufacturing, LLC; MetShield.
    - e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

### 3. MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

#### 4. FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 2. Obtain field measurements for accurate fit before shop fabrication.
  - 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

## 5. STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
  - 1. Aluminum: 0.032 inch (0.81 mm) thick.
- B. Drip Edges: Fabricate from the following materials:
  - 1. Aluminum: 0.032 inch (0.81 mm) thick.
- C. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
  - 1. Aluminum: 0.032 inch (0.81 mm) thick.
- D. Counterflashing: Fabricate from the following materials:
  - 1. Aluminum: 0.032 inch (0.81 mm) thick.
- E. Flashing Receivers: Fabricate from the following materials:
  - 1. Aluminum: 0.032 inch (0.81 mm) <Insert thickness> thick.

## 3.EXECUTION

### 1. EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.



- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2. UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

## 3. INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
  - 5. Install sealant tape where indicated.
  - 6. Torch cutting of sheet metal flashing and trim is not permitted.
  - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
  - 1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as shown and as required for watertight construction.
  - 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
  - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
  - 1. Do not solder metallic-coated steel and aluminum sheet.
  - 2. Pre-tinning is not required for zinc-tin alloy-coated stainless steel and zinc-tin alloy-coated copper.
  - 3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
  - 4. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

#### 4. ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of

4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant interlocking folded seam or blind rivets and sealant anchor and washer at 36-inch (900-mm) centers.

- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric butyl sealant and clamp flashing to pipes that penetrate roof.

## 5. WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

## 6. MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

## 7. ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

## 8. CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

## SECTION 07920 - JOINT SEALANTS

### 1. GENERAL

#### 1. SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
  - 1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 2. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
- B. See Division 8 Section "Glazing" for glazing sealants.

#### 2. PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

#### 3. SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Joint Sealant Schedule: Include the following information:
  - 1. Joint sealant application, joint location, and designation.
  - 2. Joint sealant manufacturer and product name.
  - 3. Joint sealant formulation.
  - 4. Joint sealant color.
- D. Preconstruction field test reports.
- E. Compatibility and adhesion test reports.
- F. Product certificates.

#### 4. QUALITY ASSURANCE

- A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to

ASTM C 1087 and manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

- B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.
- C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
  - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

## 5. WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## 2.PRODUCTS

### 1. MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

### 2. MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.
4. Other Sealant Primers: 750 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 3. ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Single-Component Neutral-Curing Silicone Sealant ES-1.

#### 1. Products:

- a. Dow Corning Corporation; 799.
- b. GE Silicones; UltraGlaze SSG4000.
- c. GE Silicones; UltraGlaze SSG4000AC.
- d. Polymeric Systems Inc.; PSI-631.
- e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
- f. Tremco; Proglaze SG.
- g. Tremco; Spectrem 2.
- h. Tremco; Tremsil 600.

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).

5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

F. Single-Component Nonsag Urethane Sealant ES-2:

#### 1. Products:

- a. Bostik Findley; Chem-Calk 900.

- b. Bostik Findley; Chem-Calk 915.
  - c. Bostik Findley; Chem-Calk 916 Textured.
  - d. Bostik Findley; Chem-Calk 2639.
  - e. Pecora Corporation; Dynatrol I-XL.
  - f. Polymeric Systems Inc.; Flexiprene 1000.
  - g. Polymeric Systems Inc.; PSI-901.
  - h. Schnee-Morehead, Inc.; Permthane SM7100.
  - i. Schnee-Morehead, Inc.; Permthane SM7108.
  - j. Schnee-Morehead, Inc.; Permthane SM7110.
  - k. Sika Corporation, Inc.; Sikaflex 15LMg
  - l. Tremco; DyMonic.
  - m. Tremco; Vulkem 921.
  - n. Tremco; Vulkem 931.
- 2. Type and Grade: S (single component) and NS (nonsag).
  - 3. Class: 100/50
  - 4. Use Related to Exposure: NT (nontraffic).
  - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

G. Single-Component Pourable Urethane Sealant ES-3:

- 1. Products:
  - a. Bostik Findley; Chem-Calk 950.
  - b. Pecora Corporation; Urexpan NR-201.
  - c. Polymeric Systems Inc.; Flexiprene 952.
  - d. Schnee-Morehead, Inc.; Permthane SM7101.
  - e. Tremco; Tremflex S/L.
  - f. Tremco; Vulkem 45.
- 2. Type and Grade: S (single component) and P (pourable).
- 3. Class: 25.
- 4. Use Related to Exposure: T (traffic).
- 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

4. LATEX JOINT SEALANTS

A. Latex Sealant LS-1: Comply with ASTM C 834, Type O P, Grade NF.

B. Products:

- 1. Bostik Findley; Chem-Calk 600.
- 2. Pecora Corporation; AC-20+.
- 3. Schnee-Morehead, Inc.; SM 8200.
- 4. Sonneborn, Division of ChemRex Inc.; Sonolac.
- 5. Tremco; Tremflex 834.



## 5. ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## 1. Products:

- a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
- b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

## 6. JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 7. MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

### 3.EXECUTION

#### 1. PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
    - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
  - 2. Remove laitance and form-release agents from concrete.
    - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

#### 2. INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3. JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application JS-1: Exterior horizontal nontraffic and traffic, isolation and contraction joints in cast-in-place concrete slabs.
  - 1. Joint Sealant: Single-component pourable urethane sealant ES3
  - 2. Joint-Sealant Color: Match concrete.
- B. Joint-Sealant Application JS-2: Exterior vertical and horizontal nontraffic joints between plant-precast architectural concrete units.
  - 1. Joint Sealant: Single-component nonsag urethane sealant ES2
  - 2. Joint-Sealant Color: Match pre-cast units.
- C. Joint-Sealant Application JS-3: Exterior vertical control and expansion joints in unit masonry.
  - 1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
  - 2. Joint-Sealant Color: Match masonry.
  - 3.
- D. Joint-Sealant Application JS-4: Exterior vertical joints between different materials listed above.
  - 1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
  - 2. Joint-Sealant Color: Match adjacent materials.

- E. Joint-Sealant Application JS-5: Exterior perimeter joints between exterior surfaces and frames of doors, windows and louvers.
  - 1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
  - 2. Joint-Sealant Color: Verify with Architect.
- F. Joint-Sealant Application JS-6 Other exterior joints in vertical and horizontal nontraffic surfaces.
  - 1. Joint Sealant: Single-component nonsag urethane sealant <Insert joint sealant> ES-2.
  - 2. Joint-Sealant Color: Verify with Architect.
- G. Joint-Sealant Application JS-7: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
  - 1. Joint Sealant: Single-component nonsag urethane sealant ES-2.
  - 2. Joint-Sealant Color: Match adjacent surfaces.
- H. Joint-Sealant Application JS-8: Interior perimeter joints of exterior openings.
  - 1. Joint Sealant: Latex sealant LS1
  - 2. Joint-Sealant Color: Match adjacent walls.
- I. Joint-Sealant Application JS-9: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
  - 1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant ES-1.
  - 2. Joint-Sealant Color: Match plumbing fixture.
- J. Joint-Sealant Application JS-10: Vertical joints on exposed surfaces of interior partitions.
  - 1. Joint Sealant: Latex sealant LS1
  - 2. Joint-Sealant Color: Match Adjacent surfaces.
- K. Joint-Sealant Application JS-11: Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
  - 1. Joint Sealant: Latex sealant LS1
  - 2. Joint-Sealant Color: Match Adjacent wall.
- L. Joint-Sealant Application JS-12: Interior control, expansion, and isolation joints in horizontal traffic surfaces of flooring.
  - 1. Joint Sealant: Single-component pourable urethane sealant ES-3.
  - 2. Joint-Sealant Color: Verify with Architect.

END OF SECTION 07920

## SECTION 08110 - STEEL DOORS AND FRAMES

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

##### A. Section Includes:

- 1. Standard hollow metal doors and frames.

##### B. Related Sections

- 1. Division 4 Section "Unit Masonry Assemblies" for embedding anchors for hollow metal work into masonry construction.
- 2. Division 8 Section "Door Hardware" "Door Hardware (Scheduled by Describing Products)" for door hardware for hollow metal doors.
- 3. Division 9 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
- 4. Division 16 Sections for electrical connections including conduit and wiring for door controls and operators.

#### 3. DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
- C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

#### 4. SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
2. For the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) <Insert size> to demonstrate compliance with requirements for quality of materials and construction:
  - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
  - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

E. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

F. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

## 5. QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Preinstallation Conference: Conduct conference at Project site.

6. DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

7. PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

8. COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

2.PRODUCTS

1. MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amweld Building Products, LLC.
  - 2. Benchmark; a division of Therma-Tru Corporation.
  - 3. Ceco Door Products; an Assa Abloy Group company.
  - 4. Curries Company; an Assa Abloy Group company.
  - 5. Deansteel Manufacturing Company, Inc.
  - 6. Firedoor Corporation.
  - 7. Fleming Door Products Ltd.; an Assa Abloy Group company.
  - 8. Habersham Metal Products Company.
  - 9. Karpen Steel Custom Doors & Frames.
  - 10. Kewanee Corporation (The).
  - 11. Mesker Door Inc.
  - 12. Pioneer Industries, Inc.
  - 13. Security Metal Products Corp.

14. Steelcraft; an Ingersoll-Rand company.
15. Windsor Republic Doors.

## 2. MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
  1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- H. Glazing: Comply with requirements in Division 8 Section "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 3. STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
  1. Design: Flush panel.
  2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
    - a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W) when tested according to ASTM C 1363.



- 1) Locations: Exterior doors.
3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
  - a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from galvanized steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  1. Level 1 and Physical Performance Level C (Standard Duty), Model 2 (Seamless).
    - a. Width: 1-3/4 inches (44.5 mm).
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
4. STANDARD HOLLOW METAL FRAMES
  - A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
  - B. Exterior Frames: Fabricated from galvanized steel sheet.
    1. Fabricate frames with mitered or coped corners.
    2. Fabricate frames as full profile welded unless otherwise indicated.
    3. Frames for Level 1 Steel Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
    4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
    5. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
    6. Frames for Level 4 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet.
  - C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
    1. Fabricate frames with mitered or coped corners.
    2. Fabricate frames as full profile welded unless otherwise indicated.
    3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
    4. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
    5. Frames for Borrowed Lights: Same as adjacent door frame.
  - D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

## 5. FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
  - 2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
  - 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

## 6. STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.
- D. Terminated Stops: Where indicated on interior door frames, terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
  - 1. Provide terminated stops where indicated.

## 7. ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

## 8. FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical,

fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  - 2. Glazed Lites: Factory cut openings in doors.
  - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 6. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
      - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
      - 5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
    - b. Compression Type: Not less than two anchors in each jamb.
    - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  - 7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

- b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
  - E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
  - F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
    - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
    - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
    - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
    - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.
  - G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
    - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
    - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
    - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
    - 4. Provide loose stops and moldings on inside of hollow metal work.
    - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
9. STEEL FINISHES
- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
    - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

### 3.EXECUTION

- 1. EXAMINATION
  - A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2. PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

## 3. INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

- g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
  - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
- 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
- 6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
- 7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

4. ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

## SECTION 08161 - FIBERGLASS DOORS

### 1. GENERAL

#### 1. SECTION INCLUDES

- A. Fiberglass Entrance Doors and Sidelights
- B. Glazing

#### 2. RELATED SECTIONS

- A. Division 1 - General Conditions, Supplementary Conditions
- B. Division 8 - Finish Hardware
- C. Division 8 - Glass and Glazing

#### 3. REFERENCES

##### A. American Architectural Manufacturer Association (AAMA)

- 1. AAMA 1304; Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems.

##### B. ASTM International

- 1. ASTM E283; Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
- 2. ASTM E330; Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Pressure Difference
- 3. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- 4. ASTM E547; Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference
- 5. ASTM E 1886; Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- 6. ASTM E 1996; Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

##### C. National Fenestration Rating Council (NFRC)

- 1. NFRC 100; Procedure for Determining Fenestration Thermal Properties
- 2. NFRC 200; Solar Heat Gain Coefficient and Visible Transmittance



D. Florida Building Code

1. FBC Section 1626: High Velocity Hurricane Zones – Impact Tests for Windborne Debris

4. QUALITY ASSURANCE

A. General Qualifications:

1. Manufacturer Qualifications: A company that specializes in manufacturing FRP doors and frames with a minimum of 30 years experience.
2. Quality Assurance: Obtain all FRP doors and FRP frames from a single manufacturer to ensure consistent quality.
3. Quality Assurance: Hardware and accessories for all FRP doors and FRP frames shall exactly adhere to the Architect's specification.
4. Quality Assurance: Glass for windows in doors shall be furnished per the Architect's instructions and specifications.

B. Regulatory Requirements:

1. Fire-rated door, panel and frame construction conforms to products tested under ASTM E152, UL10C & NFPA 252.
2. Install doors, panels and frames conforming to NFPA 80 for fire-rated class, ANSI A117.1 specifications for handicap accessibility, ADA requirements, ANSI A250.4-2011 cycle swing in excess of 1,000,000 cycles with no failure of any design features of the door.
3. Flame Spread: All rated FRP component parts, including the finish, shall have a flame spread classification of 25 or less per ASTM E84 and shall be self extinguishing per ASTM D635, unless operating conditions dictate otherwise.
4. Products manufactured—that have passed the Florida Building Code (FBC), including Miami-Dade High Velocity Hurricane Zone (HVHZ).

5. DESIGN REQUIREMENTS

A. Structural Requirements – Provide doors capable of complying with requirements indicated:

1. Design pressure: As indicated on Structural drawings.

B. Impact (Windborne-Debris) Resistance

1. Doors capable of resisting impact from windborne debris, when tested in accordance with ASTM E1886 and ASTM E1996.
2. Provide doors that have been tested in accordance with FBC Section 1626.

C. NFRC Requirements – Provide doors capable of complying with the following total door ratings:

1. U-Factor: 0.40 in accordance with NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): 0.25 in accordance with NFRC 200.

6. SUBMITTALS

- A. Refer to Section 01330 Submittal Procedures.
- B. Product Data: Submit door manufacturer current product literature, including installation instruction.
- C. Samples: Provide finish samples for all products.
- D. Quality Assurance Submittals
  1. Design Data: Provide manufacturer test report numbers indicating product compliance with indicated requirements.
  2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
- E. Closeout Submittals
  1. Refer to 01770 Closeout Procedures.

7. DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01600 Product Requirements.
- B. Deliver doors, materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store doors as recommended by manufacturer.

8. WARRANTY

- A. Manufacturer standard warranty indicating that doors will be free from material and workmanship defects from the date of substantial completion for the time periods indicated below:
  1. Door System: 10 Years.

2.PRODUCTS

1. MANUFACTURER

- A. BASIS OF DESIGN: SPECIAL LITE SL-20 FRP DOOR
- B. Corrim
- C. MDI, Metropolitan Door Industries
- D. Special Lite

- E. Other Approved Equal
  - 2. MATERIALS
    - A. Stiles and Rails: FRP/Aluminum
  - 3. FIBERGLASS ENTRANCE DOORS
    - A. Door Style: 2 Lite with Intermediate rail with Insulated Glass.
    - B. Finish
      - a. Color: As selected by Architect from Manufacturers full range
    - C. Hardware: Prep door for door hardware per Section 08710.
  - 4. CONSTRUCTION ACCESSORIES
    - A. Frames
      - 1. Aluminum tube frame by door manufacturer
    - B. Flashing
      - 1. Refer to Section 07600 Flashing and Sheet Metal.
    - C. Sealants
      - 1. Refer to Section 07920 Joint Sealants.
      - 2. Provide manufacturer recommended sealants maintain watertight conditions.
  - 5. FABRICATION
    - A. Skins are adhered to engineered wood frames with core materials and bonding agents that permanently lock skin to frame.
- 3.EXECUTION
- 1. GENERAL
    - A. Install doors in accordance with manufacturer's installation guidelines and recommendations.
  - 2. EXAMINATION
    - A. Inspect door prior to installation.

- B. Inspect rough opening for compliance with door manufacturer recommendations. Verify rough opening conditions are within recommended tolerances.

3. INSTALLATION

- A. Doors and frames will be delivered in individual cartons with the identifying mark number listed on each carton.
- B. Install FRP doors, frames and accessories in accordance with manufacturers printed instructions, final shop drawings, NFPA 80 standards at fire rated openings and / or HVHZ standards for FBC labeled openings.
- C. Provide clearance for doors of 1/8 inch at jambs and heads; 1/4 inch clearance above threshold.
- D. Fire labeled doors, frames and accessories must be installed by qualified, licensed installers adhering to the latest version of NFPA 80.

4. ADJUSTING

- A. At substantial completion, adjust all operable components to ensure proper installation. Doors shall function smoothly and swing freely without binding. Doors shall remain open at any angle without being affected by gravitational influence

5. PROTECTION

- A. Protect installed doors from damage.

6. CLEANING

- A. Per requirements of Specification Section 01770 Closeout Procedures
- B. Remove dirt and excess sealant from exposed surfaces. Follow the manufacturer's recommended cleaning techniques and procedures for cleaning all surfaces. Only use cleaning products that will not scratch or damage the surfaces and are recommended by the manufacturer.

END OF SECTION 08161

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**SECTION 08331**  
**OVERHEAD COILING DOORS**

**PART 1      GENERAL**

1.01    RELATED DOCUMENTS

- A.    Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02    SUMMARY

- A.    This Section includes the following types of overhead coiling doors:
  - 1.    Insulated service doors.
  - 2.    Non-Insulated service doors.
- B.    Related Sections include the following:
  - 1.    Division 8 Section "Door Hardware" for lock cylinders and keying.
  - 2.    Division 16 Electrical Wiring

1.03    DEFINITIONS

- A.    Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.04    PERFORMANCE REQUIREMENTS

- B.    Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
  - 1.    Wind Load: Uniform pressure (velocity pressure) of **20 lbf/sq. ft.**, acting inward and outward.
- C.    Operation-Cycle Requirements: Design overhead coiling door components and operator to operate for not less than 20,000 cycles.
  - 1.    Include tamperproof cycle counter.

1.05    SUBMITTALS

- B.    Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual

## OVERHEAD COILING DOORS

components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
  2. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
1. Curtain Slats: 12-inch length.
- D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

### 1.06 QUALITY ASSURANCE

- A. Manufacturer: Rolling doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of rolling doors.
- B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.
- C. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
1. Obtain operators and controls from the overhead coiling door manufacturer.
- D. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
1. Atlas Door Corp.; Div. of Clopay Building Products Co.
  2. The Cookson Company.
  3. Cornell Iron Works Inc.
  4. McKeon Rolling Steel Door Company, Inc.
  5. Overhead Door Corporation.
  6. Raynor Garage Doors.
  7. Wayne-Dalton Corp.

**Exterior Doors:** Series 625 with F-265I slat, tan color, by Overhead Door Corporation, or approved equal.

**Interior Doors:** Series 610 with F-265 slat, tan color, by Overhead Door Corporation, or approved equal.

**2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION**

- A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Aluminum Door Curtain Slats. **ASTM B 209** or **ASTM B 221**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
    - a. Provide slats equal to those specified above.
  2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
  3. Inside Curtain Slat Face: To match material of outside metal curtain slat and as follows:



## OVERHEAD COILING DOORS

- a. Aluminum Sheet Thickness: Same thickness as outside aluminum curtain face slat.
- B. Endlocks: Malleable-iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets, or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Windlocks: Malleable-iron castings secured to curtain slats with galvanized rivets or high-strength nylon, as required to comply with wind load.
- D. Bottom Bar: Consisting of 2 angles, each not less than **1-1/2 by 1-1/2 by 1/8 inch** thick, either galvanized or stainless-steel or aluminum extrusions to suit type of curtain slats.
  - 1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior door.
- E. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than **3/16-inch-** thick, galvanized steel sections complying with **ASTM A 36**, and ASTM A 123. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain and a continuous bar for holding windlocks.

### 3.03 HOODS AND ACCESSORIES

- A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
  - 1. Fabricate aluminum hoods, complying with **ASTM B 209**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and not less than **0.032 inch** thick, for aluminum doors.
  - 2. Shape: Round.
  - 3. Exterior Mounted Door: Fabricate hood with sealant-joint bead profile for applying joint sealant.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and at top of exterior doors, unless

## OVERHEAD COILING DOORS

otherwise indicated. At door head, use **1/8-inch-** thick, replaceable, continuous sheet secured to inside of curtain coil hood.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
  2. In addition, provide replaceable, adjustable, continuous, flexible, **1/8-inch-** thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.
- C. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
1. Provide pull-down straps or pole hooks for doors more than **84 inches** high.
- D. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
1. Locking Bars: Single-jamb side, operable from inside only.
  2. Provide Lock cylinder for electric operation with interlock switch.
- E. Chain Lock Keeper: Suitable for padlock.
- F. Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

### 2.04 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft.** of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.05 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 ALUMINUM FINISHES

- A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. Provide manufacturer's standard bronze anodized finish.

2.07 ELECTRIC DOOR OPERATORS

- A. Provide electric door operators for the following doors: #127, #128, #129, #130
- B. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- C. Comply with NFPA 70.
- D. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- E. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- F. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
- G. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft, gear-head hoist-type door operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and auxiliary chain-hoist and floor level disconnect.

- H. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than **2/3 fps** or more than **1 fps**, without exceeding nameplate ratings or considering service factor.

Electric motor: Provide Model RG+ by Overhead Door Corporation or approved equal.

1. Type: Polyphase, medium-induction type.
  2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
  3. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
  4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
  5. Provide totally enclosed, nonventilated or fan-cooled motors, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.
- I. Remote-Control Station: Provide momentary-contact, 3-button control station with push-button controls labeled "Open," "Close," and "Stop."
1. Provide exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- J. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
    - a. Self-Monitoring Type: Provide self-monitoring sensor designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door operates to close only with constant pressure on close button.
- K. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- L. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

**3.02 ADJUSTING**

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

**3.03 DEMONSTRATION**

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
  - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
  - 3. Review data in the maintenance manuals. Refer to Division 1 Sections "Contract Closeout." or "Operation and Maintenance Data."
  - 4. Schedule training with Owner with at least 7 days' advance notice.

**END OF SECTION**

## SECTION 08411 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. Section Includes:

- 1. Interior storefront entrance framing.

#### 3. DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

#### 4. PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
  - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
  - 2. Dimensional tolerances of building frame and other adjacent construction.
  - 3. Failure includes the following:
    - a. Deflection exceeding specified limits.
    - b. Thermal stresses transferring to building structure.
    - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    - d. Glazing-to-glazing contact.
    - e. Noise or vibration created by wind and by thermal and structural movements.
    - f. Loosening or weakening of fasteners, attachments, and other components.
    - g. Sealant failure.
    - h. Failure of operating units.
- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:

1. Wind Loads: As indicated on Structural Drawings.
2. Seismic Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed  $L/175$  of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to  $3/4$  inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to  $L/360$  of clear span or  $1/8$  inch (3.2 mm), whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa) 6.24 lbf/sq. ft. (300 Pa).

5. SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Qualification Data: For qualified Installer.
- G. Preconstruction Test Reports: For sealant.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- I. Field quality-control reports.
- J. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- K. Warranties: Sample of special warranties.
6. QUALITY ASSURANCE
  - A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
  - B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
  - C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
  - D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
    1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
  - E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
  - F. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
  - G. Preinstallation Conference: Conduct conference at Project site.



7. PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

8. WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Noise or vibration caused by thermal movements.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- d. Adhesive or cohesive sealant failures.
- e. Water leakage through fixed glazing and framing areas.
- f. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

9. MAINTENANCE SERVICE

- A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

## 2.PRODUCTS

### 1. MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Kawneer IR501 Exterior Storefront Framing** or comparable product by one of the following:
1. Arcadia, Inc.
  2. Arch Aluminum & Glass Co., Inc.
  3. CMI Architectural
  4. Commercial Architectural Products, Inc.
  5. EFCO Corporation.
  6. Kawneer North America; an Alcoa company.
  7. Leed Himmel Industries, Inc.
  8. Pittco Architectural Metals, Inc.
  9. TRACO.
  10. Tubelite.
  11. United States Aluminum.
  12. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
  13. YKK AP America Inc.

### 2. MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
  2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Structural Profiles: ASTM B 308/B 308M.
  5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

### 3. FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Nonthermal Thermally improved Thermally broken.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: As indicated.

## ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
  - 1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 4. GLAZING SYSTEMS

- A. Glazing: As specified in Division 8 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

## 5. ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."
  - 1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

6. FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
  - 4. Physical and thermal isolation of glazing from framing members.
  - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 6. Provisions for field replacement of glazing from exterior.
  - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

7. ALUMINUM FINISHES

- A. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604 AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range including premium colors.

3.EXECUTION

1. EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2. INSTALLATION

### A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

### B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

### C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

### D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

### E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

### F. Install glazing as specified in Division 8 Section "Glazing."

### G. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

## 3. ERECTION TOLERANCES

### A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:
  - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
  - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

### B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

END OF SECTION 08411

**SECTION 08421**  
**ALUMINUM FLOOR HATCHES**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.      This section covers the work necessary to furnish, install, and complete the floor hatches specified herein.

1.02    GENERAL

- A.      Like items of materials provided hereunder shall be the end products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
- B.      See    CONDITIONS    OF    THE    CONTRACT    and    Section    GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this project.

**PART 2      PRODUCTS**

2.01    GENERAL

- A.      The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.
- B.      Unless otherwise indicated, all materials shall conform to the latest issue of the following ASTM Specifications:

<u>Item</u>	<u>ASTM Specification</u>
Anchor Bolts & Nuts:	
Carbon Steel	A 307 or A 36
Stainless	A 193, Type 316
Galvanized Steel Bolts	A 153, Zinc Coating for
& Nuts	A 307 or A 36
Flat Washers (Unhardened)	F 844, Use A 153 for Zinc
	Coating
Threaded Bars	A 36
Connection Bolts for	A 2024-T4; or use
Aluminum	appropriate stainless steel

2.02 FLOOR HATCH

- A. Provide and install aluminum floor hatches with minimum opening angle equal to 90°. Single or double leaf, “shoe-box” type access hatch fabricated in accordance with details shown on the Drawings. Embedded waterstop collar assembly shall be of continuously welded, Alloy 6061-T6 aluminum construction. Leaf top assembly shall be of continuously welded, Alloy 6061-T6 aluminum construction. All exposed welds shall be ground smooth. Manufacturer shall be Bilco, Halliday, or equal.

2.03 ELECTROLYTIC PROTECTION

- A. Where aluminum is in contact with dissimilar metals, or to be embedded in masonry or concrete, protect surfaces with bituminous paint in accordance with Section PAINTING. Allow paint to dry before installation of the material. Protect painted surfaces during installation; should coating become marred, prepare and touch up surface per paint manufacturer’s instructions.

2.04 PREPARATION FOR SHIPMENT

- A. Insofar as is practical, the items provided hereunder shall be factory assembled. The parts and assemblies that are of necessity shipped unassembled, shall be packaged and clearly tagged in a manner that will protect the materials from damage, and facilitate the identification and final assembly in the field.

**PART 3 EXECUTION**

3.01 GENERAL

- A. Workmanship and finish of all metalwork specified under this section shall be the highest grade and equal to the best practice of modern shops for the respective work. Exposed surfaces shall have smooth finish and sharp, well-defined lines. Provide all necessary rabbets, lugs, and brackets so that the work can be assembled in a neat, substantial manner. Conceal fastenings where practical. Drill metalwork and countersink holes as required for attaching hardware or other materials. Fabricate materials as specified. Weld connections, except where bolting is directed. Items requiring special fabrication methods are mentioned herein. Fabrication of all other items shall be of equal quality. Methods of fabrication not otherwise specified or shown shall be adequate for the stresses and as directed by the Engineer.
- B. Grind all exposed edges of welds smooth. All sharp edges shall be rounded to a 1/8-inch minimum radius; all burrs, jagged edges, and surface defects shall be ground smooth.

- C. Welds and adjacent areas shall be prepared such that there is (1) no undercutting or reverse ridges on the weld bead, (2) no weld spatter on or adjacent to the weld or any other area to be painted, and (3) no sharp peaks or ridges along the weld bead. All embedded pieces of electrode or wire shall be ground flush with the adjacent surface of the weld bead.
  - 1. Aluminum: Fabricate aluminum as shown, and in accordance with the Aluminum Association Standards and the manufacturer's recommendations as approved. Grind smooth sheared edges exposed in the finished work.

### 3.02 WELDING

- A. The technique of welding employed, appearance, quality of welds made, and the methods of correcting defective work shall conform to codes for Arc and Gas Welding in Building Construction of the AWS and AISC. Surfaces to be welded shall be free from loose scale, rust, grease, paint, and other foreign material, except that mill scale which will withstand vigorous wire brushing may remain. A light film of linseed oil may likewise be disregarded. No welding shall be done when the temperature of the base metal is lower than zero degrees F. Finished members shall be true to line and free from twists.
- B. All welding operators shall be qualified in accordance with the requirements of current AWS Standard Qualification Procedure D1.1, Chapter 5, and welders of structural and reinforcing steel shall be certified for all positions of welding in accordance with such procedure. Qualification tests shall be run by a recognized testing laboratory at the Contractor's expense.
- C. All welding operators shall be subject to examination for re-qualification using the equipment, materials, and electrodes employed in the execution of the Contract work. Such re-qualification, if ordered by the Engineer, shall be done at the expense of the Contractor.
  - 1. Aluminum: Aluminum shall be welded with Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) processes in accordance with the manufacturer's recommendations as approved, and in accordance with the recommendations of the American Welding Society contained in the Welding Handbook, as last revised. Grind smooth all exposed aluminum welds.

### 3.03 INSTALLATION OF FABRICATED METALWORK

- A. Install in accordance with the shop drawings, the Drawings, and these Specifications. Perform field welding and erection work by skilled mechanics. Install fabricated metalwork plumb or level as applicable. The completed installations shall, in all cases, be rigid, substantial, and neat in appearance. Erect structural steel in accordance with the applicable portions of AISC Code of



## ALUMINUM FLOOR HATCHES

Standard Practice, except as modified. Install commercially manufactured products in accordance with manufacturer's recommendations as approved.

- B. Aluminum: Erection of aluminum shall be in accordance with the Aluminum Association. Mill markings shall not be removed from concealed surfaces. Exposed surfaces not otherwise coated shall have the inked or painted identification marks removed after the material has been inspected and approved by the Engineer.

### 3.04 ANCHOR BOLTS

- A. All anchor bolts shall be accurately located and held in place with templates at the time the concrete is poured.

### 3.05 CONCRETE ANCHORS

- A. Installation shall not begin until the concrete or masonry receiving the anchors has attained its design strength. An anchor shall not be installed closer than six times its diameter to either an edge of the concrete or masonry, or to another anchor, unless specifically detailed otherwise on the Drawings. Install in strict conformance with manufacturer's written instructions. Use manufacturer's recommended drills and equipment.
- B. Epoxy Anchors: Do not install when temperature of concrete is below 35 degrees F or above 110 degrees F.

**END OF SECTION**

## SECTION 08710 - DOOR HARDWARE

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:
  - 1. Commercial door hardware for the following:
    - a. Swinging doors.
    - b. Other doors to the extent indicated.
- B. Related Sections include the following:
  - 1. Division 8 Section "Flush Panel Wood Doors".
  - 2. Division 8 Section "Aluminum Framed Entrances and Storefronts"
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
  - 1. Pivots, thresholds, weather stripping and cylinders for locks specified in other Sections.

#### 3. DOOR HARDWARE ALLOWANCE

- A. Door Hardware Selection: Furnish door hardware selected by Architect, in quantities specified in this Section and in Division 1 Section "Allowances."
- B. Allowance Bidding: After Architect selects door hardware and issues the door hardware sets, request bids for products and materials.
- C. Allowance Award: Architect will select bid from bids furnished by Contractor. Award purchase order to bidder selected.
- D. Allowance Adjustment: A Change Order will be issued to adjust difference between door hardware allowance and selected bid from door hardware Installer.
- E. Installation: General types and approximate quantities of door hardware are indicated in the list of door hardware sets to provide a basis for the cost of installation and other Work that is part of the Contract Sum but not included in door hardware allowance.

## 4. SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.
- C. Qualification Data: For Architectural Hardware Consultant.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks latches delayed-egress locks and closers.
- E. Warranty: Special warranty specified in this Section.
- F. Other Action Submittals:
  - 1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    - b. Content: Include the following information:
      - 1) Identification number, location, hand, fire rating, and material of each door and frame.
      - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
      - 3) Complete designations of every item required for each door or opening including name and manufacturer.
      - 4) Fastenings and other pertinent information.
      - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
      - 7) Mounting locations for door hardware.
      - 8) Door and frame sizes and materials.
      - 9) List of related door devices specified in other Sections for each door and frame.
    - c. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.
  - 2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

5. QUALITY ASSURANCE

- A. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 UBC Standard 7-2.

6. DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

7. COORDINATION

- A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

8. WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

9. MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## 2.PRODUCTS

1. Manufacturers
  - A. Product: Subject to compliance with requirements, Provide the product named for each door hardware item indicated in Door Hardware Schedule.
    - a. Basis-o Design product: Product named for each door hardware item indicated in door hardware sets establishes the basis of design. Provide either the named product or a comparable product by on of the manufacturers specified for each type of hardware set.
    - b. Products Manufacture specified acceptable equal. Hinges Iveshager, Stanley Lockset Schlage no substitutions keypad lockset electronics no substitutions exit devices Von Duprin as series Stanley APEX Falcon 24closerSLCN 1461 FCSargent 351  
Falcon SC71 overhead stops Glynn Johnson, Rixson, Ashpulls, Stops Iveshager, Rockwood flushbolts Iveshager, Rockwood thresholds / Seals National Guardhager, Pemko, Zeropower Transfers/Suppliesvon DuprinStanley, FalconNauto, Operators Lonna Substitutions 2.2 Door Hardware
  - 1) Scheduled door Hardware: Provide door hardware according to door hardware sets. Manufacturers' names are abbreviated.
2. Hinges
  - A. General: Except for hinges and pivots to be installed entirely into wood doors and frames, provide only template-produced units.
  - B. Hinge base metal: unless otherwise indicated, provide the following:
    - 1) Exterior Hinges: Stainless steel with stainless steel pin.
    - 2) Interior hinges: Steel with steel pin.
  - C. Non-removable pins: Provide set screw in hinge barrel that prevent removal of pin while door is closed; for out swinging exterior doors.
  - D. Screws: Phillips flat head screws; screw heads finished to match surface of hinges.
  - E. Metal Doors and frames: Machine screws (drilled and tapped holes).
3. Mechanical locks and latches
  - A. Cylindrical Locks:
    1. Locks shall be ANSI A156.2, Series 4000 Grade 1 UL Listed for 3-hour doors. Manufactured from heavy gauge cold rolled steel mechanisms that are corrosion treated for normal conditions.
    2. Locks to have standard 2-3/4" backset with a full 1/2 inch reversible dead latch. Thru-bolted mounting post for positive interlock to the door with concealed mounting screws.
    3. Lever trim shall be pressure cast zinc to match finishes. The design specified, with 3-7/16 inch diameter roses, trim shall be applied by no exposed screws
4. Bolts
 

Shall have forged bronze faceplate with extruded brass level wrought brass guide and strike.

Flush bolts for hollow metal doors shall be extension rod type door up to 7'-6" in height shall be increased by 6 inches for each additional 6 inch of door height. Wood doors shall have corner-wrap type. Provide dust proof strikes for all bottom bolts.

5. Exit Devices
  - A. Panic Exit device: Listed and labeled for panic protection, based on testing according to UL 305.
  - B. All lever design shall mortice or cylindrical lock level designs.
  - C. All devices to incorporate a security dead-latching feature. Provide roller strikes for all rim and surface mounted vertical rod devices, ASA strikes for mortice devices, and manufacturer's standard strikes for concealed vertical rod devices.
6. Closers
  - A. Surface mounted closers.
  - B. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves, closers shall have separate adjustment for latch speed, general speed, and back check.
  - C. All closers will not be seen on the public side or hallway side of the door. The appropriate drop plate or mounting plates will be used as conditions dictate.
7. Protective trim units
  - A. Protective trim units: Sized 2 inches less than door width on push side and 1 inch less than door on pull side, by height scheduled or indicated. Fasten with exposed machine or self-tapping screws.
8. Stops and holders
  - A. Stops and holders: Provide floor stops for doors, unless wall or other type stops are scheduled or indicated. Do not mount door stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
9. Silencers for Door Frames: Neoprene or Rubber, fabricated for drilled-in application to frame.
10. Door Gasketing and Thresholds
  - A. Door Gasketing: Provide continuous weather-strip gasketing on exterior doors. Provide non-corrosive fasteners for exterior applications.
11. Cylinders, Keying, and Strikes.
  - A. Cylinders: Tumbler Type, constructed from brass or bronze, stainless steel, or nickel silver.
  - B. Keying system: Factory-registered keying system, grand master key system.
  - C. Master key all locks to the owner's master key system. Manufacturer's representative shall coordinate with the owner's representative to determine exact keying requirements.
12. Fabrication

- A. Base metals: Furnish metals of a quality equal to or greater than that os specified door hardware units and BHMAA156.18 for finishes. Do not furnish manufacturer's standard materials if different from specified standard.
- B. Fasteners: Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated. Provide steel, machine or wood screws or steel though bolts for fire rated applications.
- C. Spacers or sex bolts: For through bolting of hollow metal doors.
- D. Fasteners for wood doors: Comply with requirements of DHIWDHS.2 "Recommended Fasteners for Wood Doors".
- E. Finishes: Comply with BHMA A156.18.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 2. PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
- B. Wood Doors: Comply with DHI A115-W Series.

#### 3. INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

#### 4. ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

#### 5. CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

#### 6. HARDWARE SCHEDULE

##### A. Hardware Sets

Group # 1      DOORS      1, 2, 3, 9, 10,

Hardware provided by Others (Haworth Aluminum Interior Wall System)

Group # 2      DOORS      11, 12



## DOOR HARDWARE

3 Hinges	IVE	5BB1HW 5 x 4.5	652
1 Storeroom Lock	SCH	ND80TD SPA	626
FSIC Core	SCH	23-300	626
OH Stop & Holder	SCH	100H	630
Mop Plate	IVE	8400 4" x 1" LDW	630
Map Plate	IVE	8400 x 4" x 2" LDW	630

## Group # 3 DOOR 5

3 Hinges	IVE	5BB1 4.5 x 4.5	652
1 Storeroom Lock	SCH	ND80TD SPA	626
1 FSIC Core	SCH	23-030	626
1 Wall Stop	IVE	WS406 / 407CCV	630

## Group # 4 DOORS 6

3 Hinges	IVE	5BB1 4.5 x 4.5	652
1 Storeroom Lock	SCH	ND80TD SPA	626
1 FSIC Core	SCH	23-030	626
1 Electric Strike	VON	6211 FSE DS	630
1 Wall Stop	IVE	WS406 / 407CCV	630
1 Surface Closure	LCN	1461 CUSH FC	689
1 Kick Plate	IVE	8400 8" x 2" LDW	630
1 Power Supply	SCE	PS920	AL

Note: Card reader Furnished and Installed by Others

Door to open 180 degrees.

## Group # 5 DOORS 13

3 Hinges	IVE	5BB1 4.5 x 4.5	652
1 Storeroom Lock	SCH	ND80TD SPA	630
1 FSIC Core	SCH	23-030	626
1 Electric Strike	VON	6211 FSE DS	630
1 Surface Closure	LCN	1461 CUSH FC	689
1 Kick Plate	IVE	8400 8" x 2" LDW	630
1 Wall Stop	IVE	WS406 / 407CCV	630
1 Power Supply	SCE	PS920	AL

Note: Card reader Furnished and Installed by Others

## Group #6 DOORS 14

3 Hinges	IVE	5BB1 4.5 x 4.5 NRP	630
Electric Classroom Lock	SCH	CO-100-CY-70-KP-SPA-PD	626
1 FSIC Core	SCH	23-030	626
1 Surface Closure	LCN	1461 CUSH FC	689
1 Kick Plate	IVE	8400 8" x 2" LDW	630

## DOOR HARDWARE

1 Wall Stop	IVE	WS406 / 407CCV	630
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Group #7	DOOR	16	
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3 Hinges	IVE	5BB1 4.5 x 4.5	652
1 Storeroom Lock	SCH	ND80TD SPA	630
1 FSIC Core	SCH	23-030	626
1 Electric Strike	VON	6211 FSE DS	630
1 Kick Plate	IVE	8400 8" x 2" LDW	630
1 Wall Stop	IVE	WS406 / 407CCV	630
1 Power Supply	SCE	PS920	AL
1 Gasket All Around			
1 Threshold			
1 Angle Viewer	SCH	698-619	

Note: Card reader Furnished and Installed by Others

Group # 8	DOORS	15	
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3 Hinges	IVE	5BB1 4.5 x 4.5	652
1 Storeroom Lock	SCH	ND80TD SPA	626
1 FSIC Core	SCH	23-030	626
1 Electric Strike	VON	6211 FSE DS	630
1 Wall Stop	IVE	WS406 / 407CCV	630
1 Surface Closure	LCN	1461 CUSH FC	689
1 Kick Plate	IVE	8400 8" x 2" LDW	630
1 Power Supply	SCE	PS920	AL

Note: Card reader Furnished and Installed by Others

Group # 9	DOORS	4, 7, 8	
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3 Hinges	IVE	5BB1 4.5 x 4.5	652
1 Passage Latch	SCH	ND10S SPA	626
1 Wall Stop	IVE	WS406 / 407CCV	630
1 Kick Plate	IVE	8400 8" x 2" LDW	630

## NOTES:

Mount all closers inside; away from exterior, lobbies, corridors, etc. Furnish brackets for proper mounting.

Furnish kick and armor plates 2" less than door width.

Furnish floor stops where wall bumpers are not appropriate.

Furnish proper attachment for wall bumper for wall conditions.

Provide thresholds with transition strips where required.

Furnish closers for all fire rated doors.

Furnish smoke seals (S88) for all 20 minute openings.

Check stile width before scheduling push plates.

END OF SECTION 08710

## SECTION 08800 - GLAZING

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Windows.
  - 2. Doors.
  - 3. Glazed entrances.
  - 4. Interior borrowed lites.

#### 3. DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

#### 4. PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
  - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    - a. Specified Design Wind Loads: As indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
    - b. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
      - 1) Load Duration: 30 days.
    - c. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
      - 1) For monolithic-glass lites heat treated to resist wind loads.
      - 2) For insulating glass.
      - 3) For laminated-glass lites.
    - d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
    - e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
  - 1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
  - 2. For laminated-glass lites, properties are based on products of construction indicated.

3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
  - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
  - b. Solar Heat Gain Coefficient: NFRC 200.
  - c. Solar Optical Properties: NFRC 300.

## 5. SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- C. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
  1. Each color of tinted float glass.
  2. Each type of patterned glass.
  3. Coated vision glass.
  4. Ceramic-coated spandrel glass.
  5. Each pattern and color of ceramic-coated vision glass.
  6. Wired glass.
  7. Fire-resistive glazing products.
  8. Each type of laminated glass with colored interlayer.
  9. Insulating glass for each designation indicated.
  10. For each color (except black) of exposed glazing sealant indicated.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
  1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.
- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each of the following types of glazing products:
  1. Tinted float glass.
  2. Coated float glass.

3. Insulating glass.
4. Glazing sealants.
5. Glazing gaskets.

I. Warranties: Special warranties specified in this Section.

## 6. QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass coated float glass laminated glass glass-clad polycarbonate and insulating glass.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
  1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
  2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
  1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
  2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  2. Submit not fewer than eight <Insert number> pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
  5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- H. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- I. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
- J. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
  2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- K. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
  2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
  3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
  4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- L. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.



2. Associated Laboratories, Inc.

- M. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

7. DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

8. PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

9. WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 5 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

## 2.PRODUCTS

### 1. MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Products: Subject to compliance with requirements, provide one of the products specified.
  3. Product: Subject to compliance with requirements, provide product specified.
  4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  5. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  6. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

### 2. GLASS PRODUCTS

- A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
  2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  3. For uncoated glass, comply with requirements for Condition A.
  4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
  5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

### 3. GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Neoprene, ASTM C 864.
  2. EPDM, ASTM C 864.
  3. Silicone, ASTM C 1115.
  4. Thermoplastic polyolefin rubber, ASTM C 1115.
  5. Any material indicated above.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene.
  - 2. EPDM.
  - 3. Silicone.
  - 4. Thermoplastic polyolefin rubber.
  - 5. Any material indicated above.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

#### 4. GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
  - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  - 1. Single-Component Non-Sag Silicone Glazing Sealant.
- C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

#### 5. GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 804.3 tape, where indicated.
  - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
  - B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
    1. Type 1, for glazing applications in which tape acts as the primary sealant.
    2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
6. MISCELLANEOUS GLAZING MATERIALS
- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
  - B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
  - C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
  - D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
  - E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
  - F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
  - G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.
7. FABRICATION OF GLAZING UNITS
- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
  - C. Grind smooth and polish exposed glass edges and corners.

## 8. MONOLITHIC FLOAT-GLASS UNITS

- A. Uncoated Clear Float-Glass Units – Interior sidelites & windows: Class 1 (clear) Kind FT (fully tempered) float glass.

- 1. Thickness: 6.0 mm.

## 9. LAMINATED GLASS UNITS

- A. Laminated Glass Unit: Storefront Windows

- 1. Glazing: 1 5/16" insulated hurricane impact glazing.
- 2. Basis of Design:
  - a. Exterior – 1/4" PPG Solarban 70, Low E #3
  - b. Airspace – 1/2"
  - c. Interior – 9/16" laminate, 1/4" clear, .090 storm glass innerlayer, 1/4" clear

## 3.EXECUTION

### 1. EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 2. PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3. GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or

other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

#### 4. TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

5. GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

6. SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

7. LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

## 8. CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08800



## SECTION 09111 - NON-LOAD-BEARING STEEL FRAMING

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
- B. Related Sections include the following:
  - 1. Division 5 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
  - 2. Division 7 Section "Building Insulation" for insulation installed with Z-shaped furring members.
  - 3. Division 7 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.
  - 4. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittal:
  - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating costs for each product having recycled content.

#### 4. QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

## 2.PRODUCTS

### 1. NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120) or ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized, unless otherwise indicated.
- C. Provide framing system to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
  - 1. Upward and downward movement of 1/2 inch (13 mm).

### 2. STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 20 gage 0.0312 inch (0.79 mm).
  - 2. Depth: As indicated on Drawings
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
  - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
      - 2) Superior Metal Trim; Superior Flex Track System (SFT).

- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
    - b. Metal-Lite, Inc.; The System.
- D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm)
  - 2. Depth: As indicated on Drawings
- E. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical

### 3. AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

## 3.EXECUTION

### 1. EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 2.

## 2. INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

## 3. INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
  - 1. Space studs as follows:
    - a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - c. Tile backing panels: 16 inches (406 mm) o.c., unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb, unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

- a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
  - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
  - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09111END OF SECTION 09111

## SECTION 09250 - GYPSUM BOARD

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:

- 1. Interior gypsum board.
- 2. Tile backing panels.

- B. Related Sections include the following:

- 1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
- 2. Division 6 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
- 3. Division 6 Section "Sheathing" for gypsum sheathing.
- 4. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
- 5. Division 7 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.
- 6. Division 9 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board.
- 7. Division 9 Section "Gypsum Shaft-Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
- 8. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.
- 9. Division 9 painting Sections for primers applied to gypsum board surfaces.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
- 2. Textured Finishes: Manufacturer's standard size <Insert size> for each textured finish indicated and on same backing indicated for Work.

4. QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

5. STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

6. PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

2.PRODUCTS

1. PANELS, GENERAL

- A. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 75 percent by weight.
- B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2. INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Gypsum Co.
  - b. BPB America Inc.
  - c. G-P Gypsum.
  - d. Lafarge North America Inc.
  - e. National Gypsum Company.
  - f. PABCO Gypsum.
  - g. Temple.
  - h. USG Corporation.
  - i. <Insert manufacturer's name.>
- B. Regular Type:
  1. Thickness: 5/8".
  2. Long Edges: Tapered.
- C. Type X:
  1. Thickness: 5/8 inch (15.9 mm).
  2. Long Edges: Tapered.
- D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
  1. Core: 5/8 inch (15.9 mm), Type X.
  2. Long Edges: Tapered.
3. TILE BACKING PANELS
  - A. Glass-Mat, Water-Resistant Backing Board:
    1. Complying with ASTM C 1178/C 1178M.
      - a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
    2. Complying with ASTM C1177/C 1177M.
      - a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.
    3. Core: 5/8 inch (15.9 mm), Type X.
4. TRIM ACCESSORIES
  - A. Interior Trim: ASTM C 1047.



1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
  - a. Cornerbead.
  - b. Bullnose bead.
  - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - d. L-Bead: L-shaped; exposed long flange receives joint compound.
  - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
  - f. Expansion (control) joint.
  - g. Curved-Edge Cornerbead: With notched or flexible flanges.

## 5. JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  1. Interior Gypsum Wallboard: Paper.
  2. Exterior Gypsum Soffit Board: Paper.
  3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
  1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

## 6. AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: See Division 7, Building Insulation.
- E. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."
  - 1. Provide sealants that have a VOC content of 250 <Insert limit> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."
- G. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

### 3.EXECUTION

- 1. EXAMINATION
  - A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
  - B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
  - C. Proceed with installation only after unsatisfactory conditions have been corrected.
- 2. APPLYING AND FINISHING PANELS, GENERAL
  - A. Comply with ASTM C 840.
  - B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
  - C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
  - D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
  - E. Form control and expansion joints with space between edges of adjoining gypsum panels.

- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

### 3. APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Regular Type: As indicated on Drawings.
  - 2. Type X: As indicated on Drawings.
  - 3. Type C: As indicated on Drawings.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

#### 4. APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

#### 5. INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners, unless otherwise indicated.
  2. LC-Bead: Use at exposed panel edges.
  3. L-Bead: Use where indicated.
  4. U-Bead: Use at exposed panel edges.

6. FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 3: None.
  - 4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 9 Sections.
  - 5. Level 5: None.
    - a. Primer and its application to surfaces are specified in other Division 9 Sections.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

7. PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09250

## SECTION 09310 - CERAMIC TILE

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

##### A. Section Includes:

- 1. Ceramic tile.
- 2. Stone thresholds.
- 3. Waterproof membrane.
- 4. Crack isolation membrane.
- 5. Tile backing panels.
- 6. Metal edge strips.

##### B. Related Sections:

- 1. Division 1 Section "Allowances."
- 2. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
- 3. Division 9 Section "Gypsum Board" for glass-mat, water-resistant backer board.

#### 3. DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

#### 4. PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum <Insert required static coefficient of friction>.
2. Step Treads: Minimum <Insert required static coefficient of friction>.
3. Ramp Surfaces: Minimum <Insert required static coefficient of friction>.

## 5. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittal:
  1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Samples for Verification:
  1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
  2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square <Insert size>, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
  3. Full-size units of each type of trim and accessory for each color and finish required.
  4. Metal edge strips in 6-inch (150-mm) lengths.
- E. Qualification Data: For qualified Installer.
- F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Product Certificates: For each type of product, signed by product manufacturer.
- H. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

## 6. QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
  1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
  - 1. Stone thresholds.
  - 2. Waterproof membrane.
  - 3. Crack isolation membrane.
  - 4. Joint sealants.
  - 5. Cementitious backer units.
  - 6. Metal edge strips.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of each type of floor tile installation.
  - 2. Build mockup of each type of wall tile installation.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

## 7. DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

## 8. PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## 9. EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.



1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

10. WARRANTY

- A. Provide 10 year warranty of complete system.

2.PRODUCTS

1. PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2. TILE PRODUCTS

- A. See Division 1, "Allowances" for each type of tile.

3. TILE BACKING PANELS

- A. See Division Nine, "Gypsum Board"

#### 4. WATERPROOF MEMBRANE – AT TOILET ROOMS

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
  - 1. Products: Subject to compliance with requirements, provide MAPEI Mapelastic 400 or equal from one of the following:
    - a. Boiardi Products; a QEP company; Elastiment 644 Membrane Waterproofing System.
    - b. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane.
    - c. Bostik, Inc.; Durabond D-222 Duraguard Membrane Hydroment Gold.
    - d. C-Cure; Pro-Red Waterproofing Membrane 63.
    - e. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane.
    - f. Jamo Inc.; Waterproof.
    - g. Laticrete International, Inc.; Latapoxy 24hr HydroProofing Laticrete Watertight Floor N' Wall Waterproofing.
    - h. MAPEI Corporation; Mapelastic 400.
    - i. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
    - j. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

#### 5. CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
  - 1. Products: Subject to compliance with requirements, provide MapeiGuard SM or equal from one of the following:
    - a. MAPEI Corporation; MapeiGuard SM.
    - b. National Applied Construction Products, Inc.; Strataflex.

#### 6. SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
  - 1. Manufacturers: Subject to compliance with requirements, provide MAPEI Ultraflex3 or equal.

- a. Boiardi Products; a QEP company.
- b. Bonsal American; an Oldcastle company.
- c. Bostik, Inc.
- d. C-Cure.
- e. Custom Building Products.
- f. Jamo Inc.
- g. Laticrete International, Inc.
- h. MAPEI Corporation.
- i. Mer-Kote Products, Inc.
- j. Southern Grouts & Mortars, Inc.
- k. Summitville Tiles, Inc.
- l. TEC; a subsidiary of H. B. Fuller Company.

B. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Basis-of-Design Product: Subject to compliance with requirements, provide MAPEI Kerapoxy 410 or comparable product by one of the following at Chemistry Lab, Chemistry Support Areas, Stair 1 and Stair 2:

- a. Atlas Minerals & Chemicals, Inc.
- b. Bonsal American; an Oldcastle company.
- c. Bostik, Inc.
- d. C-Cure.
- e. Custom Building Products.
- f. Jamo Inc.
- g. Laticrete International, Inc.
- h. MAPEI Corporation.
- i. Mer-Kote Products, Inc.
- j. Southern Grouts & Mortars, Inc.
- k. Summitville Tiles, Inc.
- l. TEC; a subsidiary of H. B. Fuller Company.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

## 7. GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Basis-of-Design Product: Subject to compliance with requirements, provide MAPEI Kerapoxy IEG @ chemistry lab and chemistry support areas and MAPEI Opticolor @ all other areas, or comparable product by one of the following:

- a. Atlas Minerals & Chemicals, Inc.
- b. Boiardi Products; a QEP company.
- c. Bonsal American; an Oldcastle company.
- d. Bostik, Inc.
- e. C-Cure.
- f. Custom Building Products.
- g. Jamo Inc.

- h. Laticrete International, Inc.
  - i. MAPEI Corporation.
  - j. Mer-Kote Products, Inc.
  - k. Southern Grouts & Mortars, Inc.
  - l. Summitville Tiles, Inc.
  - m. TEC; a subsidiary of H. B. Fuller Company.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

## 8. ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
- 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant 100 percent Silicone Kitchen and Bath Sealant.
    - b. Dow Corning Corporation; Dow Corning 786.
    - c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
    - d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
    - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
    - f. Tremco Incorporated; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Bostik, Inc.; Chem-Calk 550.
    - b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
    - c. Pecora Corporation; Dynatrol II-SG NR-200 Urexpan.
    - d. Sika Corporation; Sikaflex-2c SL.
    - e. Tremco Incorporated.; THC-900 THC-901 Vulkem 245.

- E. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Atlas Minerals & Chemicals, Inc.
    - b. <Insert manufacturer's name>.

## 9. MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Provide flooring transition strips, and edge protection and wall outside corner edge protection.
  - 1. Metal corner bead edge protection – Basis of Design, Schluter Rondel or equal. Color as selected by Architect from Manufacturer's full range.
  - 2. Metal edge protection – Basis of Design, Schluter Jolly or equal. Color as selected by Architect from Manufacturer's full range.
  - 3. Metal flooring transition tile to carpet – Basis of Design, Schluter Reno-TK or equal. Color as selected by Architect from Manufacturer's full range.
  - 4. Metal flooring transition tile to tile – Basis of Design, Schluter Deco or equal. Color as selected by Architect from Manufacturer's full range.
  - 5. Metal flooring transition tile to rubber – Basis of Design Schluter Reno-U or equal. Color as selected by Architect from Manufacturer's full range.
- C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
  - 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
  - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Bonsal American; an Oldcastle company; Grout Sealer.
- b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer Magic Seal Silox 8 Siloxane 220.
- c. C-Cure; Penetrating Sealer 978.
- d. Custom Building Products; Surfaceguard Grout and Tile Grout Sealer.
- e. Jamo Inc.; Matte Finish Penetrating Sealer.
- f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
- g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
- h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
- i. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone TA-257 Silicone Grout Sealer.

#### 10. MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
  - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with adhesives bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2. PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

## 3. TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.
    - b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
    - c. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
  2. Quarry Tile: 1/4 inch (6.35 mm) 3/8 inch (9.5 mm).
  3. Paver Tile: 1/4 inch (6.35 mm) 3/8 inch (9.5 mm).
  4. Glazed Wall Tile: 1/16 inch (1.6 mm).
  5. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).
- F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
  2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- H. Metal Edge Strips: Install at locations indicated.
- I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

#### 4. WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

#### 5. CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

#### 6. CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.



1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
  2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
  3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

## 7. INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
1. Tile Installation F115: Thin-set mortar; epoxy grout; TCA F115.
    - a. Tile Type:
    - b. Thin-Set Mortar: Medium-bed, latex- portland cement mortar.
    - c. Grout: Water-cleanable epoxy grout.
- B. Interior Wall Installations, Metal Studs or Furring:
1. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
    - a. Tile Type:
    - b. Thin-Set Mortar: Latex- portland cement mortar.
    - c. Grout: Water cleanable epoxy grout.

END OF SECTION 09310

## SECTION 09512 - ACOUSTICAL TILE CEILINGS

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes acoustical tiles for ceilings and the following:
  - 1. Concealed suspension systems.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

#### 3. DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light-Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

#### 4. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension system members.
  - 2. Method of attaching hangers to building structure.
    - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
  - 2. Concealed Suspension System Members: 12-inch- (300-mm-) long Sample of each type.
  - 3. Exposed Moldings and Trim: Set of 12-inch- (300-mm-) long Samples of each type and color.
- D. Maintenance Data: For finishes to include in maintenance manuals.

## 5. QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
  - 1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
  - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
  - 1. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Smoke-Developed Index: 450 or less.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 6. DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

7. PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

8. COORDINATION

- A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

9. EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed, but not less than one box.
  - 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

2.PRODUCTS

1. ACOUSTICAL TILES, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
- B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
- C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.
- D. Antimicrobial Fungicide Treatment: Provide acoustical tiles with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2. ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Armstrong World Industries, Inc.;
  - 2. BPB USA;
  - 3. USG Interiors, Inc.;
- B. Basis-of-Design Product: Subject to compliance with requirements, provide the following or a comparable product:
  - 1. ACT1– Armstrong Calla 2232 1” thick, White
- C. Color: White.
- D. Modular Size: As indicated in a schedule.

3. METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 <Insert number> percent.
- B. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.
- E. Hanger Rods Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

4. METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- B. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Armstrong World Industries, Inc.; .
  - 2. USG Interiors, Inc.; .
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the following or a comparable product:
  - 1. Armstrong, Suprafine 9/16" ML

## 5. MISCELLANEOUS MATERIALS

- A. Staples: 5/16-inch- (8-mm-) long, divergent-point staples.

## 3.EXECUTION

### 1. EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 2. PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

### 3. INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical tile ceilings to comply with ASTM C 636 UBC Standard 25-2 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard

- suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
  2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
  3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
4. CLEANING
- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09512



## SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

##### A. Section Includes:

- 1. Resilient base.
- 2. Resilient stair accessories.
- 3. Resilient molding accessories

##### B. Related Sections:

- 1. Division 9 Section "Sheet Vinyl Floor Coverings" for resilient sheet floor coverings.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

#### 4. QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

#### 5. DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

6. PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

7. EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

2.PRODUCTS

1. RESILIENT BASE

- A. Resilient Base:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allstate Rubber Corp.; Stoler Industries.
    - b. Armstrong World Industries, Inc.
    - c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
    - d. Endura Rubber Flooring; Division of Burke Industries, Inc.
    - e. Estrie Products International; American Biltrite (Canada) Ltd.
    - f. Flexco, Inc.
    - g. Johnsonite.
    - h. Mondo Rubber International, Inc.
    - i. Musson, R. C. Rubber Co.
    - j. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
    - k. PRF USA, Inc.
    - l. Roppe Corporation, USA.
    - m. VPI, LLC; Floor Products Division.
- B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TP (rubber, thermoplastic).
  2. Manufacturing Method: Group I (solid, homogeneous).
  3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- D. Height: 4 inches (102 mm).
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Preformed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: As selected by Architect from full range of industry colors.
2. INSTALLATION MATERIALS
- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Cove Base Adhesives: Not more than 50 g/L.
    - b. Rubber Floor Adhesives: Not more than 60 g/L.

### 3.EXECUTION

1. EXAMINATION
  - A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
  - C. Proceed with installation only after unsatisfactory conditions have been corrected.

2. PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are same temperature as the space where they are to be installed.
  - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3. RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible.

4. CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.

## RESILIENT WALL BASE AND ACCESSORIES

2. Sweep and vacuum surfaces thoroughly.
  3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products until Substantial Completion.

END OF SECTION 09653

## SECTION 09672 - RESINOUS FLOORING

### PART 1 - GENERAL

#### 1.01 Work Included

- A. Work described in this section includes surface preparation and installation of resinous floor system.
- B. See drawings for locations and quantities.

#### 1.02 Related Work -

- B. Cast-in-place concrete (Section 03300)
- C. Painting (Section 09900)

#### 1.03 Quality Assurance

- A. Manufacturer Qualifications:
  - 1. Manufacturer must have a minimum of 10 years experience producing this product
  - 2. All resins must be manufactured and tested under an ISO 9001 registered quality system and ISO 14001 ecology management system.
- B. Installer Qualifications:
  - 1. Installer must be licensed by Manufacturer.
  - 2. Installer must have three (3) years experience of installing resinous flooring systems and submit a list of five projects/references. At least one of the five projects/ references must be of equal size, quantity, and magnitude to this project.
- C. Bond Testing:
  - 1. Surface preparation efforts shall be evaluated by conducting Bond Tests at the site prior to application of the flooring system
- D. Pre-Installation Conference:
  - 1. A pre-installation conference with representatives of Owner,Architect, Contractor, Installer and Material Manufacturer in attendance. The agenda shall include a review and clarification of this specification, application procedures, quality control, inspection and acceptance criteria, and production schedules.

#### 1.04 Reference Standards

- A. ACI 308 - Standard Practice for Curing Concrete
- B. ACI 302.1R-80 - Guide for Concrete Floor and Slab Construction

#### 1.05 Submittals

- A. Acceptance Sample: One foot square (1 ft. by 1 ft.) sample of the specified resinous flooring system applied to hardboard or similar backing for rigidity and ease of handling.
  - 1. Sample shall be thicknesses of respective film layers, color, texture, overall appearance and finish.
- B. Manufacturer's Literature: Descriptive data and specific recommendations for surface preparation, mixing, and application of materials.
- C. Manufacturer's Material Safety Data Sheets (MSDS) for each respective product to be used. Cleaning and Maintenance.

#### 1.06 Delivery, Storage, And Handling

- A. All material shall be delivered in original Manufacturer's sealed containers with all pertinent labels intact and legible.
- B. Store materials in dry protected area between 25° and 80° Fahrenheit. Keep out of direct sunlight. Protect from open flame; keep all containers grounded.
- C. Follow all Manufacturer's specific label instructions and prudent safety practices for storage and handling.

#### 1.07 Project/Site Conditions

- A. Material, air, and surface temperatures shall be in the range of 32° to 85° Fahrenheit during application and cure, unless a special formulation is being used and Manufacturer has been consulted.
- B. Relative humidity in the specific location of the application shall be less than 85 percent and the surface temperature shall be at least 5 degrees above the dew point.
- C. Conditions required of new concrete to be coated.
  - 1. Concrete shall be moisture cured for a minimum of 7 days at 70° F. The concrete must be fully cured for a minimum of 28 days prior to application of the coating system pending moisture testing.
  - 2. Surface contaminants such as curing agents, membranes, or other bond breakers should not be used.
  - 3. Concrete shall have a "rubbed" finish; float or darby finish the concrete (a hard steel trowel is neither necessary nor desirable).
  - 4. Drains should be set to the concrete grade rather than raised to the finished grade of the topping.
- D. Concrete shall have a moisture emission rate of no more than 5 lbs. per 1000 sq. ft. per 24 hour period as determined by proper Calcium Chloride Testing. Concrete R/H must be 85% or less as measured by protimeter.

1. Contractor shall be responsible to install any additional treatments/ products to the slab as required by the manufacturer for readings greater than 5 by the Calcium Chloride method or 85% by protimeter.

#### 1.08 Warranty

- A. Warranty Period: 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 Manufacturers

- A. Basis of Design: Silikal or comparable

#### 2.02 Materials

- A. Silikal 62 SLQ Self Leveling Quartz Flooring

1. Moisture Vapor Treatment (if required) Silikal RE40
2. Saturating Primer/Silikal Coat: Silikal R51 with Additive I
3. Patching/Sloping (if required) Silikal R17 Polymer Concrete
4. Coving: Silikal HK20 with #10-#12 mesh dry silica sand.
5. Topping: Silikal R61 SL, consisting of Silikal R61 resin and Silikal Filler
6. Topcoat(s): Silikal R71re Colorless Silikal Topcoat Resin.
7. Silikal Flakes for broadcasting:
  - a. Color as selected by architect from manufacture's full range.

#### 2.02.02 Product Installation & Application Criteria

- A. All Silikal Material Systems Excepting Moisture Vapor Treatment:
  1. Pot Life at 68° F.: 10-15 minutes
  2. Cure Time at 68° F.: 60 minutes
  3. Recoat Time at 68° F.: 60-90 minutes

#### 2.03 Mixes

- A. Follow manufacturer's prescribed procedures and recommendations.

### PART 3 - EXECUTION

#### 3.01 Pre-installation Examination



- A. Examine all surfaces to be coated with material systems and report to the Architect any conditions that will adversely affect the appearance or performance of these coating systems and that cannot be put into acceptable condition by the preparatory work.
- B. Do not proceed with application until the surface is acceptable.

### 3.02 General

- A. Provide sufficient ventilation to allow complete air exchange every five (5) minutes.
- B. Installer will protect adjacent surfaces not to be coated.

### 3.03 Preparation

#### A. Surface Preparation - General

1. Concrete substrate must be clean and dry. Dislodge dirt, mortar spatter, paint overspray, and other dry surface accumulations and contamination by scraping, brushing, sweeping, vacuuming, and/or compressed air blowdown.
2. New concrete: See 1.08 - C for requirements.
3. Surfaces that are heavily contaminated shall be cleaned with the appropriate degreaser, detergent, or other appropriate cleaner/surfactant followed by thoroughly rinsing with fresh water to remove the accumulation prior to mechanical cleaning efforts. Mechanical cleaning will not remove such deposits, but only drive them deeper.
4. Concrete shall have a moisture emission rate of no more than 5 lbs. per 1000 sq. ft. per 24 hour period as determined by proper Calcium Chloride Testing and no more than 85% R/H as measured by Protimeter

#### B. Bond Testing

1. The applicator shall evaluate all surface preparation by conducting bond tests at strategic locations.
2. Mix six (6) ounces of the primer to be used in the application with 5% by volume Silikal Powder Hardener. Add #10-#12 mesh, dry quartz sand until an easily trowelable mixture is obtained. Apply palmsized patties 1/8" to 1/4" thick.
3. After one (1) hour at (68° F.), patties must be cured tack-free and cooled to ambient temperature of concrete. Remove patties with hammer and chisel and examine fracture/delamination plane. Concrete with fractured aggregate must be attached to the entire underside of the patty.
4. If only laitance or a small amount of concrete is attached or if interface between patty and substrate is tacky, further substrate preparation is required.
5. If further surface preparation is required, bond tests shall be conducted again when this has been completed.

#### C. Mechanical Surface Preparation and Cleaning

1. All accessible concrete floor surfaces shall be mechanically blast cleaned using a mobile steel shot, dust recycling machine such as BLASTRAC<sup>®</sup>, or approved equivalent. All surface and embedded accumulations of paint, toppings, hardened concrete layers,

laitance, power trowel finishes, and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a profile similar to 40 grit sandpaper and exposing the upper fascia of concrete aggregate.

2. Floor areas inaccessible to the mobile blast cleaning machines shall be mechanically abraded to the same degree of cleanliness, soundness, and profile using vertical disc scarifiers, starwheel scarifiers, needle guns, scabblers, or other suitably effective equipment.
3. After blasting, traces or accumulations of spent abrasive, laitance, removed toppings, and other debris shall be removed with brush or vacuum.
4. Conduct Bond Tests to check adequacy of surface preparation.
5. Application of the respective specified material system(s) must be completed before any water or other contamination of the surface occurs.

### 3.04 Installation

- A. Application of Silikal 62 SLQ flooring system consists of:
  1. Applying moisture vapor treatment (if required)
  2. applying the primer,
  3. applying coving,
  4. performing patching and sloping with polymer concrete (if required),
  5. re-priming polymer concrete areas,
  6. applying the topping, broadcasting the Silikal quartz,
  7. applying the topcoat(s),
  8. Time for curing (45 - 60 minutes) shall be allowed between each coat. Thicknesses are specified below and/or in Paragraph 3.07.
- B. Open only the containers of component materials to be use in each specific application as needed. Refer to Manufacturer's data sheets for pot-life/temperature relationship to determine size of batches to mix and mix ratios for each respective coat of the system.
- C. Measure, add, and mix the Silikal BP-Powder Hardener into the respective resin components in the proportions recommended by the Material Manufacturer. Pot life is short, so mix only as much material at a time as can be easily and efficiently applied.
- D. The finished Silikal floor coating system shall be uniform in color combinations, texture, and appearance. All edges that terminate at walls, floor discontinuities, and other embedded items shall be sharp, uniform, and cosmetically acceptable with no thick or ragged edges. The Contractor shall work out an acceptable masking technique to ensure the acceptable finish of all edges.

#### 3.04.01 Moisture Vapor Treatment (if required)

- A. Mix moisture vapor treatment products as recommended by manufacturer.
- B. Pour out all resin onto the concrete surface and spread it with a squeegee. After a short operating time (appr. 10 minutes) the excess must be removed with the squeegee. The remaining resin can be rolled out with a lint free resin proof roller. Resin films as well as the building of puddles have to be avoided!
- C. Waiting time between the coats depends on the absorbency of the substrate and is normally between one and three hours. Before applying the second coat if required, the impregnation of the first coat into the substrate should be evident.

- D. If required, repeat the above process. During application of the treatment take care that there is no film building at the surface. The surface texture has to be maintained after every step.

#### 3.04.02 Prime Coat

- A. Mix primer components according to manufacturers instructions.
- B. Pour the mixture batches onto the floor surface and use a 9" or 18" wide, 1/2" - 3/4" thick-napped, solvent resistant paint roller to roll out the material at a rate of 100 sq. ft./ gal. to form a uniform, continuous film, ensuring that all crevices, cracks, other surface discontinuities have been saturated and coated. Use a paint brush to reach areas inaccessible to the roller. Work quickly and deliberately; the pot life is short (10 -15 minutes). Do not leave any "puddles"; roll out any such accumulations.
- C. Allow the primer coat to cure.
- D. If any of the concrete has absorbed all of the primer or if the concrete still has a dry look, reprime these areas before applying the next layer.

#### 3.04.03 Coving

- A. Surface Preparation
  - 1. If concrete walls are to be painted prior to installation of cove base, the bottom portion of the walls shall remain uncoated to the height of the cove base to insure a proper bond to the concrete wall.
  - 2. If walls are constructed of a non-compatible material or if a coating exists, a backer board of 1/2" cement board cut to the desired height of the cove base needs to be installed. The top of the backer board should be cut at a 45° angle to create a "beveled" edge.
  - 3. If a backer board needs to be installed it shall be fastened using a high grade construction adhesive as well as counter sunk screws or concrete masonry anchors.
- B. System Description
  - 1. Cove base shall be installed according to manufacturer's recommendations and shall be:
    - a. Application area requires prime coat according to 3.04.02
    - b. Trowel-On Cove Base consisting of a trowel applied radius/base mix with a termination strip installed at the top of the base.
  - 2. Cove base will receive a broadcast and top coat consistent with flooring system.

#### 3.04.04 Patching/Sloping (If Required)

- A. Mix polymer concrete components as recommended by the Material Manufacturer.
- B. Use mixture to repair any damaged concrete, or to slope any areas as needed.
- C. Once cured, material must be re-primed before next layer is applied.

#### 3.04.05 Topping

- A. Size the batches, and mix according to Manufacturer's instructions. The entire batch should be poured and spread at once, i.e., do not let material set in pail.
- B. Spread the topping material with a gauge rake set to a depth of 3/16". Lightly trowel to a uniform thickness of 3/16" as necessary.
- C. If necessary, roll with a porcupine roller to release trapped air.
- D. Broadcast Silikal quartz into the fresh material before it begins to cure. Broadcast by hand, or use a backpack type blower or sand blast pot to achieve an even broadcast. The quartz must 'rain' down and not be thrown into the wet base coat.
- E. Allow the topping to cure.
- F. Remove excess quartz by sweeping, "blow-down", and/or vacuuming.

#### 3.04.06 Top Coat

- A. Apply with clean rollers at a rate of 80 - 90 sq. ft./gal. in the same way as the Silikal Primer was applied as described in Paragraph 3.04.02.
- B. (If Required) Broadcast aluminum oxide, or other suitable material into wet topcoat resin; size and rate as determined by owner.
- C. Allow topcoat to cure. Floors without aluminum oxide broadcast may be lightly sanded if required. Vacuum all dust, paying particular attention to edges and corners.

#### 3.04.07 Second Top Coat

- A. Apply with clean rollers at a rate of 100 - 125 sq. ft./gal. in the same way as the Silikal Primer was applied as described in Paragraph 3.04.02.
- B. Allow topcoat to cure.

#### 3.05 Cleaning

- A. Contractor shall remove any material spatters and other material that is not where it should be. Remove masking and covers taking care not to contaminate surrounding area.
- B. Contractor shall repair any damage that should arise from either the application or clean-up effort.

END OF SECTION 09672

## SECTION 09900 PAINTING

### PART 1 GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed exterior items and surfaces.
  - 2. Exposed interior items and surfaces.
  - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Engineer or Owner will select from standard colors and finishes available.
  - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Prefinished items include the following factory-finished components:
    - a. Finished mechanical and electrical equipment.
    - b. Light fixtures.
    - c. Distribution cabinets.
  - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

3. Finished metal surfaces include the following:
    - a. Anodized aluminum.
  4. Operating parts include moving parts of operating equipment and the following:
    - a. Valve and damper operators.
    - b. Linkages.
    - c. Sensing devices.
    - d. Motor and fan shafts.
  5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

#### 1.03 DEFINITIONS

- A. General: Standard Coating Terms defined in ASTM D 16 apply to this Section.
1. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
  2. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
  3. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
  4. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

#### 1.04 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. **Manufacturer's Information:** Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  3. **Performance Criteria:** Provide a side by side comparison of performance data should the Contractor propose to use materials other than those listed in the standard of quality.
- B. **Samples for Verification:** Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
  2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

1.05 **QUALITY ASSURANCE**

- A. **Applicator Qualifications:** Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. **Source Limitations:** Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.06 **DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
1. Product name or title of material.
  2. Product description (generic classification or binder type).
  3. Manufacturer's stock number and date of manufacture.
  4. Contents by volume, for pigment and vehicle constituents.
  5. Thinning instructions.
  6. Application instructions.
  7. Color name and number.
  8. VOC content.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

**1.07 PROJECT CONDITIONS**

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.
- B. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
  - 1. Tnemec Company, Inc.
  - 2. Or approved Equal

Technical information may be obtained from the following:

SteelCon Coating Systems, Inc.  
2100 3<sup>rd</sup> Ave South  
Irondale, Alabama 35210  
Phone: 205-951-2086



**2.02 PAINT MATERIALS, GENERAL**

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
  - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide custom colors of the finished paint as indicated on the Room Finish Schedule and Legend and the Piping Schedule in Section PIPING AND ACCESSORIES.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify the Engineer about anticipated problems using the materials specified over substrates primed by others.

## 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible existing coatings or remove and re-prime.
  - 2. Cementitious Materials Non-Submerged: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
  - 3. Concrete – Submerged or Intermittently Submerged
    - a. Allow concrete to cure for not less than 30 days prior to painting.

- b. Abrasive blast to remove all curing compounds, hardeners, laitance, and provide an adequate surface profile (Reference SSPC-SP 13 / ICRI CSP 5).
- 4. Concrete – Secondary Containment (Previously Painted)
  - a. Pressure wash to remove all contaminants. Verify that the substrate and remaining coatings are a neutral PH.
  - b. Mechanically in accordance with SSPC-SP 7 Bush-Off Blast Cleaning to remove all loose existing coating and to provide a angular profile to the remaining intact coating.
  - c. Rout our cracks to sound material.
- 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
  - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
  - c. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
  - d. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
- 4. Ferrous Metals:
  - a. New Steel – Non Immersion Service (Shop or Field Primed): Prior to abrasive blasting all surfaces shall be cleaned of all oil, grease, as well as any other foreign matter in accordance with SSPC-SP 1 Solvent Cleaning. All surfaces shall be abrasive blast cleaned in accordance with SSPC-SP 6 Commercial Blast Cleaning. All surfaces shall be clean and dry and have a surface profile of 1.5 – 2.5 mils. Cleaned surfaces shall be primed within eight hours of surface preparation and prior to the formation or corrosion by products. After erection and prior to application of the finish coat(s) all surface shall be cleaned of all dirt, dust, oil, grease as well as any other foreign matter. All areas of damage to the shop

primer shall be cleaned in accordance with SSPC-SP 6 Commercial Blast Cleaning. All edges shall be feathered. Damaged shop primer shall be spot primed with the same primer specified for use on the item.

- b. New Steel – Immersion Service (Shop or Field Primed): Prior to abrasive blasting all surfaces shall be cleaned of all oil, grease, as well as any other foreign matter in accordance with SSPC-SP 1 Solvent Cleaning. All surfaces shall be abrasive blast cleaned in accordance with SSPC-SP 10 Near White Blast Cleaning. All surfaces shall be clean and dry and have a surface profile of 1.5 – 2.5 mils. Cleaned surfaces shall be primed within eight hours of surface preparation and prior to the formation or corrosion by products. After erection and prior to application of the finish coat(s) all surface shall be cleaned of all dirt, dust, oil, grease as well as any other foreign matter. All areas of damage to the shop primer shall be cleaned in accordance with SSPC-SP 10 Near White Blast Cleaning. All intact shop primer shall be brush blasted to provide a uniform surface profile of at least 1.0 mil. All edges shall be feathered. Damaged shop primer shall be spot primed with the same primer specified for use on the item.
- c. Previously Painted Ferrous Metal (Non-Immersion Service): All surfaces shall be high pressure water washed (minimum 3,500 psi with rotating 0° tip) to remove all dirt, dust, chalk, loose paint, as well as any other foreign matter. All areas of failing paint and corrosion shall be prepared in accordance with SSPC-SP 11 Power Tool Cleaning to Bare Metal. All edges shall be feathered. Spot primer shall be applied within eight hours of surface preparation and prior to the formation of corrosion by products.

5. Ductile Iron Pipe:

- a. New Ductile Iron Pipe – Non Immersion Service (Shop Primed): Ductile Iron Pipe shall not have ever been coated with asphalt. Prior to abrasive blasting all surfaces shall be cleaned of all oil, grease, as well as any other foreign matter in accordance with SSPC-SP 1 Solvent Cleaning. Uniformly abrasive blast the entire exterior surface using angular abrasive to an NAPF 500-03-04: “External Pipe Surface Condition”. When viewed without magnification, the exterior surfaces shall be free of all visible dirt, dust, loose annealing oxide, loose mold coating, rust and other foreign matter. Tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife. Any area where rust reappears before application shall be re-blasted.

- b. Previously Painted Ductile Iron Pipe (Non-Immersion Service): All surfaces shall be high pressure water washed (minimum 3,500 psi with rotating 0° tip) to remove all dirt, dust, chalk, loose paint, as well as any other foreign matter. All areas of failing paint and corrosion shall be prepared in accordance with SSPC-SP 11 Power Tool Cleaning to Bare Metal. All edges shall be feathered. Spot primer shall be applied within eight hours of surface preparation and prior to the formation of corrosion by products.
- 6. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Abrasive blast to remove passivation and to provide a uniform 1.0 mil anchor profile.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
  - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  - 3. Use only thinners approved by paint manufacturer and only within recommended limits.

### 3.03 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
  - 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  - 3. Provide finish coats that are compatible with primers used.
  - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
  10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer on metal surfaces that have been shop primed and touchup painted.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
  4. Heat Exchangers
  5. Tanks
  6. Ductwork
  7. Insulation
  6. Motors and mechanical equipment.
  7. Accessory items.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
  2. Switchgear.
  3. Panelboards.
- H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

- I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- L. Pipe Identification Painting:
  - 1. Color code nonsubmerged metal and plastic piping except electrical conduit. Paint fittings and valves the same color as pipe.
  - 2. Piping Color Coding: Suggested colors are shown on the Piping Schedule. The Owner shall make final color selections. Provide colors selected by the Owner at no additional cost.
  - 3. On exposed stainless steel piping, apply color 24 inches in length along pipe axis at connections to equipment, valves, branch fittings, at wall boundaries, and at intervals along piping not greater than 9 feet on center, with identification labels applied to each exposed run of pipe as specified herein.
  - 4. Pipe Supports: Pipe supports shall be painted the same color as the piping they support.
- M. Piping Labels:
  - 1. Identification labels shall bear full piping system name as specified in the Piping Schedule shown.
  - 2. Install separate flow directional arrows with each label.
  - 3. Include black lettering on OSHA safety yellow self-adhesive vinyl or vinyl cloth.
  - 4. Lettering Height: Meet ANSI A13.1.
  - 5. Label and Adhesive: Long lasting, resistant to moisture, oils, solvents, and weathering, meeting OSHA requirements.
  - 6. Locate labels at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 18 feet on center, with at least one label applied to each exposed run of pipe.



7. Manufacturers:
  - a. W.H. Brady Co., Milwaukee, WI.
  - b. Seton Nameplate Corp., New Haven, CT.

3.04 FIELD QUALITY CONTROL

- A. Apply coatings in accordance with manufacturer's printed data sheets. Allow sufficient time between coats to insure complete curing of previously applied coatings.
- B. Dry Film Thickness Testing:
  1. Check each coat for correct millage. Do not take DFT measurements until coatings have cured a minimum of eight (8) hours.
  2. After repaired and recoated areas have cured sufficiently, final tests will be conducted by the Engineer, measuring coating thickness, as specified in mils, with a magnetic type dry film thickness gauge as specified per SSPC-PA2. The Contractor shall furnish the gauge.
  3. Test finish coats (except zinc primers, galvanized, and elastomeric coatings in excess of 25.0 mils MDFT), for holidays and discontinuities using a low voltage, wet sponge holiday detector (Tinker & Rasor M-1 or equal) per manufacturer's instructions. Contractor shall furnish the holiday detector.
  4. Testing of finish coats in excess of 25.0 mils MDFT, where required, shall be done using a high voltage holiday detector (Tinker & Rasor Model AP or equal) per manufacturer's instructions. Contractor shall furnish the holiday detector.
- C. Damaged Coatings, Pinholes, and Holidays:
  1. Feather edges and repair in accordance with manufacturer's recommendations.
  2. Repair fusion bonded coatings as recommended by original applicator. Applicator shall provide liquid repair kits for this purpose as recommended by coating manufacturer.
  3. Apply finish coats, including touch-up and damage-repair coats, in a manner which will present a uniform texture and color-matched appearance.

**D. Unsatisfactory Application:**

1. If an item has improper finish color or insufficient film thickness, clean and recoat the surface with specified paint material to obtain specified color and coverage. Obtain specific preparation information from coating manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat in accordance with the specifications. Depending on extent of repair, finish sanding and additional coats may be required.
3. Evidence of runs, drips, sags, dry-spray, lap marks, blisters, or other imperfections shall be cause for rejection.
4. Repair defects in coating system per written recommendations of coating manufacturer.
5. Leave all staging up until the Engineer has inspected the surface or coating.
6. Replace staging removed prior to approval of the Engineer.

**3.05 CLEANING**

- A. Cleanup:** At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

**3.06 PROTECTION**

- A.** Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B.** Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 EXTERIOR PAINT SCHEDULE

- A. Concrete, Stucco, and Masonry (Other than Concrete Masonry Units): Provide the following finish systems over exterior concrete, stucco, and brick masonry surfaces:
  - 1. Surface Preparation: Brush blast or high pressure water blast to remove glaze and provide a uniform anchor profile (Reference SSPC-SP 13, ICRI CSP 1 - 2)
  - 2. Block Filler: Tnemec Series 130 applied at 60 - 80 square feet per gallon.
  - 3. First and Second Coats: Tnemec Series 156 Envirofill applied at a rate to achieve 6.0 - 8.0 mils DFT per coat.
- B. Non-Submerged Ferrous Metal:
  - 1. Surface Preparation: See Section 3.2 - 4 - a.
  - 2. Primer: Tnemec Series 91 H20 Hydro-Zinc applied a rate to achieve 2.5 - 3.5 mils DFT.
  - 3. Field Touch-Up: Tnemec Series 91 H20 Hydro-Zinc applied a rate to achieve 2.5 - 3.5 mils DFT.
  - 4. Intermediate: Tnemec Series 66 Epoxoline applied at a rate to achieve 3.0 - 5.0 mils DFT
  - 5. Finish: Tnemec Series 1094 Endura-Shield applied at a rate to achieve 2.0 - 3.0 mils DFT.
- C. Previously Painted Non-Submerged Ferrous Metal and Ductile Iron Pipe:
  - 1. Surface Preparation: See Section 3.2 - 4 - c.
  - 2. Spot Primer: Tnemec Series 135 Chembuild applied a rate to achieve 3.0 - 5.0 mils DFT.
  - 3. Full Prime: Tnemec Series Chembuild applied at a rate to achieve 3.0 - 5.0 mils DFT
  - 4. Finish: Tnemec Series 1094 Endura-Shield applied at a rate to achieve 2.0 - 3.0 mils DFT.
- D. Non-Submerged Galvanized:
  - 1. Surface Preparation: See Section 3.2, C, 6.

## PAINTING

2. Primer: Tnemec Series 66 Epoxoline applied at a rate to achieve 3.0 – 5.0 mils DFT
3. Finish: Tnemec Series 1094 Endura-Shield applied at a rate to achieve 2.0 – 3.0 mils DFT.

### E. Wood

1. Surface Preparation: Clean and dry. Sand to achieve smooth finish. Fill voids
2. Primer: Tnemec Series 10-99W Primer applied at a rate to achieve 2.0 – 3.0 mils DFT
3. Finish: Two coats of Tnemec Series 1029 Enduratone applied at a rate to achieve 2.0 – 3.0 mils DFT per coat.

### F. Non-Submerged Ductile Iron Pipe

1. Surface Preparation:
2. Primer: Tnemec Series N140-1211 Pota-Pox Plus applied a rate to achieve 6.0 – 8.0 mils DFT.
3. Field Touch-Up: Tnemec Series N140-1211 Pota-Pox Plus applied a rate to achieve 6.0 – 8.0 mils DFT.
4. Intermediate: Tnemec Series 66 Epoxoline applied at a rate to achieve 3.0 – 5.0 mils DFT
5. Finish: Tnemec Series 1094 Endura-Shield applied at a rate to achieve 2.0 – 3.0 mils DFT.

## 3.08 INTERIOR PAINT SCHEDULE

### A. Concrete and Concrete Masonry Units: Provide the following paint system:

1. Surface Preparation: Clean and Dry.
2. Block Filler: Tnemec Series 130 applied at 60 – 80 square feet per gallon.
3. Intermediate Coat: Tnemec Series 113 Tneme-Tufcoat applied at a rate to achieve 4.0 – 6.0 mils DFT.
4. Finish: Tnemec Series 297 Enviro-Glaze applied at a rate to achieve 2.0 – 3.0 mils DFT.

- B. Concrete and Concrete Masonry Units: Provide the following paint system:
1. Surface Preparation: Clean and Dry.
  2. Block Filler: Tnemec Series 130 applied at 60 – 80 square feet per gallon.
  3. Intermediate Coat: Tnemec Series 113 Tneme-Tufcoat applied at a rate to achieve 4.0 – 6.0 mils DFT.
  4. Finish: Tnemec Series 297 Enviro-Glaze applied at a rate to achieve 2.0 – 3.0 mils DFT.
- B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
1. Primer: Tnemec 51-792 Primer applied at a rate to achieve 1.0 – 2.0 mils DFT.
  2. Finish: Two coats of Tnemec Series 1026 Enduratone applied at a rate to achieve 2.0 – 3.0 mils DFT per coat.
- C. Wood
1. Surface Preparation: Clean and dry. Sand to achieve smooth finish. Fill voids.
  2. Primer: Tnemec Series 10-99W Primer applied at a rate to achieve 2.0 – 3.0 mils DFT
  3. Finish: Two coats of Tnemec Series 1029 Enduratone applied at a rate to achieve 2.0 – 3.0 mils DFT per coat.
- D. Non-Submerged Ferrous Metal:
1. Surface Preparation: See Section 3.2, C, 4, a.
  2. Primer: Tnemec Series 91 H20 Hydro-Zinc applied a rate to achieve 2.5 – 3.5 mils DFT.
  3. Field Touch-Up: Tnemec Series 91 H20 Hydro-Zinc applied a rate to achieve 2.5 – 3.5 mils DFT.
  4. Intermediate: Tnemec Series 66HS Epoxoline applied at a rate to achieve 3.0 – 5.0 mils DFT
  5. Finish: Tnemec Series 1094 Endura-Shield applied at a rate to achieve 2.0 – 3.0 mils DFT.
- E. Non-Submerged Galvanized:

1. Surface Preparation: See Section 3.2, C, 6.
  2. Primer: Tnemec Series 66 Epoxoline applied at a rate to achieve 3.0 – 5.0 mils DFT
  3. Finish: Tnemec Series 1094 Endura-Shield applied at a rate to achieve 2.0 – 3.0 mils DFT.
- F. Concrete Sealer: Provide the following finish system over concrete and masonry to be sealed:
1. Clear or pigmented acrylic sealer.
    - a. Surface Preparation: Brushoff blast and/or acid etching.
    - b. Coverage: As recommended by manufacturer.
- G. Non-Submerged Ductile Iron Pipe
1. Surface Preparation: 3.2, C, 5, a
  2. Primer: Tnemec Series N140-1211 Pota-Pox Plus applied a rate to achieve 6.0 – 8.0 mils DFT.
  3. Field Touch-Up: Tnemec Series N140-1211 Pota-Pox Plus applied a rate to achieve 6.0 – 8.0 mils DFT.
  4. Intermediate: Tnemec Series 66HS Epoxoline applied at a rate to achieve 3.0 – 5.0 mils DFT
  5. Finish: Tnemec Series 1094 Endura-Shield applied at a rate to achieve 2.0 – 3.0 mils DFT.

### 3.09 IMMERSION SERVICE COATINGS

- A. Submerged Concrete – Filters
1. Surface Preparation: See Section 3.2, C, 3
  2. Surfacer: Tnemec Series 218 MortarClad applied at a rate to achieve 1/8" minimum dry film thickness. All voids, bug holes and other defects shall be filled with a smooth surface obtained.
  3. Primer: Tnemec Series 20 Pota-Pox applied at a rate to achieve 4.0 – 6.0 mils DFT. Spray and backroll.
  4. Lining: Tnemec Series 22 Epoxoline applied at a rate to achieve 25.0 – 35.0 mils DFT.

B. Submerged Ductile Iron Pipe (Potable Water)

1. Surface Preparation: 3.2, C,5,a
2. Primer: Tnemec Series N140-1211 Pota-Pox Plus applied a rate to achieve 6.0 – 8.0 mils DFT.
3. Field Touch-Up: Tnemec Series N140-1211 Pota-Pox Plus applied a rate to achieve 6.0 – 8.0 mils DFT.
4. Intermediate: Tnemec Series 20Pota-Pox applied at a rate to achieve 4.0 – 6.0 mils DFT
5. Finish: Tnemec Series 141 Epoxoline applied at a rate to achieve 10.0 – 12.0 mils DFT.

C. Submerged Ferrous Metal (Potable Water):

1. Surface Preparation: See Section 3.2 , C, 4, b
2. Primer: Tnemec Series 91 H20 Hydro-Zinc applied a rate to achieve 2.5 – 3.5 mils DFT.
3. Field Touch-Up: Tnemec Series 91 H20 Hydro-Zinc applied a rate to achieve 2.5 – 3.5 mils DFT.
4. Intermediate: Tnemec Series 20 Pota-Pox applied at a rate to achieve 3.0 – 5.0 mils DFT
5. Finish: Tnemec Series 141 Epoxoline applied at a rate to achieve 8.0 – 10.0 mils DFT.

3.10 OTHER COATINGS

A. Dielectric Insulation (including aluminum and concrete):

1. Surface Preparation: Clean and dry or SP-3.
2. Tnemec Series 46H-413 Hi-Build Tneme-Tar @ 8.0-12.0 mils DFT.

B. PVC and Plastic:

1. Surface Preparation: Sanding with medium grit.
2. Primer: Tnemec Series 66HS Epoxoline applied at a rate to achieve 3.0-5.0 mils DFT.

3. Finish: Tnemec Series 1095 Endura-Shield applied at a rate to achieve 2.0 – 3.0 mils DFT.

C. Launder Coating System:

1. Surface Preparation: Abrasive blast or mechanically abrade to remove all laitance, curing compounds, hardeners as well as any other contaminants and to provide a surface profile (Reference SSPC-SP 13/ICRI CSP 5). Lining shall terminate 2' below the waterline and as shown on the drawings below the waterline. Provide a neat transition line.
2. Primer/Surfacer: Tnemec / Epoxytec Ceramico applied at 1/8" minimum DFT to fill all voids, bugholes and to seal the surface.
3. Lining: Tnemec / Epoxytec CPP Trowel-Liner applied at a rate to achieve 125 mils DFT. Apply lining 6" onto bare concrete to seal the edge. Featheredge transition onto bare concrete.

### 3.11 Product Performance Criteria

Provide the following product information and **manufacturers published performance** data should coatings or coating system be submitted in lieu of the standard of quality established in the project documents. Should the data not be available in a published format, or if the duration of the test does not meet the specified requirement, please respond in the appropriate space with NT (Not Tested).

A. Steel Primer

1. Standard of Quality: Tnemec Series 91 H20 Hydro-Zinc
2. Generic Type: Organic Zinc Rich Urethane Primer
3. Solids By Volume: 63%
4. Zinc Content: 83% by weight. ASTM D520 Type III Zinc Dust
5. Salt Spray (Fog): ASTM B 117, Scribed Panels, 50,000 hours exposure.
6. Adhesion: ASTM 4541 Elcometer Adhesion.
7. Humidity: ASTM D 4585. 4,000 hours exposure.
8. Cathodic Disbondment: ASTM G8, Method A. Days Exposure
9. Immersion: ASTM D 870 Potable Water Immersion. 7 years immersion.
10. Prohesion: ASTM G 85 Prohesion Cabinet. 15,000 hours exposure.



**B. NSF Approved Polyamide Epoxy (Locations as Specified)**

1. Standard of Quality: Tnemec Series 20 Pota-Pox
2. Generic Type: Polyamide Epoxy
3. Special Qualifications: NSF Std 61 approved for tanks 6,000 gallons capacity or greater
4. Solids By Volume: 56%.
5. Salt Spray (Fog): ASTM B 117. Result after 10,000 hours exposure (plane rust, rust at scribe and blistering).
6. Immersion: ASTM D 870. 140° Deionized Water – 2,000 hours
7. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
8. Adhesion: ASTM 4541 Elcometer Adhesion.
9. Humidity: ASTM D 4585. 15,000 hours.
10. Immersion: ASTM D 870. 7 Years.

**C. Polyamide Epoxy (Locations as Specified)**

1. Standard of Quality: Tnemec Series 66 Epoxoline
2. Generic Type: Polyamide Epoxy
3. Solids By Volume: 56%.
4. Salt Spray (Fog): ASTM B 117. Result after 10,000 hours exposure (plane rust, rust at scribe and blistering).
5. Immersion: ASTM D 870. 140° Deionized Water – 2,000 hours
6. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
7. Adhesion: ASTM 4541 Elcometer Adhesion.
8. Humidity: ASTM D 4585. 15,000 hours.
9. Immersion: ASTM D 870. 7 Years.

**D. NSF Approved Modified Polyamine Epoxy (Locations as Specified)**

1. Standard of Quality: Tnemec Series 141 Epoxoline

2. Generic Type: Modified Polyamine Epoxy
  3. Solids By Volume: 82%.
  4. Salt Spray (Fog): ASTM B 117. Result after 10,000 hours exposure (plane rust, rust at scribe and blistering).
  5. Immersion: ASTM D 870. 140° Deionized Water – 2,000 hours
  6. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
  7. Adhesion: ASTM 4541 Elcometer Adhesion.
  8. Humidity: ASTM D 4585. 2,000 hours.
- E. NSF Approved 100% Solids Modified Polyamine Epoxy (Filter Basins)
1. Standard of Quality: Tnemec Series 22 Epoxoline
  2. Generic Type: Modified Polyamine Epoxy
  3. Special Qualifications: Meets the health effects requirements of NSF/ANSI/CAN 600 according to the requirements of NSF/ANSI/CAN 61 for potable water tanks of 50 gallons or greater. Also meets the requirements set forth for AWWA C-210-07 testing
  4. Solids By Volume: 100%.
  5. Cyclic Salt Fog/UV: ASTM D 5894. Result after 10,000 hours exposure (plane rust, and blistering).
  6. Immersion: ASTM D 870. 140° Deionized Water – 2,000 hours.
  7. Immersion: ASTM D 870. 200° potable water for 6 months.
  8. Abrasion: ASTM 4060 (CS-17 Wheel, 1,000 gram load, 1,000 cycles)
  9. Adhesion: ASTM 4541 Elcometer Adhesion.
  10. Adhesion: ASTM 4541 Elcometer Adhesion. After 6 months immersion in crude oil at 275° F.
  11. Humidity: ASTM D 4585. 2,000 hours.
- F. Aliphatic Acrylic Polyurethane with Added UV Absorbers (Locations as Specified)
1. Standard of Quality: Tnemec Series 1094 Endura-Shield

2. Generic Type: Aliphatic Acrylic Urethane with added UV Protection
3. Solids By Volume: 66%.
4. Salt Spray (Fog): ASTM B 117. Result after 5,000 hours exposure (plane rust, rust at scribe and blistering).
5. Cyclic Salt Fog/UV: ASTM D 5894. 5,000 hours
6. Adhesion: ASTM 4541 Elcometer Adhesion.

QUV: ASTM D 4587. Result after 6,000 hours exposure. Report color retention and gloss retention.

**G. Fluoropolymer Urethane (Chemical Storage Tank Exterior)**

1. Standard of Quality: Tnemec Series 700 HydroFlon
2. Generic Type: Fluoropolymer Urethane
3. Solids By Volume: 60%.
4. Salt Spray (Fog): ASTM B 117. Result after 10,000 hours exposure (plane rust, rust at scribe and blistering).
5. Adhesion: ASTM 4541 Elcometer Adhesion.

QUV: ASTM D 4587. Result after 25,000 hours exposure. Report color retention and gloss retention.

6. EMMAQUA; ASTM D 4141. Results after 1,500 mj/m2 Exposure. Report color retention and gloss retention.
7. EMMAQUA; ASTM D 4141. Results after 2,000 mj/m2 Exposure. Report color retention and gloss retention.
8. EMMAQUA; ASTM D 4141. Results after 3,500 mj/m2 Exposure. Report color retention and gloss retention.

**END OF SECTION**

**SECTION 09903**  
**SUBMERGED METALS PAINTING (NON-POTABLE)**

**PART 1      GENERAL**

**1.01    SUBMITTALS**

- A.    Five (5) sets of Submittals shall be submitted to the Engineer for review prior to performing any Work. Submittals shall at a minimum include the following:
  - 1.    Supplier, type and size of abrasive to be used with Material Safety Data Sheets (MSDS).
  - 2.    Supplier, type and quantity of coatings to be used with Material Safety Data Sheets (MSDS).
  - 3.    For each paint system used (interior, exterior) herein, the Contractor shall obtain from the paint manufacturer for submittal to the Engineer, a Paint System Data Sheet (PSDS), Technical Data Sheets, and paint colors (where applicable) for each product used in the paint system.

**1.02    PAINTING STANDARDS**

- A.    All Work shall be done in accordance with the requirements of the Steel Structures Painting Council (latest edition of Volume 1 and Volume 2, including Commentary Sections and Appendices), the United States Bureau of Reclamation, the paint manufacturer's published product data, and the Specifications herein. The Steel Structures Painting Council "Visual Standard for Abrasive Blast Cleaned Steel" SSPC-Vis 1-89 shall also be used taking into account staining from prior paint applications. Where the foregoing standards, recommendations, and Specifications are conflicting, said conflicts shall be brought to the attention of the Engineer. Manufacturer's published product data shall be adhered to unless changed in writing by the home office of the manufacturer.

**1.03    NOTIFICATION**

- A.    The Contractor shall notify the Owner and the Engineer at least seven (7) days before starting the Work at the site. The Contractor shall reconfirm the commencement of Work with the Owner and Engineer twenty-four (24) hours prior to starting Work at the site.

**1.04    EMERGENCY INFORMATION**

- A.    The Contractor shall post information concerning emergency medical, fire, and rescue phone numbers from which personnel on the site can obtain information if needed. The emergency information shall be in a central position, located so it

## SUBMERGED METALS PAINTING (NON-POTABLE)

is visible and accessible twenty-four (24) hours a day. The emergency information shall be posted the entire length of time that the Contractor is performing work at the tank site.

### 1.05 OPERATION OF VALVES AND EQUIPMENT

- A. All operations which would include closing valves, switching, starting, stopping, or removal from service of any equipment shall be done by the Owner's personnel upon request by the Contractor. The Contractor shall have a full complement of personnel working on a continuous basis until the Work causing the interruption is completed. All Work performed under this Agreement shall be performed in close cooperation with the Owner.

### 1.06 CONTRACTOR SUPERVISION

- A. Except where the Contractor is an individual and gives his personal superintendence to the Work, the Contractor shall provide a competent superintendent, satisfactory to the Owner, for the Work at all times during working hours with full authority to act for him. The Contractor shall also provide an adequate staff for the proper coordination and expedition of his Work.

### 1.07 COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

- A. Compliance with local, state and federal regulations concerning emissions or disposal of solid, particulate, liquid, or gaseous matter as a result of the cleaning, painting, or other operations under this Agreement shall be the responsibility of the Contractor. This compliance shall be accomplished without supervision from the Owner, Engineer, field observer, or other direct or indirect agents of the Owner. No additional compensations for changes in the laws, regulations, or the interpretation thereof shall be granted by the Owner. No burning of trash (including abrasive bags or other paper or wood products) on the site shall be permitted. All shielding, abrasive retrieval, or other methods of using precautions required by the regulating agencies shall also be accomplished at no additional cost to the Owner unless otherwise provided herein. Any fines imposed on the Owner or Engineer by any regulatory agency as a result of the Contractor's non-compliance with environmental regulations shall be paid or reimbursed by the Contractor.

### 1.08 ATTRACTIVE NUISANCES AND CLEANUP

- A. The job site shall be kept in a clean and safe condition at all times. Hazards or attractive nuisances shall be protected at all times. Upon completion of the Work, the job site and all nearby sites impacted by the Work activities shall be left clean of all debris, blasting residue, or any other items resulting from the operations of the Contractor. The cost of any cleanup which must be done by the Owner shall be deducted from funds due the Contractor. Any oils, solvents,

## SUBMERGED METALS PAINTING (NON-POTABLE)

organic compounds, or contaminants spilled on the site shall be immediately removed and cleaned up by the Contractor. If the Owner has to remove the oils, solvents, organic compounds, or contaminants, the Owner may deduct the costs of removal and clean-up from the total contract amount owed the Contractor.

### 1.09 PROTECTION OF STRUCTURES AND EQUIPMENT

- A. Before blast cleaning on any portion of the tank, all structures and equipment on or adjacent to the site shall be covered or protected to prevent the entry of blasting abrasive, dust or paint and so they can continue to function as required. Any blasting or paint debris on or inside the structures and equipment shall be removed by the Contractor prior to completion of the Work.

## PART 2 PRODUCTS

### 2.01 APPROVAL OF COATINGS

- A. All coatings shall be acceptable to the USEPA, ADEM and/or the controlling local health and environmental regulatory agencies. All coatings to be used shall be as specified herein.
- B. The interior and exterior coatings shall be furnished by the same manufacturer unless specifically stated otherwise herein. Only thinners recommended and furnished by the paint manufacturer shall be used. The specified coatings are intended to be standards of quality.
- C. Substitute materials must be for complete systems and not individual products combined with the specified materials and the performance criteria for all products within a system must meet or exceed the specified materials.

### 2.02 COATING MATERIALS

- A. All paints and thinners shall be new and furnished for this job. They shall be delivered from the coating manufacturer to the job site in the original factory sealed containers, which are clearly and properly labeled by the coating manufacturer showing the manufacturer's name, product number, type of paint, batch number, and expiration date. The amounts delivered shall provide the proper coverage rates, taking in account normal application loss. The materials shall be stored and handled in accordance with all manufacturer's published product data, including all requirements listed on the Material Safety Data Sheets (MSDS).
- B. Submerged Metal Coatings: Approved coatings for the submerged metals or metals exposed to corrosive liquids shall be a hydrophobic aromatic polyurethane applied in 2-3 coats. The system shall be as follows:
  - 1. Primer: Tnemec Series 446 Perma Shield MCU

## **SUBMERGED METALS PAINTING (NON-POTABLE)**

2. Stripe Coat and Intermediate Coat: Tnemec Series 446 Perma Shield MCU
3. Final Coat: Tnemec Series 446 Perma Shield

### **2.03 THINNERS**

- A. All thinners are to be supplied by the paint manufacturer. Thinners shall be used only in accordance with the instructions on the manufacturer's published product data.

## **PART 3 EXECUTION**

### **3.01 WORK SCHEDULE**

- A. The cleaning and painting of the tank shall be accomplished in such a way as to minimize the number of days required for observing the repairing, cleaning and painting operations.
- B. No cleaning or painting is to be done in the night period between sunset and sunrise unless otherwise approved by the Owner. The times for Work shall also comply with local, state, and federal regulations and laws regarding days of week, noise and interference with activities of surrounding property owners.

### **3.02 SURFACES TO BE CLEANED AND PAINTED**

- A. All metal surfaces that are submerged or exposed to corrosive liquids near the liquid surface, including (but not limited to) the container, tower, riser, all piping and appurtenances, and all rods, turnbuckles, threads, bolts, nuts, pins, brackets, seams, corners, etc., but excluding the nameplate and the safe climbing devices, shall be cleaned and painted as specified herein.
- B. The surfaces to be painted shall be free from mud, oil, grease, dust, moisture, salts, and other foreign material which would cause adhesion or other problems in the finished product. The manufacturer's published product data concerning the time between coats and the preparation of the previously painted surfaces shall be followed. If field tests by the field observer find questionable amounts of contamination on the steel surfaces or painted surfaces to be top-coated, a representative of the home office of the paint manufacturer may be called to examine the surfaces in question and determine if the surfaces are in accordance with these Specifications and the manufacturer's published product data.

### **3.03 PAINT APPLICATIONS**

- A. Quality: All cleaning and painting shall be done in a workmanlike manner. Drying times and ventilation requirements of the paint manufacturer shall be strictly enforced by the Contractor. In addition to the minimum and maximum dry film requirements, all sags, runs, dry spray, pinholes, craters, roller nap, or

## SUBMERGED METALS PAINTING (NON-POTABLE)

other irregularities which would be detrimental to the life or appearance of the coating(s) shall be removed and repaired.

- B. Painting Environment: All temperature and humidity requirements of the paint manufacturer's published product data shall be followed. In addition, no painting shall be done when the relative humidity is greater than eighty-five (85%) percent, or the temperature of the steel is or is expected to be less than five (5°) degrees F above the dew point temperature during application and until the coating has cured to resist moisture in accordance with the manufacturer's published product data. If there is not full-time resident observation on the Work, the Contractor shall have wet bulb-dry bulb measuring equipment and steel temperature measuring equipment on the job at all times. Readings shall be recorded at the beginning and end of each painting session and at no less than four (4) hour intervals. Wind velocities during exterior painting shall be compatible for the quality application of the exterior coating.
- C. Mixing of Coatings: Each component shall be thoroughly mixed on site with a power agitator to insure no pigment remains on the bottom of the container. An entire kit shall be mixed together to ensure proper ratios of components. If the Contractor opts to use partial kits, then accurate measuring apparatus shall be used to carefully measure each component by volume into a clean container in accordance with the manufacturer's published product data. The container shall be large enough to hold all components to be mixed, including thinner. The combined material shall be thoroughly mixed with a power agitator to achieve a uniform consistency. Adherence to proper induction times for the combined coating material in accordance with the manufacturer's published product data shall be accomplished by the Contractor.
- D. Application and Damages: Unless otherwise specified, methods of application are at the discretion of the Contractor as long as the materials are applied in accordance with the manufacturer's published product data and the end results are in compliance with these Specifications (including all others inferred by reference). Application equipment (including air and airless sprayers, rollers and brushes) shall be good quality, in good condition and shall be as recommended by the coating manufacturer.

### 3.04 IRREGULAR SURFACES

- A. Any burrs, weld spatter, rough welds, weld overlap, bolts, sharp edges, or corners or any areas disturbed or installed by the Contractor's operations which would cause difficulty in achieving a defect-free coating shall be chipped and/or ground smooth. It is not the intent to have these irregular surfaces chipped and/or ground flush. The objective of the chipping and/or grinding is to eliminate irregular surfaces to provide a surface that is sufficiently smooth for the application of a uniform thickness coating without voids. This chipping and/or grinding is considered incidental to the painting and is to be included in the Base Bid.



## SUBMERGED METALS PAINTING (NON-POTABLE)

### 3.05 PRIMING

- A. Not later than during the same day and before the forming of rust, the cleaned and blasted surfaces shall be primed with the specified primer. Special attention shall be given to lapped joints, bolt heads and nuts, rivets, threads, corners, member intersections, and other deviations from smooth surfaces. These special areas shall be primed by brush with twenty (20%) percent thinned material, prior to the complete priming.

### 3.06 SURFACE PREPARATION AND COATING

- A. Metals
  - 1. Surface Preparation: SSPC-SP 10, Near-White Blast
  - 2. Stripe Coat: Use brush to apply a 2.0 mils dry film of a stripe coat of twenty (20%) percent thinned primer to all weld seams and repaired and existing pits.
  - 3. Primer: 7.0-9.0 mils, dry film
  - 4. Final Coat: 7.0-9.0 mils, dry film

### 3.07 CURING

- A. The wet area coating shall be completely cured and the tank shall not be filled with water for at least seven (7) days or until approved by the Owner. Exterior coatings on the opposite side of water bearing surfaces shall be completely cured and the tank shall not be filled with water for at least (seven) 7 days or until approved by the Owner. Solvent rub tests, pencil hardness tests, or other industry recognized testing procedures shall be used as recommended by the manufacturer.
- B. Forced ventilation shall be supplied to interiors for a continuous period of at least forty-eight (48) hours after the final coat has been applied. Adequate ventilation of tank bottoms and other low lying areas shall be provided by the Contractor as recommended by the coating manufacturer and as directed by the Engineer. The Contractor shall furnish, install, and operate the equipment that is necessary to provide forced ventilation to aid curing. If supplementary heating or dehumidification is required to effect curing, the Contractor shall furnish, install, and operate the equipment at no additional cost.

### 3.08 TESTING

- A. Accessibility for observation: All Work shall be made accessible to the Engineer using the Contractor's rigging and equipment. The Contractor shall provide any

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labor to the Engineer to assist with inspections and testing and safely access the Work.

- B. Holiday Testing: All interior coatings, including those above the high water level, shall be checked by the Contractor in the presence of the Engineer with a wet sponge low voltage holiday detector. Any voids indicated shall be repaired by applying more of the finish coat of paint by brush or roller. The repaired areas shall be retested after the appropriate drying time. The coating system must pass the holiday test regardless of the mil thickness existing.

### 3.09 POST-CURE CLEANING

- A. After curing and prior to returning the structure to service, the Contractor shall wash interiors with potable water. The Contractor shall supply an adequate volume of water (twenty (20) gpm minimum) with sufficient pressure (sixty (60) psi minimum at the nozzle) to wash thoroughly all of the interior wet surfaces, including those surfaces above the high water level. All residue and trash shall be removed.

### 3.10 FIRST ANNIVERSARY INSPECTION

- A. All Work shall be guaranteed for one (1) year after the date of Substantial Completion. This guarantee shall be provided for in the Contractor's Performance Bond. The Contractor shall be present for the inspection and shall furnish an experienced foreman, rigging, and assistance for the inspection and shall be prepared to perform minor touch-up operations.
- B. The Contractor shall have sufficient quantities of each of the primers, intermediate coatings, and finish coatings at the time of the inspection along with power cleaning tools and "Scotch-Brite" abrasive disks for spot cleaning.

In order to return the tank into service more quickly, the Contractor shall also have one (1) gallon of Aquatapoxy Gel to touch up the interior wet surfaces. Spot repairs shall be made by the Contractor before returning the tank back into service. Repairs requiring extensive Work and rigging may be delayed until a time mutually agreeable to the Owner and Contractor. All costs associated with the First Anniversary Inspection shall be included in the Base Bid Price.

**END OF SECTION**

## SECTION 09910 –PAINTING & STAINING ARCHITECTURE (PROFESSIONAL PRODUCTS)

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Steel.
  - 2. Aluminum (not anodized or otherwise coated).
  - 3. Wood.
  - 4. Gypsum board.
- B. Related Sections include the following:
  - 1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
  - 2. Division 6 Sections for shop priming carpentry with primers specified in this Section.
  - 3. Division 9 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
  - 4. Division 9 Section "Wood Stains and Transparent Finishes" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
  - 5. Division 9 painting Sections for special-use coatings.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

#### 4. QUALITY ASSURANCE

- A. MPI Standards:
  - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

## PAINTING & STAINING (PROFESSIONAL PRODUCTS)

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
  3. Final approval of color selections will be based on benchmark samples.
    - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.
5. DELIVERY, STORAGE, AND HANDLING
  - A. Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:
    1. Product name, and type (description)
    2. Application & use instructions
    3. Surface preparation
    4. VOC content
    5. Environmental issues
    6. Batch date
    7. Color number/name
  - B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
    1. Maintain containers in clean condition, free of foreign materials and residue.
    2. Remove rags and waste from storage areas daily.
6. PROJECT CONDITIONS
  - A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).
  - B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
  - C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

7. EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

2.PRODUCTS

1. MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. BLP Mobile Paint Manufacturing.
  - 3. ICI Paints.
  - 4. Porter Paints.
  - 5. PPG Architectural Finishes, Inc.
  - 6. Sherwin-Williams Company (The).

2. PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Chemical Components of Interior Paints and Coatings: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions:
  - 1. Flat Paints and Coatings: VOC not more than 50 g/L.
  - 2. Non-Flat Paints and Coatings: VOC not more than 150 g/L.
  - 3. Anticorrosive Coatings: VOC not more than 250 g/L.
  - 4. Varnishes and Sanding Sealers: VOC not more than 350 g/L.
  - 5. Stains: VOC not more than 250 g/L.

6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
7. Restricted Components: Paints and coatings shall not contain acrolein; acrylonitrile; antimony; benzene; butyl benzyl phthalate; cadmium; di (2-ethylhexyl) phthalate; di-n-butyl phthalate; di-n-octyl phthalate; 1,2-dichlorobenzene; diethyl phthalate; dimethyl phthalate; ethylbenzene; formaldehyde; hexavalent chromium; isophorone; lead; mercury; methyl ethyl ketone; methyl isobutyl ketone; methylene chloride; naphthalene; toluene (methylbenzene); 1,1,1-trichloroethane; or vinyl chloride.

D. Colors: Match samples.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Wood: 15 percent.
  2. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

#### 2. PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
  2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

E. Wood Substrates For Stain Finish:

1. Patch all nail holes and imperfections with a wood filler and sand smooth.

F. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

G. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

- a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
- b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
- c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

H. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

3. APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Sand lightly between each succeeding enamel or varnish coat.
- F. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
  - 1. Omit primer over metal surfaces that have been shop primed and touchup painted.
  - 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
- G. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- H. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
- L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- M. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
  - 1. Mechanical Work:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Tanks that do not have factory-applied final finishes.



- e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
- f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
- g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

- a. Switchgear.
- b. Panelboards.
- c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

4. FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
  - 1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
  - 2. Testing agency will perform tests for compliance with product requirements.
  - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

5. CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

6. PAINTING SCHEDULE

- A. Steel Substrates (Interior HM Doors & Frames):
  - 1. Epoxy System (Water Base)

- a. Prime Coat: S-W Pro Industrial Pro-Cryl® Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
  - b. Intermediate Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15
  - c. Top Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15 (2.5 - 3 mils dry per coat)
- B. Galvanized-Metal Substrates (Exterior):
  - 1. High-Performance Architectural Latex System:
    - a. Prime Coat: Waterborne galvanized-metal primer.
    - b. Intermediate Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series
    - c. Top Coat: S-W Pro Industrial™ Zero VOC Gloss Acrylic, B66-600 Series (2.5-4 mils dry per coat)
- C. Wood: Including architectural woodwork & doors
  - 1. High-Performance Architectural Latex System:
    - a. Prime Coat: S-W PrepRite® ProBlock® Latex Primer, B51 Series (4 mils wet, 1.4 mils dry)
    - b. Intermediate Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series
    - c. Top Coat: S-W Pro Industrial Zero VOC Gloss Acrylic, B66-600 Series (2.5-4 mils dry per coat)
- D. Wood - STAINED: Including cabinetry
  - 1. Stain & Varnish System:
    - a. Stain: S-W Minwax 250 VOC Stains
    - b. Intermediate Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series
    - c. Top Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series
- E. Gypsum Board Substrates:
  - 1. Latex System – Egg-shell Finish (Walls):
    - a. Prime Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 (4 mils wet, 1.5 mils dry per coat)
    - b. Intermediate Coat: S-W ProGreen 200 Eg-Shel, B20-650 Series.
    - c. Topcoat: Interior S-W ProGreen 200 Eg-Shel, B20-650 Series (4 mils wet, 1.6 mils dry per coat)
  - 2. Latex System – Flat Finish (Ceilings):
    - a. Prime Coat: S-W ProGreen 200 Interior Latex Primer, B28W600 (4 mils wet, 1.5 mils dry per coat)

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- b. Intermediate Coat: S-W ProGreen 200 Flat, B30-600 Series.
- c. Topcoat: Interior S-W ProGreen 200 Flat, B30-600 Series (4 mils wet, 1.6 mils dry per coat)

END OF SECTION 09912

**SECTION 09963**  
**HIGH PERFORMANCE COATINGS AND SPECIAL COATINGS FOR**  
**EXTERIOR SURFACE OF PRESTRESSED CONCRETE WATER STORAGE TANKS**

**PART 1 GENERAL**

1.01 Summary

- A. This Section includes applying special coating systems to items and surfaces scheduled, including surface preparation, prime coats, and topcoats for exterior painting.
- B. Types of Special Coatings for exterior use as indicated on the drawings and schedules include the following:
  - 1. Waterborne Acrylate: Single-component, high performance, elastomeric, and high build acrylic coating.
- C. Related Work:
  - 1. Documents affecting work of this Section include, but are not limited to, General Conditions, Supplementary Conditions, Sections in Division 1 of these Specifications, and including the following Divisions:
    - a. Division 3 – Cast-in-Place & Precast Concrete

1.02 References

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM B 117 Standard Test Method for Corrosion Resistance.
  - 2. ASTM D 2240 Standard Test Method for Measuring Shore Hardness.
  - 3. ASTM D 2794 Standard Test Method for Measuring Direct Impact.
  - 4. ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test.
  - 5. ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test.
  - 6. ASTM D 4060 Standard Test Method for Abrasion Resistance.
  - 7. ASTM D 4213 Standard Test Method for Measuring Scrub-ability of Coatings.
  - 8. ASTM D 4258 Standard Practice for Surface Cleaning Concrete for Coating.

## HIGH PERFORMANCE COATINGS AND SPECIAL COATINGS

9. ASTM D 4259 Standard Practice for Abrading Concrete.
10. ASTM D 4261 Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
11. ASTM D 4263 Standard Test Method for Indicating Moisture by the Plastic Sheet Method.
12. ASTM D 4541 Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
13. And various other ASTM test standards.

### B. Steel Structures Painting Council (SSPC):

1. Steel Structures Painting Council Surface Preparation Specifications (SSPC-SP)
2. Steel Structures Painting Council Paint Application Specifications (SSPC-PA)

## 1.03 Definitions

### A. Definitions as used in Finish Schedule shown on Drawings and Coating Schedule included herein.

1. Coatings: Paint or heavy duty finishes for use on surfaces subject to interior and exterior exposure, submergence, high moisture, splash, or chemical environment, including primers, sealers, fillers, and intermediate and finish coats.
2. Normal: Surfaces subject to normal temperature and humidity.
3. First Coat: Field primer, factory primer, or shop primer. When only one coat is required, first coat is the finish coat.
4. Second, Third, Intermediate, or Finish coats: Successive finish coats applied over first coat.
5. DFT: Dry Film Thickness (Mils/coat).
6. Sfpq: Square feet per gallon (per coat).

## 1.04 Submittals

### A. Product Data:

1. To be considered for approval all submittals shall include the following: Manufacturer's product data sheets, product performance criteria, generic

## **HIGH PERFORMANCE COATINGS AND SPECIAL COATINGS**

chemistry of each coating, and application recommendations for each coating scheduled.

2. List each material and cross-reference the specific coating, finish system, and application.
- B. Submit one copy of manufacturer's Material Safety Data Sheets (MSDS) for each type of coating to ARCHITECT'S field office for information. CONTRACTOR shall post a copy of MSDS on the Site at all times when coating is in progress.

### **1.05 Quality Assurance**

A. Regulatory Requirements:

1. All coatings shall conform to OSHA requirements for allowable exposure to lead and other hazardous substances.

B. Product Manufacturer:

1. Manufacturer shall be a company that specializes in producing high quality industrial coating materials. This company shall have 30 years or more experience demonstrated by case histories in the designated field of application.

C. Applicator Qualifications:

1. Engage an experienced applicator with 5 years or more experience that has successfully completed coating system applications similar in material and extent to those indicated.

D. Single-Source Responsibility:

1. Provide coating material produced by the same manufacturer for each system.

E. Performance Testing:

1. The OWNER/ENGINEER may request testing from the manufacturer for required performance that may include but is not limited to adhesion to the substrate and between coating layers, and resistance to abrasion, humidity, freeze/thaw, and Ultra-violet light exposure.

### **1.06 Delivery, Storage, and Handling**

- A. Materials shall be delivered to the site in original containers with labels intact and seals unbroken.
- B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturers, but not less than 50 degrees F.

## **HIGH PERFORMANCE COATINGS AND SPECIAL COATINGS**

- C. Oily rags and waste must be removed from buildings each night or kept in appropriate metal containers. Provide fire extinguishers of the type recommended by coating manufacturers in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvent.
- D. Empty containers shall have labels canceled and clearly marked as to use.

### **1.07 Project / Site Conditions**

#### **A. Environmental Requirements:**

- 1. Use indirect-fired dry heat and ventilate areas to obtain conditions recommended by coating manufacturer.
- 2. Relative humidity conditions as specified by coating manufacturer shall be adhered to.
- 3. No unprotected, unheated exterior coating shall be undertaken when cold damp, foggy, or rainy weather appears probable, nor when the temperature of the substrate is below 50 degrees F, unless listed in this specification or approved in writing by the coating manufacturer.
- 4. Maintain the manufacturer's environmental requirements until the coating is fully cured.
- 5. Apply no coating in areas where dust is being generated.
- 6. Testing and disposal of any waste and coating shall be the responsibility of the CONTRACTOR.

#### **B. Protection:**

- 1. Drop cloths shall be provided in all areas where coating is performed to fully protect other surfaces.
- 2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace items or remove protection and clean.

- C. Upon Substantial Completion, remaining unused material will become property of the OWNER. Seal material as required for storage, mark contents with color, type, location, and shelf life, and store on Site where required by the OWNER. Provide a minimum of two gallons of each system component and color used.

## **PART 2 PRODUCTS**

### **2.01 Manufacturers**

- A. Tnemec Company, Inc. or equal.

Technical information may be obtained from the following:

SteelCon Coating Systems, Inc.  
2100 3<sup>rd</sup> Ave South  
Irondale, AL 35210  
Phone: 205-951-2086

### **2.02 HIGH PERFORMANCE COATINGS**

- A. High performance coating products of Tnemec Company, Inc. are listed in the Coating Schedule as a standard of quality and performance, and it is not the intent of the specifier that these materials are to be used to the exclusion of equivalent products of other manufacturers.
- B. Only coatings that meet or exceed the performance of these specified coatings may be submitted for use. No substitutions will be considered that change the generic chemistry of the coatings specified.
- C. No substitution will be considered unless the Engineer/Owner has received a written request for approval from a prospective bidder at least 10 days prior to the bid date for receipt of bids. Each request shall include the name of the specified material for which a substitute is being requested; name of the proposed substitute material; and a complete description of the proposed substitute including performance & test data, cure times, recoat windows, and generic composition. No request for substitution will be considered that would decrease film thickness or offer a change in the generic type of coating specified. The decision of the Architect/Owner regarding approval or disapproval of the proposed substitution shall be final.

### **2.03 Colors, Mixing, and Thinning**

- A. Color shall be formed of pigments free of lead, lead compounds, or other materials that might be affected by the presence of hydrogen sulfide or other gases likely to be present at the Site.
- B. Where thinning is necessary, only the products of the manufacturer furnishing the coating will be allowed. All such thinning shall be done in strict accordance with the coating manufacturer's recommendations.
- C. Mix in accordance with the manufacturer's recommendations.



## HIGH PERFORMANCE COATINGS AND SPECIAL COATINGS

### 2.04 Source Quality

- A. Source Quality: Obtain painting, coating, and thinning materials from a single manufacturer.

## PART 3 EXECUTION

### 3.01 Manufacturer's Instructions

- A. Compliance: Comply with manufacturer's product data, including technical information, catalogue instructions, and product instructions listed on material containers.

### 3.02 Examination

- A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the timely and proper completion of the work. Materials removed and replaced to correct defects due to errant application such as overspray or drips on unsuitable surfaces shall be at the CONTRACTOR'S expense.

### 3.03 Surface Preparation

- A. General:

1. All surfaces to be coated shall be prepared as specified herein and in accordance with the coating manufacturer's recommendations. The object shall be to obtain a uniform, clean, and dry surface.
2. Quality of surface preparation described herein is considered a minimum. If the coating manufacturer requires a higher degree of preparation, comply with the coating manufacturer's recommendations.
3. Where surface dryness is questioned, test with a dampness-indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted by the coating manufacturer.
4. Workmanship for surface preparation shall conform to the following Steel Structures Painting Council (SSPC) specification:
  - a. Surface Preparation of Concrete: SSPC-SP13/NACE 6

- B. Exterior Concrete:

1. Concrete must be at least 28 days old and shall pass a dryness test in accordance with ASTM D4263 Test Method for Indicating Moisture by the Plastic Sheet Method, before coating is applied.
2. Remove fins and other protrusions by grinding.

## HIGH PERFORMANCE COATINGS AND SPECIAL COATINGS

3. Repair surface defects and voids as recommended by the coating manufacturer.
4. All surfaces shall be high pressure water wash (3,500 psi) to remove all dirt, dust, laitance, as well as any other contaminants. All surfaces shall be clean, dry, and free of form release agents and all foreign matter (Reference SSPC-SP 13 / ICRI CSP 1-2).

### 3.04 Application

- A. Surfaces shall be dry at the time of application.
- B. The minimum surface temperature shall be 50 degrees F and rising unless noted otherwise.
- C. Apply in strict accordance with the manufacturer's recommendations by brush, roller, spray, or other application method. The number of coats and thickness required is the same regardless of application method.
- D. Each coat shall be allowed to dry in accordance with the manufacturer's requirements. Drying time shall be construed to mean "under normal conditions." Where conditions other than normal exist, because of weather or because of confined space, longer times will be necessary.
- E. Coatings shall be applied to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, or other surface imperfections will not be acceptable. Areas cut-in by brush prior to rolling shall have uniform appearance in comparison to adjoining surfaces.
- F. Edges of coatings adjoining other materials or other colors shall be sharp and clean without overlapping.
- G. Crevices and other hard to apply areas shall be back-rolled/back-brushed in conjunction with the field-applied prime coat.
- H. Where multiple coats of the same material are applied, each undercoat shall be slightly different in shade to facilitate identifying each coat.

### 3.05 Final Touch-Up and Cleaning

- A. Prior to substantial completion, examine the coated surfaces and retouch or refinish surfaces to leave in condition acceptable to the Engineer.
- B. Remove masking, coatings, and other material from floors, glass, and other surfaces not scheduled to be coated.

### 3.06 Coating System

## **HIGH PERFORMANCE COATINGS AND SPECIAL COATINGS**

- A. Scheduled thickness or coverage rate is the minimum as recommended by Tnemec Company, Inc. If another manufacturer is used, manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled.
- B. Coatings shall conform to the following schedule and coating manufacturer's recommendations. Examples of surfaces to be coated may not be all inclusive.

### **3.07 SCHEDULE OF COATING SYSTEMS FOR EXTERIOR SERVICE**

\*All coating thicknesses are expressed in dry film thickness (DFT.)

#### **A. Exterior – Prestressed Concrete Storage Tanks**

- 1. Surface Preparation: High pressure water wash (3,500 psi) to remove all dirt, dust, laitance, as well as any other contaminants. All surfaces shall be clean, dry, and free of form release agents and all foreign matter (Reference SSPC-SP 13 / ICRI CSP 1-2). See above for more specific requirements.
- 2. 1<sup>st</sup> Coat: Series 156 Enviro-Crete
  - a. Dry Film Thickness: 4.0 – 6.0
- 3. Stripe Coat (As necessary to address hairline cracks): : Series 156 Enviro-Crete
  - a. Dry Film Thickness: 4.0 to 6.0 mils DFT.
- 4. Finish Coat: Series 156 Enviro-Crete
  - a. Dry Film Thickness: 4.0 – 6.0
- 5. Total Dry Film Thickness: No less than 8.0 mils DFT

**END OF SECTION**

## SECTION 10431 - SIGNAGE

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:

- 1. Plaques.
- 2. Dimensional characters.
- 3. Panel signs.

- B. Related Sections include the following:

- 1. Division 1 Section "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
- 2. Division 14 Section "Hydraulic Elevators" for code-required elevator signage.
- 3. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
- 4. Division 16 Sections for electrical service and connections for illuminated signs.
- 5. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
- 6. Division 16 Section "Interior Lighting" for illuminated Exit signs.

#### 3. DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

#### 4. SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop Drawings: Show fabrication and installation details for signs.

- 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
- 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- 3. Wiring Diagrams: Power, signal, and control wiring.

- C. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
  - 1. Plaque Casting: 6 inches (150 mm) square including border.
  - 2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter, number, and graphic element).
  - 3. Aluminum: For each form, finish, and color, on 6-inch- (150-mm-) long sections of extrusions and squares of sheet at least 4 by 4 inches (100 by 100 mm).
  - 4. Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
  - 5. Polycarbonate Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
  - 6. Fiberglass Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
  - 7. Panel Signs: Not less than 12 inches (305 mm) square including border.
  - 8. Photoluminescent Signs: Full-size sign.
  - 9. Trim Frame: 6-inch- (152-mm-) long sections of each profile.
  - 10. Accessories: Manufacturer's full-size unit.
- D. Sign Schedule: Use same designations indicated on Drawings.
- E. Qualification Data: For fabricator.
- F. Maintenance Data: For signs to include in maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

## 5. QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

## 6. PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

7. COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

8. WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Deterioration of metal and polymer finishes beyond normal weathering.
- b. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five years from date of Substantial Completion.

2.PRODUCTS

1. MATERIALS

- A. See Section 1, Allowances.

2. ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

3. FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.

- 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
- 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
- 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
- 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

#### 4. FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

#### 5. ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 2. INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
  - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
  2. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
  3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
  4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
  5. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
  6. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
  7. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.
- C. Bracket-Mounted Signs: Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.
- D. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
1. Flush Mounting: Mount characters with backs in contact with wall surface.
  2. Projected Mounting: Mount characters at projection distance from wall surface indicated.
- E. Cast-Metal Plaques: Mount plaques using standard fastening methods to comply with manufacturer's written instructions for type of wall surface indicated.
1. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.
  2. Face Mounting: Mount plaques using exposed fasteners with rosettes attached through face of plaque into wall surface.
3. CLEANING AND PROTECTION
- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10431



## SECTION 10500 - METAL LOCKERS

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. Section Includes:
  - 1. Standard metal lockers.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker .
- B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Show locker trim and accessories.
  - 2. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For metal lockers and locker benches, in manufacturer's standard sizes.
- E. Qualification Data: For qualified Installer.
- F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.
- G. Warranty: Sample of special warranty.

#### 4. QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single manufacturer.

- C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.
- D. Preinstallation Conference: Conduct conference at Project site

5. DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

6. PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

7. COORDINATION

- A. Coordinate sizes and locations of bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

8. WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation of latches and other door hardware.
  - 2. Damage from deliberate destruction and vandalism is excluded.
  - 3. Warranty Period for All-Welded Metal Lockers: Lifetime from date of Substantial Completion.

9. EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. 1 Set of Full-size units of the following metal locker hardware items for each type and finish installed

- a. Identification plates.
- b. Hooks.

## 2.PRODUCTS

### 1. MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
- C. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
- E. Plastic Laminate: NEMA LD 3, Grade HGP.
- F. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
- G. Steel Tube: ASTM A 500, cold rolled.
- H. Particleboard: ANSI A208.1, Grade M-2.
- I. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- J. Anchors: Material, type, and size required for secure anchorage to each substrate.
  - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
  - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

### 2. STANDARD METAL LOCKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **Penco Guardian Locker** or comparable product by one of the following:
  - 1. Art Metal Products
  - 2. ASI Storage Solutions Inc
  - 3. DeBourgh Mfg. Co
  - 4. General Storage Systems Ltd
  - 5. Hadrian Manufacturing Inc
  - 6. List Industries Inc
  - 7. Lyon Workspace Products, LLC
  - 8. Republic Storage Systems Company

- 9. Shanahan's Manufacturing Limited
- 10. Tennsco Corp

B. Locker Arrangement: 1 tier, As indicated on Drawings

C. Material: Cold-rolled steel sheet.

D. Ventilation: Solid Door

E. Door Handle: Die Cast Pull Out Handle

F. Equipment:

- 1. Equip each metal locker with identification plate
- 2. Provide each locker with a hat shelf, hanging rod and hook

G. Accessories:

- 1. Legs: 6 inches (152 mm) high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.
  - a. Closed Front and End Bases: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.
- 2. Filler Panels: manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
- 3. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.
- 4. Center Dividers: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

H. Finish: Baked enamel or powder coat.

- 1. Color(s): As selected by Architect from manufacturer's full range

### 3. FABRICATION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

- 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
- 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

- C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Accessible Lockers: Fabricate as follows:
  - 1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
  - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- F. Identification Plates: Manufacturer's standard, etched, embossed, or stamped **aluminum** plates, with numbers and letters at least 3/8 inch (9 mm) high.
- G. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- I. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
  - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- J. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

#### 4. STEEL SHEET FINISHES

- A. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- B. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.
- C. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2. INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
  - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
  - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
  - 3. Anchor back-to-back metal lockers to floor.
- B. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
  - 1. Attach hooks with at least two fasteners.
  - 2. Attach door locks on doors using security-type fasteners.
  - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
    - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    - b. Attach plates to upper shelf of each open-front metal locker, centered, with at least two aluminum rivets.
  - 4. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
  - 5. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
  - 6. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

## 3. ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10500

## SECTION 10520 - FIRE-PROTECTION SPECIALTIES

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:
  - 1. Portable fire extinguishers.
  - 2. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Sections include the following:
  - 1. Division 9 Painting and Staining.

#### 3. SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
  - 1. Fire Extinguishers: Include rating and classification.
  - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Samples for Initial Selection: For fire-protection cabinets with factory-applied color finishes.
- C. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

#### 4. QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

- D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

5. COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

6. SEQUENCING

- A. Apply decals or vinyl lettering on field-painted fire-protection cabinets after painting is complete.

7. WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

2.PRODUCTS

1. MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2. MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
  - 1. Sheet: ASTM B 209 (ASTM B 209M).
  - 2. Extruded Shapes: ASTM B 221 (ASTM B 221M).
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
- D. Copper-Alloy Brass Sheet: ASTM B 36/B 36M, alloy UNS No. C26000 (cartridge brass, 70 percent copper).
- E. Copper-Alloy Bronze Sheet: ASTM B 36/B 36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).
- F. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, 3 6 mm thick.



- G. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear) 2 (tinted, heat absorbing, and light reducing), bronze tint.
- H. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm thick, single strength.
- I. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.
- J. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.
- K. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, 3 mm thick, double strength.
- L. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 1.5 3 6 mm thick, with Finish 1 (smooth or polished) 2 (patterned, textured).
- M. Acrylic Bubble: One piece.

### 3. PORTABLE FIRE EXTINGUISHERS

- A. Manufacturers:
  - 1. Amerex Corporation.
  - 2. Ansul Incorporated.
  - 3. Badger Fire Protection.
  - 4. Buckeye Fire Equipment Company.
  - 5. Fire End & Croker Corporation.
  - 6. General Fire Extinguisher Corporation.
  - 7. JL Industries, Inc.
  - 8. Kidde Fyrnetics.
  - 9. Larsen's Manufacturing Company.
  - 10. Modern Metal Products; Div. of Technico.
  - 11. Moon American.
  - 12. Potter Roemer; Div. of Smith Industries, Inc.
  - 13. Watrous; Div. of American Specialties, Inc.
- B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
- C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

### 4. FIRE-PROTECTION CABINET

- A. Basis-of-Design Product: Larsen's Manufacturing Company or a comparable product by one of the following:
- B. Manufacturers:
  - 1. Fire End & Croker Corporation.

2. General Accessory Mfg. Co.
  3. JL Industries, Inc.
  4. Kidde Fyrnetics.
  5. Modern Metal Products; Div. of Technico.
  6. Moon American.
  7. Potter Roemer; Div. of Smith Industries, Inc.
  8. Watrous; Div. of American Specialties, Inc.
- C. Cabinet Type: Suitable for fire extinguisher.
- D. Cabinet Construction: Nonrated.
- E. Cabinet Material: Aluminum sheet.
- F. Recessed Cabinet: Cabinet box recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face.
1. Square-Edge Trim: 5/16" Flat Trim.
- G. Cabinet Trim Material: Same material and finish as door.
- H. Door Material: Aluminum
- I. Door Style: Vertical Duo Clear Acrylic Door with Larsen Loc
- J. Door Glazing: Acrylic panel (clear).
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide recessed door pull and friction latch.
  2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- L. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
  3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
  4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door
      - 2) Application Process: Pressure-sensitive vinyl letters.
      - 3) Lettering Color: Black.
      - 4) Orientation: Vertical.
- M. Finishes:
- a. Aluminum: Clear anodized

## 5. FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
  - 2. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material.
    - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
  - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 6. FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 7. STEEL FINISHES

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
  - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 2. PREPARATION

- A. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.

#### 3. INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below or acceptable to authorities having jurisdiction.
  - 1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
  - 2. Provide inside latch and lock for break-glass panels.
  - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply vinyl lettering at locations indicated.

#### 4. ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10520

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## SECTION 10801 - TOILET AND BATH ACCESSORIES

### 1.GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

- A. This Section includes the following:
  - 1. Bathroom accessories.
- B. Related Sections include the following:
  - 1. Division 9 Section "Ceramic Tile" for ceramic toilet and bath accessories.

#### 3. SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
  - 5. Manufacturer's warranty.

#### 4. COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

### 2.PRODUCTS

#### 1. BATHROOM ACCESSORIES

- A. Manufacturers: Provide products as noted on drawings

2. FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

3.EXECUTION

1. INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

2. ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801



**SECTION 11000**  
**PACKAGED BOOSTER PUMP STATION**

**1.01 GENERAL**

- A. The plant water pump station shall be supplied as a DUPLEX package system. System shall include pumps, distribution control panel, control panel stand, controls, pipe valves & fittings and all equipment and incidentals required to provide a complete pump station as specified herein. To ensure reliability and proper component integration package system must be provided by a UL listed manufacture conforming to NSF-61, UL508/A, UL778 & ULQCZJ.

**1.02 OPERATING CONDITIONS**

- A. Each vertical turbine pump shall be designed to handle water free of suspended solids rated 15HP, 460volts, 3-phase, 60 hertz, and 1800RPM. Unit shall be line shaft driven and coupled to a vertical hollow-shaft motor and VFD controlled allowing for precise speed control to match field conditions. The pump shall be non-overloading throughout the entire range of operation without employing service factor. The performance curve submitted for approval shall state in addition to head and capacity performance, NPSHr, the pump efficiency, impeller size.

Booster Pump Station	Pump 1	Pump 2
Model	7WALC	7WALC
Station Feed Power	230 or 460V/60Hz/3pH	230 or 460V/60Hz/3pH
Pump Motor Power	460V/60Hz/3pH	460V/60Hz/3pH
Single Pump Design Flow (each pump)	220GPM	220GPM
Design Head at discharge head	160'	160'
Maxiumn HP (Non-Overloading)	15	15
Maxiumn RPM	3600	3600
Max Stages	2	2
Efficiency at design	71%	71%
Sump Depth	24"-60"	24"-60"
Discharge Manifold (customer connection)	6"	6"

**1.03 SCOPE OF SUPPLY**

- A. The contractor shall furnish and install a complete factory built above ground constant pressure booster pump station. The station shall be complete with all necessary equipment installed on a fabricated steel base. Package system shall be Model VTP as manufactured by CLAY-GREENE PACKAGE SYSTEMS a div of Morrow Water Technologies or pre-approved equal. In order for alternate equipment to be considered as pre-approved equal they must submit 15-days prior to bid-opening the following:
- B. A list of fifteen (15) installations where equipment manufactured is currently in similar service. Shall include contact name, telephone numbers of owner/consulting engineer/contractor as well as general arrangement drawings for each installation.
- C. Pump performance selections including certified curves and material design.
- D. Exceptions & Clarifications list noting difference between this specification and proposed equipment.

**1.04 PUMP DESIGN**

Pumps that are supplied under this specification shall be vertical turbine open lineshaft design with lubrication method, including a bowl assembly, column assembly, discharge head and driver. The discharge head shall be designed to carry the entire weight of the bowl and column assembly along with the specified driver without excessive vibration or noise. All of the supplied equipment shall conform to this specification. The required units shall be Gould's Water Technology a div of Xylem shall be model 7WALC with 2 stages, or an approved equal. The pump manufacturer shall be certified to the ISO 9001 standard for design and manufacture of vertical turbine pumps. The manufacturer shall be capable of producing vertical turbine pumps certified to NSF/ANSI 61 & 372. Pressure containing fabrications shall be welded only by those whom are qualified on ASME code section IX. Welder certification shall be provided with the submittal package. The manufacturer shall own and operate its own U.S. based foundry producing vertical turbine components. No exceptions.

- A. Bowl Assembly
  - 1. The suction bowl shall be designed to provide conservative entrance velocities and direct the flow to the first stage impeller. The inner surface of the suction bell shall be smooth and free of sharp projections which could cause turbulence or cavitation. The suction casing shall be designed to house the suction bell bearing by means of four vanes.

## PACKAGED BOOSTER PUMP STATION

2. The bowls shall be smooth and free of sharp projections and shall have register fits for alignment and be connected by flanged and bolted construction. Bowl sizes 6" to 15" shall be porcelain enameled on the bowl interior. Bowl sizes 16" and larger shall be epoxy-lined.
3. The impellers shall be machined and finished smooth to insure proper performance. They are to be balanced prior to assembly. The impellers shall be connected to the bowl shaft by means of collet design.
4. The suction strainer shall be a clip-on basket design and have a free inlet area of at least 3-4 times the impeller eye area. The suction strainer shall be connected to the bowl assembly suction casing.

### B. Column Assembly

1. The column shall include threaded connections and shall be of open design with product lubrication.
2. The bearing spacing shall be selected to insure operation at a minimum of 25% above or below the first critical speed. Bearing spacing shall not exceed 5 feet.
3. For 3"-12" product lubricated column assemblies, the column shall be designed with drop-in steel or cast-iron bearing retainers. The interior of the column shall be free of offsets, burrs, discontinuities and irregularities.
4. The lineshaft shall be of adequate size to transmit the full power of the pump without slip, excessive vibration or elongation, and shall have threaded joints. Lineshaft lengths shall not exceed 10 feet. The lineshaft shall have left hand threads that tighten during pump operation.

### C. Discharge Head Assembly

1. For above ground service, the discharge head shall be fitted with a flanged discharge connection. The flange shall be a 150 LB F.F. ANSI flange for cast heads. The discharge head shall be designed to carry the entire weight of the complete pump and driver without distortion when spanning an opening of sufficient size to permit removal of the complete pump assembly. The discharge head shall be provided with a coupling guard. Lifting lugs shall be provided as standard. The stuffing box shall be designed for 6 rings of packing and lantern ring. An extra-long bearing shall be located below the packing in the stuffing box. Packing lubrication leakage through the stuffing box shall be drained back to the sump. The packing gland shall be of a two piece design.

**D. Driver**

1. The driver will be a VHS electric motor and shall be sized for non-overloading at any point on the curve. Motor shall be 3600RPM and premium efficient. Driver shall include properly sized headshaft from the factory and non-reverse ratchet (NRR) installed. Driver shall be suitable for operation on variable frequency drive (VFD). The driver and any related equipment will ship unmounted from the pump. Motor shall be manufactured by Baldor/Reliance, USEM or Worldwide Electric. Motor shall be of standard manufactures catalog design and must not use special bearings as a thrust handling device. Motors shall have ODP enclosure and be continuous duty high efficient. Motors shall be UR, CSA and CSA EEV listed. The stator windings shall have Class F insulation and be designed for inverter duty.

**E. Coating**

1. The bowl assembly exterior shall be coated with Tnemec 141; minimum dry film thickness 16 mils. The column assembly interior and exterior shall be coated with Tnemec 141; minimum dry film thickness 16 mils. The head assembly interior and exterior shall be coated with Tnemec 141; minimum dry film thickness 16 mils.

**F. Testing**

1. All factory testing shall conform to the most current edition of the Hydraulic Institute Standards. All pump performance testing shall be performed at the manufacturer's facility. (Specify if there are any additional standards). Performance testing shall be non-witnessed and performed on the bowl assembly only with lab motor. The test shall cover seven points including the design point (HI 14.6). The design point shall be used for any performance evaluation. Hydrostatic testing shall be non-witnessed in compliance with HI14.6. Hydro testing is to be performed on the pressure containing components. Certified test results shall be provided for record purposes for approval prior to shipment.

**1.05 PUMP CONTROL**

Booster Pump Station shall be provided with constant pressure control via EDA electronic pressure controller. Controller shall have pressure gauge, two SDPT relays with adjustable on/off setpoints over the entire range for control and alarm. Controller shall be NEMA-4x rated. Controller shall be properly sized for incoming power feed and pump station requirements. Controller, control panels, transformers and all associated electrical equipment must be provided by the package system manufacture in order to assure system integration and sole source responsibility. Controller shall be Dwyer EDA no

equal.

**A. Pump Station Functional Electrical Equipment-**

1. Pump station shall be field configurable to operate as either local control as constant pressure or remote control (by others) as tank fill. Pump Stations requiring special tools, electrical changes or reprogramming for dual operation shall not be allowed or considered equal.
2. One (1) Dwyer EDA controller with 4-20mA output with 0-300psi range. Controller shall be 24vDC powered & Shall be NSF-61 approved
3. One (1) Distribution Control Panel (DCP). Station will be equipped with a NEMA-4X panel properly sized and equipped installation with fused disconnect for each pump with a complete set of extra fuses, properly sized main breaker(s), branch circuit breaker(s), green pump run light, red fault alarm light, On-Off switches, lightning arrestor, incoming power feed distribution block DCP shall be UL508 labeled.
4. If required pump station shall be supplied with a UL-listed 3R enclosed ACME step down transformer for control power.
5. Feed power is noted above in section 1.2

**B. Functional Requirements-**

1. On pressure drop to pre-set (adjustable) level, lead pump will start. With lead pump operating, if pressure continues to drops to pre-set (adjustable) low level second pump will start
2. Pump(s) will run until pre-set pressure is met (adjustable) then they will shut off.
3. System will alternate between lead-lag pump on field adjustable timer .
4. If one pump should fail second pump shall override control.
5. System shall be field configurable to operate on remote (SCADA) control if needed.

**1.06 ELECTRICAL COMPONENTS**

All electrical components and materials supplied shall function as a complete unit to automatically control the booster pump station. All devices and material shall be new and of standard product design. All components used in the panel shall be Underwriters' Laboratory approved for the application. Electrical work shall be in accordance with the latest edition of the National Electrical Code (NEC-70).

## PACKAGED BOOSTER PUMP STATION

- A. Wire - shall be stranded copper and sized as required for load and application according to NEC. All wiring on the rear of the inner door shall be neatly bundled using tie wraps or other means. All internal wiring on the backplate shall be neatly routed in wire duct with removable covers. All wiring shall be continuous point to point (no splices) and be totally accessible.
1. All conductors shall be 98% conductive annealed copper unless otherwise note, UL listed and labeled
  2. Conductors No. 10 and smaller shall be solid
  3. Conductors No. 8 or larger shall be stranded
  4. Branch circuits shall not be less than No. 12 copper wire type THW, THHN or THWN insulation
  5. All control and signal wire shall be a minimum of No. 14 AWG, 90-degree C insulated and color-coded, colors shall be as follows:
    - (a) Red for all AC control
    - (b) Blue for all DC control
    - (c) Yellow for external source control
    - (d) White for AC neutral
    - (e) Green for equipment ground wiring
  6. Main Ground- Conductors for main ground form neutral bus or equipment grounding bus shall be bare copper.
- B. Mounting- All other components shall be securely mounted to the backplate with stainless steel hardware through machine thread tapped holes in the backplate. The screws shall be of adequate size for the device being secured. Permanent marking to identify each component as shown on the drawing shall be provided on the back plate and schematic laminated on inside of enclosure door.
- C. Pressure Controller - a pressure controller shall be furnished and installed in the piping of the pump station and shall be prewired. Controller shall be two wire type with a 4-20mA signal calibrated for 0 -300psig. Shall be of the NEMA - 4X design and equipped with a 1/4" NPT male process connection (fluid) and a 1/2" NPT male electrical connection. Accuracy shall be +/- 1.0%. wetted materials shall be 316L Stainless steel. Shall have built in test mode to simulate input over range that shall operate without pressurizing system. Controller shall be manufactured by Dwyer model EDA-W-N1-E1-06-T1 no equal.
- D. Enclosures- DCP enclosure shall be NEMA-4X fiberglass or stainless steel shall be manufactured by Allied Molded, Hoffman or equal.

## PACKAGED BOOSTER PUMP STATION

- E. On-Off Switches each pump shall be equipped with switches. Switches shall be Square-D model ZB5 Series or equal.
- F. Pump Disconnects- provide one (1) properly sized fused disconnect per pump shall be ABB OT or equal. Provide one set of spare fuses per pump.
- G. Main Circuit Breaker- shall be properly sized for pump station load and shall be Square-D QOU or equal.
- H. Branch Circuit Breakers- Shall be properly sized for load and shall be Square-D QOU or equal. At a minimum the DCP shall be equipped with:
  - 1. One (1) Duplex GFI outlet
  - 2. One (1) Enclosure heater circuit
  - 3. One (1) Enclosure blower/vent fan circuit
- I. Lightning Arrestor- Pump station shall be equipped with one (1) properly sized lightning arrestor on the feed power. Shall be Square D SDS or equal.
- J. Switches- Convenience switches shall be Square-D model ZB5 series or equal
- K. Pump Run Lights- DCP shall be equipped with one (1) green run light per pump. Shall be Square D ZB5 series or equal.
- L. Pump Fault Lights- DCP shall be equipped with one (1) red pump fault light per pump. Shall be Square D ZB5 series or equal.
- M. Common Alarm Light- DCP shall be equipped with one (1) red common fault light. Shall be Square D ZB5 series or equal
- N. Convenience Light- shall be Acuity-Lithonia or equal
- O. Main Power Distribution Block- DCP shall be equipped with a properly sized incoming power distribution block. Shall be Bussmann, Square D or equal.
- P. Control Transformer- On applications needing step-down transformer it shall be supplied and mounted on the control panel hoop. Transformer shall be properly sized for load and shall be UL-listed UL-3R enclosure with 180-degree C insulation system with 115-degree C rise. Shall be of the encapsulated design. Manufactured by Hubbell-Acme Electric or equal.
- Q. Grounding lugs- Booster pump system shall be provided with two grounding lugs. One shall be located in the DCP with a secondary lug located on the baseplate. Lugs shall be manufacturer standard
- R. Conduit- All conduit shall be of the flexible liquid-tight type or PVC NEC

approved as manufactured by Grainger, Hubbell or equal

- S. All electrical wiring shall be per NEC-70

#### 1.07 PIPE, VALVES & FITTINGS

Complete package shall be certified under UL-QCZJ. Field assembled or component build units in the field shall not be allowed or accepted.

- A. Pipe & Spools- Shall be 304 Stainless steel and shall conform to NSF-61
- B. Fittings- 2-1/2" and smaller shall be NSF-61 compliant sanitary clamp stainless steel or bronze. For 3" and larger all mainline pipe fittings shall be cement lined ductile iron conforming to ASTM A536 and ANSI/AWWA C104/A21.4. Shall be rated for 250psi.
- C. Suction & Discharge Headers- for 2-1/2" and smaller shall be sanitary clamp stainless-steel NSF-61 compliant. For 3" and larger headers shall be 304 stainless steel or cement lined ductile iron and shall be NSF-61 compliant. Flanges shall be ANSI class 150/300 raised or flat face flanged. Rating & Size shall be determined by discharge pressure as indicated in 1.2 above.
- D. Isolation Valves- All valves shall be NSF-61 compliant. Isolation valves 2-1/2" and smaller shall be ball valves and shall be manufacturers choice. Isolation valves 3" and larger shall be capable of drop tight service to 250psig. 3" and larger valves shall be full rated for bi-directional dead-end service and at a minimum these shall be equipped as:
  - 1. Valve body shall be cast iron ASTM A126 Class B wafer lug style drilled and tapped for class 150 flanges.
  - 2. Body shall have integrally cast top plate for direct flush mounting of a manual actuator.
  - 3. Seat shall be molded in isolating body, stem and journal from water flow. Seat shall be EPDM.
  - 4. Disc shall be 304 stainless steel with polished edges.
  - 5. Valve stem shall be one piece 416 stainless steel
  - 6. Upper and Lower stem bearing shall be bronze
  - 7. Valve shall be Del-Val or equal
- G. Pressure Gauges- NSF-61 compliant suction and discharge pressure gauges shall be provided. Gauges shall have a 4" minimum diameter face. Gauges shall have 1/4" NPT connections located at the bottom of the gauge. Suction gauge shall be in 10psi intervals with graduation marks every 1psi. Discharge gauges shall be in 20psi intervals with graduation marks every 2psi.



## PACKAGED BOOSTER PUMP STATION

- H. Check Valves- for 2-1/2" and smaller shall be provided with NPT threaded stainless, bronze or iron NSF-61 compliant swing check valves. 3" and smaller valves shall be manufacturer standard. For 3" and larger mainline piping shall be supplied with either a wafer style or a globe style check valve that is NSF-61 compliant with ASTM A126 Class B cast iron bodies and ASTM B584/B148 bronze and shall be manufactured by Val-Matic or equal.
- I. Pressure Tank- System shall be provided Hydro-Pneumatic expansion tank as indicated on the drawing. Shall be field chargeable with replaceable bladder and pressure tank sized for a minimum +/- 20% of single pump flow with a max working pressure of 150PSI. Shall be Amtrol or American Wheatley.
- J. Flowmeter- One flowmeter. Flowmeter shall be NSF-61 approved and shall not have any moving parts in the flow stream and shall be a Badger Modmag M2000 or equal. Flowmeter shall have an accuracy  $\pm 0.25$  percent of rate for velocities greater than 1.64 ft/s [0.50 m/s],  $\pm 0.004$  ft/s [ $\pm 1$  mm/s] for velocities less than 1.64 ft/s [0.50 m/s]. Display shall be locally mounted to the meter and shall include a four-line, 20-character, backlit LCD interface to display the following values:
  - 1. Flow rate in selectable rate units
  - 2. Forward totalizer in selectable volume units
  - 3. Reverse totalizer in selectable volume units
  - 4. Net totalizer in selectable volume units
  - 5. Modbus communication protocol
- K. PRV- package system shall be equipped with a field adjustable pressure relief valve to prevent over pressuring of the system. Shall be Bermad 1000 no equal and piped to sump with 1/4 turn isolation valves and stainless sanitary circuit piping.
- L. Painting- Painting of baseplate, pipe, valves & fittings (where needed) shall be Clay-Greene Blue. Surfaces receiving paint shall be sandblasted to a bright metal appearance per SSPC-SP6 and shall include the removal of all rust, mill scale and other foreign materials. Painting operation shall take place immediately after surface preparation. Paint shall be a two-part high solids self-priming epoxy suitable for marine applications shall be PPG Amerlok-2 or equal. A minimum of two-coats shall be applied for a final 6-12mil dry thickness.

## PACKAGED BOOSTER PUMP STATION

- M. Name Plates- Package Booster Pump system shall receive a stamped aluminum nameplate with serial number and contact information. Nameplate shall be located on the front of DCP and shall be in high visibility green over silver.

### 1.09 ENGINEERING DRAWINGS & TESTING

At a minimum package pump station shall be complete with the following documentation

- A. General Arrangement Drawings- manufacture shall be responsible for one (1) pre-submittal drawing, one (1) submittal drawing and one (1) revision of drawing at no additional charge to the owner. Drawings must be digital rendered in solidworks or equal.
- B. Electrical- One lines and Distribution Control Panel (DCP) control narrative shall be submitted. Manufacture shall be responsible for one (1) pre-submittal drawing, one (1) submittal drawing and one (1) revision of drawing at no additional charge to the owner. Drawings must be digital.
- C. Performance Testing- Each pump shall have a factory certified (non-witness) test curve.
- D. Package Testing- package system shall have (non-witness) certified hydrostatic test of completed system.
- E. Lifting Plan- One (1) Standard lifting plan (drawing).
- F. Quality Control- Manufacturer shall comply with their standard quality control documentation.
- G. Thirty (30) month warranty from date of shipment.

**END OF SECTION**

## **SECTION 11200 MIXING PUMPS**

### **PART 1 - GENERAL SYSTEM DESCRIPTION**

#### **1.01 PERFORMANCE REQUIREMENTS**

Operating Conditions - Design: 1400 GPM @ 14 FT TDH @ 71.8\_%

Secondary: 2000 GPM @ 9 FT TDH @ 67%

1000 GPM @ 17 FT TDH @ 67%

Minimum Shutoff head: 28 FT

Maximum Motor HP: 15 HP

Minimum Hydraulic Efficiency (at design): 71.8%

Maximum Motor RPM: 1180 RPM

#### **1.02 QUALITY ASSURANCE - REFERENCED STANDARDS:**

American Iron & Steel Institute (AISI)

American Society for Testing and Materials (ASTM)

Factory Mutual (FM)

Hydraulic Institute Standards for Centrifugal, Rotary, and Recip Pumps (HI)

National Fire Protection Agency (NFPA)

National Electric Code (NEC)

National Electrical Manufacturers Association (NEMA)

Anti-Friction Bearing Manufacturers Association (AFBMA)

International Standards Organization (ISO) - ISO9001

#### **1.03 WARRANTY**

The pump manufacturer shall warrant the pump, motor and guide system to the Owner against defects in workmanship and materials for a period of seven (7) years under normal use and service. If a guide cable system is used the pump manufacturer shall warrant the guide cable system (including guide cables and brackets) to the Owner against defects in workmanship and materials for a period of ten (10) years under normal use and service. Both pump manufacturer warranties shall be in published form, and shall apply to all similar units. A copy of each warranty shall be provided to the Owner at startup.

**PART 2 - PRODUCTS****2.01 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following are acceptable:
  - 1. KSB
  - 2. Flygt
- B. Equal alternates as approved by the engineer prior to bid

All products, whether named as "acceptable" or proposed as "equal" must fully comply with these specifications. Standard product must be modified, if required, for compliance. The contractor shall base his bid price on product offered by KSB, Inc. for purposes of determining the successful bidder on this project. The contractor may submit, with the bid, an alternate proposal with applicable deduct if any for supplying product other than KSB. Alternate proposals must include a clear statement of each point of difference between the proposed alternate product and these specifications. The Owner and Engineer reserve the right to reject any bid not based on KSB product.

**2.02 MATERIALS****A. SUBMERSIBLE SEWAGE PUMPS**

Pump Case: Cast Iron, ASTM A48, Class 35B

Motor Housing: Cast Iron, ASTM A48, Class 35B

Cooling Jacket: Stainless Steel, A276, Type 316 Ti

Impeller: Cast Iron, ASTM A48, Class 35B

Intermediate Housing (Backplate): Cast Iron, ASTM A48, Class 35B

Discharge Base Elbow: Cast Iron, ASTM A48, Class 35B

Pump/Motor Shaft: Carbon Steel, C 45 N with replaceable ASTM A276 Type 420 shaft protection sleeve or entire shaft to be ASTM A276 Type 420 stainless steel with an ASTM A276 Type 420 shaft protection sleeve.

Shaft Sleeve (if applicable): Stainless Steel, ASTM A276 Type 420

Wear Ring, case: Wear resistant duplex stainless steel

Wear Ring, impeller (enclosed impellers only): Wear resistant duplex stainless steel

O-Rings: Nitrile Rubber (NBR)

Fasteners (including impeller fastener): Stainless Steel, ASTM A276 Type 316Ti.

Lower Seal Faces: Silicon Carbide/Silicon Carbide

Upper Seal Faces: Silicon Carbide stationary/Carbon rotating

Guide rails/cables and mounting brackets: Stainless Steel, ASTM A276 Type 316

Lifting Chain or cable: Stainless Steel, ASTM A276 Type 316

Oil-all uses (seal lubrication, etc): Ecologically safe, parifin or mineral base

Power/Control Cable Jacket: Chloroprene with non-wicking fillers

## 2.03 ACCESSORIES

### A. POWER CABLE

Provide 50 ft of power/control cable with each pump, suitable for submersible wastewater application, sized in accordance with NEC requirements. Provide cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/ terminal area even if the cable is damaged or severed below water level. Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be provided. The cable entry shall be rated by Factory Mutual (or UL) for submerged operating depths to 85 feet.

### B. TEMPERATURE PROTECTION

Furnish temperature monitoring devices in motor windings for use in conjunction with and supplemental to external motor overload protection. Arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal. Set temperature monitors at levels recommended by pump manufacturer

### C. SEAL LEAK DETECTION

Provide a detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor. In addition, provide a stainless steel float switch in a separate leakage collection chamber to indicate leakage past the inner mechanical seal prior to its entrance into either the motor stator cavity or the lower bearing. Electronic probes which depend on sensing resistance value changes in seal oil will not be acceptable as seal leak indicators.

### D. "PumpSafe" MOTOR SENSOR MONITORING RELAYS

1. The pump supplier shall furnish all relays required for monitoring all motor

sensors. The relays shall be installed by others in the motor control panel and properly wired in accordance with pump manufacturer's instructions. Relays shall mount in standard 12-pin socket bases (provided) and shall operate on available control voltage of 24-240 VAC. If relays require an input voltage that is not available in the motor control panel an adequate transformer (with fused input) shall be provided by the pump supplier. Relays shall have a power consumption of no more than 2.8 watt, and shall be UL approved. Relays shall be modular in design, with each relay monitoring no more than two motor sensor functions.

2. Each relay module shall include a dual color (red/green) LED to indicate the status of each monitored sensor. Green will indicate "status OK"; red will indicate a failure or alarm condition. A self-corrected fault will allow the relay output contacts to reset, and cause the LED to change from a steady alarm indication to a flashing signal. The LED shall continue to flash until locally cleared, providing the operator an indication of a potential intermittent fault. Each relay shall also include a power-on LED and both "test" and "reset" pushbuttons.
3. An independent fail-safe (switch on power loss) form-C output contact shall be included for each monitored sensor to provide a normally-open / normally-closed dry contact to initiate a remote alarm device or shut down the motor. Contacts shall be rated for 5 amps at 120 volt.

### 2.04 FABRICATION

#### A. GENERAL

1. Provide pumps capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners.
2. Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load-bearing guides. All system components for guide cable systems, including cable, shall be supplied and warranted by the pump manufacturer. For guide pipe systems the pipe shall be supplied and warranted by the installing contractor. Guide cable systems shall be suitable for proper operation when installed at up to 5 degree misalignment from vertical, pipe guides must be installed perfectly plumb and vertical. Intermediate guide supports (between upper bracket and discharge elbow connections) shall not be required for cable systems but MUST be supplied where needed to maintain perfect alignment for pipe guides. Final connection shall insure zero leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no

part of the pump bears directly on the floor of the wet well. Provide Type 316 stainless steel chain of sufficient length to properly and safely lift pumps from the wet well. All exposed cast iron and ferrous surfaces shall be cleaned of dirt and grease, sandblasted to near white finish, and coated with an anti-corrosion reaction primer. The pump shall then be coated with two-component thick coat paint, with an epoxy resin base, having at minimum 83% solids by volume. This coating shall be non-toxic and approved for both wastewater and water applications.

### 2.05 MAJOR COMPONENTS

Furnish major components (pump case, impeller, intermediate housing, motor housing) of cast material as specified with smooth surfaces devoid of blow holes and other irregularities. Pump case design shall incorporate a centerline discharge for stability when mounted on the base elbow.

### 2.06 IMPELLER AND WEAR RINGS - MULTIVANE ENCLOSED TYPE

Provide non-clog type impeller, capable of passing at minimum a 3.9" spherical solid. Statically and dynamically balance the impeller. On enclosed impeller designs, provide hard metal wear rings of material specified, to insure maximum pump/impeller life and continuing high efficiencies. Impellers must incorporate back vanes which reduce axial loads and propel solids away from the seal area. Do not use soft metals (i.e. bronze, 304 or 316 stainless) or elastomers as wear ring material as these are incompatible with the grit contaminate expected in the pumpage.

### 2.07 SHAFT

Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. Machine the shaft of carbon steel or stainless steel and isolate the shaft from the pumped media with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal. Pump shafts without shaft sleeves are not acceptable due to higher maintenance costs associated with repairing shafts / rotor assemblies that are left unprotected.

### 2.08 SHAFT SEAL

Provide two mechanical shaft seals, installed in cartridge design with integral coolant impeller to recirculate glycol within motor housing. A separate leakage chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump. Seal to be lubricated by recirculated glycol within the motor cavity. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.

## 2.09 BEARINGS

Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 100,000 hours at all anticipated axial and radial loadings. Provide sealed/shielded (permanently lubricated) bearings. If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak plugs for periodic addition of lubrication from external to the pump.

## 2.10 MOTOR

- A. Provide a motor which is squirrel cage, induction in design, housed in a completely watertight and air filled chamber, with a min 1.15 service factor. The motor shall be adequately sized and rated for continuous operation at a maximum fluid temperature of 104 degrees F (40 degrees C). Allowable maximum submergence shall not be less than 100ft (30 m). Insulate the motor stator with, at minimum, Class H insulation rated for 356 degrees F (180 Degrees C). Windings shall be insulated using trickle impregnation process to ensure uniformity with a winding fill factor of at least 95%. The use of multiple step "dip and bake" type stator insulation method shall not be acceptable. The rotor bars and short circuit rings shall be made of cast aluminum. The motor and pump set complete shall be designed and manufactured by the same company. Provide temperature protection and seal leak detection as described above. The motor shall incorporate a closed-loop cooling circuit with an integrated cooling pump rated for continuous duty in a completely dry mode; as well as; in a fully submerged condition without damage. The coolant pump impeller shall integral to the seal design, between the tandem mechanical seals to circulate coolant fluid into the top inter-space between the cooling jacket and motor housing, over the surface of the motor, through ducts in the bearing housing and into a volute-casing heat exchanger. Heat losses from the motor shall be transferred to the fluid pumped in the volute-casing heat exchanger, which forms a structural unit together with the discharge cover of the actual waste water pump. After passing through the volute-casing heat exchanger, the medium returns to the suction side of the internal coolant pump. Coolant shall be an environmentally safe antifreeze down to temperatures of minus 20 degrees C (minus 4 degrees F).
- B. Motors containing di-electric oils used for motor cooling and/or bearing lubrication are not acceptable. Submergence (cooling) jackets which circulate pumped media for motor cooling may be used only if they are designed to pass 3" wastewater solids (or to filter out all solids) while maintaining a minimum 2 ft/sec non-settling velocity of coolant at all anticipated pump operating speeds.



## MIXING PUMPS

- C. Provide motors which are FM listed for use in Class I Division 1 Groups C&D hazardous locations as defined by the National Electric Code.

**END OF SECTION**

**SECTION 11225  
NRCY/RAS PUMPS**

**PART 1 - GENERAL SYSTEM DESCRIPTION**

**1.01 PERFORMANCE REQUIREMENTS**

**A. NRCY PUMPS**

Operating Conditions - Design: 900 GPM @ 9' \_ FT TDH @ 70\_% @ 1180 RPM (**Full Speed 60Hz**)

Secondary: 450 GPM @ 14 FT TDH @ 51\_%

Minimum Shutoff head: 20 FT

Maximum Motor HP: 7.5 HP

Minimum Hydraulic Efficiency (at design): 70%

Maximum Motor RPM: 1180 RPM

**B. RAS PUMPS**

Operating Conditions - Design: 900 GPM @ 6' \_ FT TDH @ 66\_% @ **53Hz (Reduced Speed)**

Secondary: 1000 GPM @ 5 FT TDH @ 64%

Minimum Shutoff head: 15 FT

Maximum Motor HP: 7.5 HP

Minimum Hydraulic Efficiency (at design): 66%

Maximum Motor RPM: 1180 RPM

**1.02 QUALITY ASSURANCE - REFERENCED STANDARDS:**

American Iron & Steel Institute (AISI)

American Society for Testing and Materials (ASTM)

Factory Mutual (FM)

Hydraulic Institute Standards for Centrifugal, Rotary, and Recip Pumps (HI)

National Fire Protection Agency (NFPA)

National Electric Code(NEC)

National Electrical Manufacturers Association(NEMA)

Anti-Friction Bearing Manufacturers Association(AFBMA)

International Standards Organization (ISO) - ISO9001

**1.03 WARRANTY**

The pump manufacturer shall warrant the pump, motor and guide system to the Owner against defects in workmanship and materials for a period of seven (7) years under normal use and service. If a guide cable system is used the pump manufacturer shall warrant the guide cable system (including guide cables and brackets) to the Owner against defects in workmanship and materials for a period of ten (10) years under normal use and service. Both pump manufacturer warranties shall be in published form and shall apply to all similar units. A copy of each warranty shall be provided to the Owner at startup.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following are acceptable:
  - 1. KSB
  - 2. Flygt
- B. All products, whether named as "acceptable" or proposed as "equal" must fully comply with these specifications. Standard product must be modified, if required, for compliance. The contractor shall base his bid price on product offered by KSB, Inc. for purposes of determining the successful bidder on this project. The contractor may submit, with the bid, an alternate proposal with applicable deduct if any for supplying product other than KSB. Alternate proposals must include a clear statement of each point of difference between the proposed alternate product and these specifications. The Owner and Engineer reserve the right to reject any bid not based on KSB product.

**2.02 MATERIALS**

**A. SUBMERSIBLE SEWAGE PUMPS**

Pump Case: Cast Iron, ASTM A48, Class 35B

Motor Housing: Cast Iron, ASTM A48, Class 35B

Impeller: Duplex Stainless Steel, ASTM A 743 CD4MCu

Intermediate Housing (Backplate): Cast Iron, ASTM A48, Class 35B

Discharge Base Elbow: Cast Iron, ASTM A48, Class 35B

Pump/Motor Shaft: Carbon Steel, ASTM A576, Gr.1045 with replaceable ASTM

## SUBMERSIBLE WET PIT PUMP, STAINLESS STEEL

A276 Type 420 shaft protection sleeve. (NOTE: If sleeve is not supplied, entire shaft is to be ASTM A276 Type 420 stainless steel)

Shaft Sleeve (if used): Stainless Steel, ASTM A276 Type 420

Wear Ring, case: Cast Iron, ASTM A48, minimum 200 Brinell

Wear Ring, impeller: Duplex stainless steel, AISI329, 350 Brinell

O-Rings: Nitrile Rubber (NBR)

Fasteners (including impeller fastener): Stainless Steel, ASTM A276 Type 316Ti.

Lower Seal Faces: Silicon Carbide/Silicon Carbide

Upper Seal Faces: Silicon Carbide stationary/Carbon rotating

Guide rails/cables and mounting brackets: Stainless Steel, ASTM A276 Type 316

Lifting Chain or cable: Stainless Steel, ASTM A276 Type 316

Oil-all uses (seal lubrication, etc): Ecologically safe, parifin or mineral base

Power/Control Cable Jacket: Chloroprene with non-wicking fillers

### 2.03 ACCESSORIES

#### A. POWER CABLE

Provide 50 ft of power/control cable with each pump, suitable for submersible wastewater application, sized in accordance with NEC requirements. Provide cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/ terminal area even if the cable is damaged or severed below water level. Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be provided. The cable entry shall be rated by Factory Mutual (or UL) for submerged operating depths to 85 feet.

#### B. TEMPERATURE PROTECTION

Furnish temperature monitoring devices in motor windings for use in conjunction with and supplemental to external motor overload protection. Arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal. Set temperature monitors at levels recommended by pump manufacturer.

#### C. SEAL LEAK DETECTION

Provide a detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor. In addition, on motors 80HP and larger

## SUBMERSIBLE WET PIT PUMP, STAINLESS STEEL

provide a stainless steel float switch in a separate leakage collection chamber to indicate leakage past the inner mechanical seal prior to its entrance into either the motor stator cavity or the lower bearing. Electronic probes which depend on sensing resistance value changes in seal oil will not be acceptable as seal leak indicators.

### D. “PumpSafe” MOTOR SENSOR MONITORING RELAY

1. The pump supplier shall furnish all relays required for monitoring all motor sensors. The relays shall be installed by others in the motor control panel and properly wired in accordance with pump manufacturer’s instructions. Relays shall mount in standard 12-pin socket bases (provided) and shall operate on available control voltage of 24-240 VAC. If relays require an input voltage that is not available in the motor control panel an adequate transformer (with fused input) shall be provided by the pump supplier. Relays shall have a power consumption of no more than 2.8 watt, and shall be UL approved. Relays shall be modular in design, with each relay monitoring no more than two motor sensor functions.
2. Each relay module shall include a dual color (red/green) LED to indicate the status of each monitored sensor. Green will indicate “status OK”; red will indicate a failure or alarm condition. A self-corrected fault will allow the relay output contacts to reset, and cause the LED to change from a steady alarm indication to a flashing signal. The LED shall continue to flash until locally cleared, providing the operator an indication of a potential intermittent fault. Each relay shall also include a power-on LED and both “test” and “reset” pushbuttons.
3. An independent fail-safe (switch on power loss) form-C output contact shall be included for each monitored sensor to provide a normally-open / normally-closed dry contact to initiate a remote alarm device or shut down the motor. Contacts shall be rated for 5 amps at 120 volt.

## 2.04 FABRICATION

### A. GENERAL

1. Provide pumps capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners.
2. Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load-bearing guides. All system components for guide cable systems, including cable, shall be supplied and warranted by the pump

## SUBMERSIBLE WET PIT PUMP, STAINLESS STEEL

manufacturer. For guide pipe systems the pipe shall be supplied and warranted by the installing contractor. Guide cable systems shall be suitable for proper operation when installed at up to 5 degree misalignment from vertical, pipe guides must be installed perfectly plumb and vertical. Intermediate guide supports (between upper bracket and discharge elbow connections) shall not be required for cable systems but MUST be supplied where needed to maintain perfect alignment for pipe guides. Final connection shall insure zero leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no part of the pump bears directly on the floor of the wet well. Provide Type 316 stainless steel chain of sufficient length to properly and safely lift pumps from the wet well. All exposed cast iron and ferrous surfaces shall be cleaned of dirt and grease, sandblasted to near white finish, and coated with an anti-corrosion reaction primer. The pump shall then be coated with two-component thick coat paint, with an epoxy resin base, having at minimum 83% solids by volume. This coating shall be non-toxic and approved for both wastewater and water applications.

### B. MAJOR COMPONENTS

Furnish major components (pump case, impeller, intermediate housing, motor housing) of cast material as specified with smooth surfaces devoid of blow holes and other irregularities. Pump case design shall incorporate a centerline discharge for stability when mounted on the base elbow.

### C. IMPELLER AND WEAR RINGS - SINGLE VANE SCREW TYPE

Provide non-clog type impeller, capable of passing at minimum a 3.9" spherical solid. Statically and dynamically balance the impeller. On single vane impeller designs, provide metal wear plate of material and Brinell hardness specified, to insure maximum pump/impeller life and continuing high efficiencies. Impellers must incorporate back vanes which reduce axial loads and propel solids away from the seal area. Do not use soft metals (i.e. bronze, 304 or 316 stainless) or elastomers as wear ring material as these are incompatible with the grit contaminate expected in the pumpage.

### D. SHAFT

Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. Machine the shaft of carbon steel or stainless steel and isolate the shaft from the pumped media with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal. Pump shafts without shaft sleeves are not acceptable due to higher maintenance costs associated with repairing shafts / rotor assemblies that are left unprotected.

**E. SHAFT SEAL**

Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent single spring system acting in a common direction. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. Provide seals which are non-proprietary in design, with replacements available from a source other than the pump manufacturer or its distributors. Do not provide seals with the following characteristics: conventional double mechanical seals with single or multiple springs acting in opposed direction; cartridge-type mechanical seals; seals incorporating coolant circulating impellers, seals with face materials other than those specified.

**F. BEARINGS**

Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 100,000 hours at all anticipated axial and radial loadings. Provide sealed/shielded (permanently lubricated) bearings. If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak plugs for periodic addition of lubrication from external to the pump

**G. MOTOR**

Provide a premium efficiency rated motor (level IE3) which is squirrel cage, induction in design, housed in a completely watertight and air filled chamber, with a min 1.15 service factor. The motor shall be adequately sized and rated for continuous operation at a maximum fluid temperature of 104 degrees F (40 degrees C). Allowable maximum submergence shall not be less than 100ft (30 m). Insulate the motor stator with, at minimum, Class H insulation rated for 356 degrees F (180 Degrees C). Windings shall be insulated using trickle impregnation process to ensure uniformity with a winding fill factor of at least 95%. The use of multiple step "dip and bake" type stator insulation method shall not be acceptable. The rotor bars and short circuit rings shall be made of cast aluminum. The motor and pump set complete shall be designed and manufactured by the same company. Provide temperature protection and seal leak detection as described above.

The motor shall be designed to operate dry or submerged without the need for internal or external cooling system. (motors rated up to 10HP only).

## **SUBMERSIBLE WET PIT PUMP, STAINLESS STEEL**

Motors containing di-electric oils used for motor cooling and/or bearing lubrication are not acceptable. Submergence (cooling) jackets which circulate pumped media for motor cooling may be used only if they are designed to pass 3" wastewater solids (or to filter out all solids) while maintaining a minimum 2 ft/sec non-settling velocity of coolant at all anticipated pump operating speeds.

Provide motors which are FM listed for use in Class I Division 1 Groups C&D hazardous locations as defined by the National Electric Code.

**END OF SECTION**



**SECTION 11250**  
**INFLUENT SUBMERSIBLE SEWAGE PUMPS**

**PART 1 - GENERAL SYSTEM DESCRIPTION**

**1.01 PERFORMANCE REQUIREMENTS**

Operating Conditions - Design: 950 GPM @ 63 FT TDH @ 68.7 %

Secondary: 600 GPM @ 76 FT TDH @ 61 %

1200 GPM @ 52 FT TDH @ 67 %

Minimum Shutoff head: 87 FT

Maximum Motor HP: 30 HP

Minimum Hydraulic Efficiency (at design): 68.7%

Maximum Motor RPM: 1180 RPM

**1.02 QUALITY ASSURANCE - REFERENCED STANDARDS:**

American Iron & Steel Institute (AISI)

American Society for Testing and Materials (ASTM)

Factory Mutual (FM)

Hydraulic Institute Standards for Centrifugal, Rotary, and Recip Pumps (HI)

National Fire Protection Agency (NFPA)

National Electric Code(NEC)

National Electrical Manufacturers Association(NEMA)

Anti-Friction Bearing Manufacturers Association(AFBMA)

International Standards Organization (ISO) - ISO9001

**1.03 WARRANTY**

The pump manufacturer shall warrant the pump, motor and guide system to the Owner against defects in workmanship and materials for a period of seven (7) years under normal use and service. If a guide cable system is used the pump manufacturer shall warrant the guide cable system (including guide cables and brackets) to the Owner against defects in workmanship and materials for a period of ten (10) years under normal use and service. Both pump manufacturer warranties shall be in published form, and shall apply to all similar units. A copy of each warranty shall be provided to the Owner at startup.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following are acceptable:
  - 1. KSB
  - 2. Flygt
- B. All products, whether named as "acceptable" or proposed as "equal" must fully comply with these specifications. Standard product must be modified, if required, for compliance. The contractor shall base his bid price on product offered by KSB, Inc. for purposes of determining the successful bidder on this project. The contractor may submit, with the bid, an alternate proposal with applicable deduct if any for supplying product other than KSB. Alternate proposals must include a clear statement of each point of difference between the proposed alternate product and these specifications. The Owner and Engineer reserve the right to reject any bid not based on KSB product.

**2.02 MATERIALS**

- A. SUBMERSIBLE SEWAGE PUMPS
  - Pump Case: Cast Iron, ASTM A48, Class 35B
  - Motor Housing: Cast Iron, ASTM A48, Class 35B
  - Impeller: High Chrome white iron, A532 IIC, 15% CrMo-Hc
  - Intermediate Housing (Backplate): Cast Iron, ASTM A48, Class 35B
  - Discharge Base Elbow: Cast Iron, ASTM A48, Class 35B
  - Pump/Motor Shaft: Carbon Steel, C 45 N with replaceable ASTM A276 Type 420 shaft protection sleeve or entire shaft to be ASTM A276 Type 420 stainless steel with an ASTM A276 Type 420 shaft protection sleeve.
  - Shaft Sleeve (if applicable): Stainless Steel, ASTM A276 Type 420
    - Wear Plate: High Chrome white iron, A532 IIC, 15% CrMo-Hc
    - O-Rings: Nitrile Rubber (NBR)
  - Fasteners (including impeller fastener): Stainless Steel, ASTM A276 Type 316Ti.
  - Lower Seal Faces: Silicon Carbide/Silicon Carbide
  - Upper Seal Faces: Silicon Carbide stationary/Carbon rotating

## INFLUENT SUBMERSIBLE SEWAGE PUMPS

Guide rails/cables and mounting brackets: Stainless Steel, ASTM A276 Type 304 or 316

Lifting Chain or cable: Stainless Steel, ASTM A276 Type 316

Oil-all uses (seal lubrication, etc): Ecologically safe, parifin or mineral base

Power/Control Cable Jacket: Chloroprene with non-wicking fillers

### 2.04 ACCESSORIES

#### A. Power Cable

Provide 50 ft of power/control cable with each pump, suitable for submersible wastewater application, sized in accordance with NEC requirements. Provide cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/ terminal area even if the cable is damaged or severed below water level. Cable seal shall include a compressed rubber grommet to seal the cable exterior and epoxy fill to seal the interior passages. A strain relief device, in direct contact with both the cable and the cast iron entry housing, shall be provided. The cable entry shall be rated by Factory Mutual (or UL) for submerged operating depths to 85 feet.

### 2.05 TEMPERATURE PROTECTION

Furnish temperature monitoring devices in motor windings for use in conjunction with and supplemental to external motor overload protection. Arrange controls to shut down pump should any of the monitors detect high temperature and automatically reset once motor temperature returns to normal. Set temperature monitors at levels recommended by pump manufacturer.

### 2.06 SEAL LEAK DETECTION

Provide a detector in the motor's stator cavity which allows a control panel mounted relay to indicate leakage into the motor. In addition, on motors 80HP and larger provide a stainless steel float switch in a separate leakage collection chamber to indicate leakage past the inner mechanical seal prior to its entrance into either the motor stator cavity or the lower bearing. Electronic probes which depend on sensing resistance value changes in seal oil will not be acceptable as seal leak indicators.

### 2.07 "PumpSafe" MOTOR SENSOR MONITORING RELAY

- A. The pump supplier shall furnish all relays required for monitoring all motor sensors. The relays shall be installed by others in the motor control panel and properly wired in accordance with pump manufacturer's instructions. Relays shall

## INFLUENT SUBMERSIBLE SEWAGE PUMPS

mount in standard 12-pin socket bases (provided) and shall operate on available control voltage of 24-240 VAC. If relays require an input voltage that is not available in the motor control panel an adequate transformer (with fused input) shall be provided by the pump supplier. Relays shall have a power consumption of no more than 2.8 watt, and shall be UL approved. Relays shall be modular in design, with each relay monitoring no more than two motor sensor functions.

- B. Each relay module shall include a dual color (red/green) LED to indicate the status of each monitored sensor. Green will indicate "status OK"; red will indicate a failure or alarm condition. A self-corrected fault will allow the relay output contacts to reset, and cause the LED to change from a steady alarm indication to a flashing signal. The LED shall continue to flash until locally cleared, providing the operator an indication of a potential intermittent fault. Each relay shall also include a power-on LED and both "test" and "reset" pushbuttons.
- C. An independent fail-safe (switch on power loss) form-C output contact shall be included for each monitored sensor to provide a normally-open / normally-closed dry contact to initiate a remote alarm device or shut down the motor. Contacts shall be rated for 5 amps at 120 volt.

### 2.08 FABRICATION

#### A. GENERAL

- 1. Provide pumps capable of handling raw unscreened wastewater. Design pumps to allow for removal and reinstallation without the need to enter the wet well and without removal of bolts, nuts or other fasteners.
- 2. Provide a pump which connects to a permanently mounted discharge connection by simple downward motion, without rotation, guided by at least two non-load-bearing guides. All system components for guide cable systems, including cable, shall be supplied and warranted by the pump manufacturer. For guide pipe systems the pipe shall be supplied and warranted by the installing contractor. Guide cable systems shall be suitable for proper operation when installed at up to 5 degree misalignment from vertical, pipe guides must be installed perfectly plumb and vertical. Intermediate guide supports (between upper bracket and discharge elbow connections) shall not be required for cable systems but MUST be supplied where needed to maintain perfect alignment for pipe guides. Final connection shall insure zero leakage between pump and discharge connection flange. Provide a discharge connection/ guide system so that no part of the pump bears directly on the floor of the wet well. Provide Type 316 stainless steel chain of sufficient length to properly and safely lift pumps from the wet well. All exposed cast iron and ferrous surfaces shall be cleaned of dirt and grease, sandblasted to near white finish, and coated with

## INFLUENT SUBMERSIBLE SEWAGE PUMPS

an anti-corrosion reaction primer. The pump shall then be coated with two-component thick coat paint, with an epoxy resin base, having at minimum 83% solids by volume. This coating shall be non-toxic and approved for both wastewater and water applications.

### 2.09 MAJOR COMPONENTS

Furnish major components (pump case, impeller, intermediate housing, motor housing) of cast material as specified with smooth surfaces devoid of blow holes and other irregularities. Pump case design shall incorporate a centerline discharge for stability when mounted on the base elbow.

### 2.10 IMPELLER AND WEAR RINGS - Dual Vane, Semi Open

Provide non-clog, dual vane, self-cleaning type impeller, capable of passing at minimum a 3" spherical solid. Statically and dynamically balance the impeller. On semi-open impeller designs, provide hard metal wear plate of material hardness specified, to insure maximum pump/impeller life and continuing high efficiencies. Impellers must incorporate back vanes which reduce axial loads and propel solids away from the seal area. Do not use soft metals (i.e. bronze, 304 or 316 stainless) or elastomers as wear ring material as these are incompatible with the grit contaminate expected in the pumpage.

### 2.11 SHAFT

Provide common pump/motor shaft of sufficient size to transmit full driver output with a maximum deflection of 0.002 inches measured at the lower mechanical seal. Machine the shaft of carbon steel or stainless steel and isolate the shaft from the pumped media with a replaceable Type 420 stainless steel shaft sleeve under the lower mechanical seal. Pump shafts without shaft sleeves are not acceptable due to higher maintenance costs associated with repairing shafts / rotor assemblies that are left unprotected.

### 2.12 SHAFT SEAL

Provide two totally independent mechanical shaft seals, installed in tandem, each with its own independent single spring system acting in a common direction. Install the upper seal in an oil-filled chamber with drain and inspection plug (with positive anti-leak seal) for easy access from external to the pump. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced. Provide seals which are non-proprietary in design, with replacements available from a source other than the pump manufacturer or its distributors. Do not provide seals with the following characteristics: conventional double mechanical seals with single or multiple springs acting in opposed direction; cartridge-type mechanical seals; seals incorporating coolant circulating impellers, seals with face materials other than those specified.

### 2.13 BEARINGS

Furnish upper and lower bearings, single row (preferred) or double row as needed to provide a B10 life of, at minimum, 100,000 hours at all anticipated axial and radial loadings. Provide sealed/shielded (permanently lubricated) bearings. If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak plugs for periodic addition of lubrication from external to the pump

### 2.14 MOTOR

- A. Provide a motor which is squirrel cage, induction in design, housed in a completely watertight and air filled chamber, with a min 1.15 service factor. The motor shall be adequately sized and rated for continuous operation at a maximum fluid temperature of 104° F (40° C) [**optional:** 140°F (60° C)]. Allowable maximum submergence shall not be less than 100 ft (30 m). Insulate the motor stator with, at minimum, Class H insulation rated for 180 Degrees C. Windings shall be insulated using trickle impregnation process to ensure uniformity with a winding fill factor of at least 95%. The use of multiple step “dip and bake” type stator insulation method shall not be acceptable. The rotors bars and short circuit rings shall be made of cast aluminum. The motor and pump set complete shall be designed and manufactured by the same company. Provide temperature protection and seal leak detection as described in above. Provide adequately rated motor with sufficient surface area for ambient only cooling suited for the intermittent mode of operation in wet well wastewater applications, submerged or partially submerged, without damage. Motors containing di-electric oils used for motor cooling and/or bearing lubrication or motors where the pumped media or externally provided fresh water is directed through the motor shell for cooling is not acceptable.
- B. Provide motors which are FM listed for use in Class I Division 1 Groups C&D hazardous locations as defined by the National Electric Code.

END OF SECTION

**SECTION 11275  
FIBERGLASS WETWELL**

**PART 1 GENERAL**

**1.01 SCOPE OF WORK**

The product listed under this section shall include all labor, materials and equipment necessary to furnish a Fiberglass Reinforced Plastic (FRP) Wet Well. FRP Wet Wells shall be one piece units manufactured to meet or exceed all specifications of ASTM D3753. Fiberglass reinforced polyester wet wells shall be manufactured from commercial grade unsaturated polyester resin with fiberglass reinforcements as manufactured by the following approved manufacturers:

- A. Fiberglass Tank Solutions (FTS) as represented by Pump & Process (205)987-3337

**1.02 SUBMITTALS**

- A. General - The manufacturer shall supply a complete set of scale drawings detailing dimensions of heights, diameter, elevations to invert, pipe sizes and any other necessary details.
- B. Anti-Flotation (Buoyancy) Calculations - A set of signed and sealed (by a Professional Engineer) anti-flotation calculations shall be provided which meet the following criteria:
  - 1. Wet well weight and soil pressure on concrete base collar may be used to calculate down forces, but pump and piping weights shall not be used.
  - 2. Assume groundwater is at grade.
  - 3. A factor of safety of 1.2, minimum, must be used.
  - 4. The design calculations shall include the design conditions as noted on the drawings.
- C. Engineering Design Report - Manufacturer shall provide a complete **Composite Engineering Design using a Finite Element Analysis** for the wet well. The calculations shall include:
  - a. Design Inputs
  - b. Design of Cylindrical Shell
  - c. Flat Top Head Design
  - d. Bottom Head Design

- e. Pump Anchorage on Flat Bottom
  - f. Component Weight
  - g. Buoyancy Calculations
  - h. Lifting Trunnion Design
  - i. Access Cover Opening Reinforcement
  - j. Design Summaries and Sketches
  - k. P.E. Stamp for the Design
- D. Mounting Plate Calculations - Pumps shall be anchored to a mounting plate (see details on the drawings). The complete design (signed and sealed by a Professional Engineer) shall be submitted. Mounting plates are not permitted to be bolted through the bottom of the basin.

### 1.03 QUALITY ASSURANCES

Comply with the latest published editions of AWWA and ASTM Standards:

ASTM D883	Standard Terminology Related to Plastics
ASTM D3299	Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM D3753	Standard Specifications for Glass-Fiber-Reinforced Polyester Manholes and Wet Wells
ANSI / AWWA D120-09	AWWA Standard for Thermosetting Fiberglass- Reinforced Plastic Tanks

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Resin – The resins used shall be commercial grade unsaturated 100% polyester resins. Interior corrosion liner shall be a Vinyl Ester resin.
- B. Reinforcing Materials – The reinforcing materials shall be a commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric, or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcements and the resin.
- C. Surfacing Materials – If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass that includes a C-Veil or Nexus liner that will provide a suitable bond with the resin and leaves a resin rich surface.



- D. Interior Materials - A minimum of a 10mm interior laminate layer of the tank construction shall include the reinforcing materials, C-Veil or Nexus, and a commercial grade Premium Vinyl Ester resin for added chemical resistance.
- E. Fillers and Additives - Fillers, when used, shall be inert to the environment and wet well construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification. No sand fillers will be allowed.

## 2.02 FABRICATION

- A. Exterior Surface - The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show.
- B. Interior Surface - The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted if they are less than 3/4 inch in diameter and less than 1/16 inch deep.
- C. Interior and Exterior of the lift station shall be either white or light gray in color.
- D. Defects Not Permitted -
  - 1. Exposed fibers - Glass fibers not wet out with resin.
  - 2. Resin runs: runs of resin and sand on the surface.
  - 3. Dry areas: areas with glass not wet out with resin.
  - 4. Delamination: separation in the laminate.
  - 5. Blisters - Light colored areas larger than 1/2 inch in diameter. Crazing: cracks caused by sharp objects.
  - 6. Pits or Voids - Air pockets.
  - 7. Wrinkles - Smooth irregularities in the surface.
  - 8. Sharp Projection - Fiber or resin projections necessitating gloves for handling.
- E. Installation of Brackets - Manufacturer or Manufacturer-certified field personnel shall glass in all stainless-steel fasteners and brackets, discharge piping brackets, etc. Manufacturer of wet well shall be responsible for integrity of all field glassing.
- F. Markings - Each wet well shall have wet well data integrated into fiberglass and affixed inside and top outside walls at or near the top. Data on the inside of the wet well should be legible from the top of the completed lift station installation. Product data shall not be written in ink or paint. Production/serial numbers shall

be kept on file by Manufacturer for a minimum of 20 years and shall be accompanied by project data for future reference and recall. Data required includes the following as an example:

1. Manufacturer's Name
  2. ASTM Designation
  3. Production or Serial Number
  4. Production date
  5. Wet Well Depth
  6. Wet Well Diameter
  7. Warranty Length
- F. Wet Well Top Flange - The wet well flange shall have an outside diameter of at least 3.0 inches greater than the diameter of the wet well.

#### 2.03 FIBERGLASS CONSTRUCTION METHODS

- A. Wet Well Penetrations – Cutouts/stub-outs must be installed by the manufacturer. Installations in the field are not recommended and may void the manufacturer's warranty. Penetrations of FRP pipe will be performed using resin and reinforced hand lay-up procedures. All resin and fiberglass shall be the same type and grade as used in the manufacturer of the basin.
- B. Pipe Installation – Discharge wall penetrations are to have sleeves large enough to accept O.D. of pipe discharge flange. All discharge sleeves shall be sealed via a gas tight-water tight Link Seal system or approved equal. Influent pipe connections shall be made with a Press Seal Boot with stainless steel band or approved equal.

#### 2.04 DESIGN FEATURES

- A. Top Slab Support – Pour reinforced concrete slab support a minimum of two feet outside of fiberglass wet well wall and minimum of six inches thick. Slab designs will be the responsibility of the design firm of record for the project, to include reinforcement and concrete mix for the specific load requirements. All top loaded slabs will provide structural loads to be placed on soil backfill outside the shadow of the fiberglass tank.
- B. Wet Well Top – Wet well top shall be concrete and designed for 300 PSF or H-2O Traffic loading as noted on the drawings. Hatches shall be as specified in this specification and as detailed on the Contract drawings. Bottom of top slab and around side of hatch opening shall be fiberglass lined and shall meet all the requirements of this specification.
- C. Frame And Covers

1. Access frame and covers shall be suitably sized for pumping units furnished as specified on the Construction plans and details. Access frame and covers shall be constructed of skid-proof aluminum with a minimum load rating of 300 pounds per square foot or H-20 traffic loading in accordance with the drawings. Frame and covers shall be furnished complete with stainless steel staple assembly (not recessed) for the locking mechanism, hold-open device, upper guide holder and cable holder. Access covers shall be hinged to open as indicated on the drawings. Hatches shall be sized to provide a 4-inch minimum clearance between hatch and pump volute (measured from all sides and includes the pump and rail system). Hatches shall be gasketed to minimize water intrusion and odors, with drain piping. All hatch openings shall be provided with aluminum powder coated safety grates.
2. All hinges, fasteners and miscellaneous hardware shall be 316 stainless steel. For tamper proof and security purposes, the hinges shall be bolted to the door(s) with stainless steel carriage bolts and nuts. The nuts shall be welded to the bolts on both the door(s) and frame. The Owner will provide pad locks, as required. Locks shall be easily accessed, no slam-lock-type locking mechanisms will be allowed.
3. Hatches to be installed by tank manufacture in the factory.

**D. Interior Piping & Pump Discharges**

1. Pump discharge systems shall be constructed using Sch. 40 304L Stainless Steel.
2. Pump guide rails shall be Sch. 40 316L Stainless Steel sized per the plans.
3. All interior piping and guide rail systems shall be installed by tank manufacturer in the factory.

**2.05 WARRANTY**

The fiberglass Manufacturer shall warrant the fiberglass wet well against defects for at least one (1) year after the date of acceptance by the Owner. Defects are defined as cracking, delaminating, or leaking. The warranty shall require the Manufacturer to supply all necessary labor, materials, and equipment to repair defects to the satisfaction of the Owner. The Contractor and/or Manufacturer shall not make any exemption or exception to the above stated conditions or warranty. Manufacturer's recommended installation procedures to assure 1-year warranty provided to the Owner to be included in submittal package.

**PART 3 INSTALLATION****3.01 GENERAL**

The FRP wet well shall be installed in the location shown on the plans in accordance with the Manufacturer's recommendations, the Report of Geotechnical Investigation (if applicable) and these specifications. The limit of excavation for the FRP shall allow for placing and removing forms, installing sheeting, shoring, bracing, etc. The Contractor shall pile excavated material in a manner that will not endanger the work and will avoid obstructing sidewalks, driveways, power poles, etc.

**3.02 HANDLING**

The wet well shall not be dropped or impacted. Wet wells shall be chocked if stored horizontally. If wet wells must be moved by rolling, the ground transverses shall be smooth and free of rocks, debris, etc. FRP wet wells may be lifted by the installation of three lifting lugs as specified by the Manufacturer on the outside surface near the top or by a sling or "choker" connection around the center. Use of chains or cables in contact with the wet well surface is prohibited. Wet wells may be lifted horizontally using one support point.

**3.03 WET WELL INSTALLATION**

Bottom of excavation should be compacted in accordance with the Report of Geo Technical Investigation (if available) or to a minimum 95 percent Modified Proctor Density. Pour reinforced concrete base a minimum of one foot deep and at least two feet in diameter larger than the fiberglass wet well outside diameter.

**3.04 VERTICAL SIDES (SHEETING, SHORING AND BRACING)**

When necessary to protect existing or proposed structures or other improvements, the Contractor shall maintain vertical sides of the excavation. The limit shall not exceed three feet outside the footing on a vertical plane parallel to the footing except where specifically approved otherwise by the Engineer. The Contractor shall provide and install any sheeting, shoring, and bracing as necessary to provide a safe work area as required protecting workers, structures, equipment, power design and adequacy of all sheeting, shoring, and bracing. For excavations deeper than 20 vertical feet, which utilize sheeting, shoring or bracing, the sheeting, shoring and bracing plan shall be designed by a Florida Professional Engineer, (signed and sealed). This plan shall be submitted to the Owner for review and approval, prior to construction. The construction of sheeting, shoring and bracing shall be in accordance with the approved plan. All major field modifications shall be approved by the Professional Engineer. The sheeting, shoring, and bracing shall be removed as the excavation is backfilled in such manner as to prevent injurious caving. Excavation shall meet OSHA Excavation Standards (29 CFR sub- part P 1926.650) at a minimum.

**3.05 SLOPING SIDES**

Where sufficient space is available, the Contractor shall be allowed to back slope the sides of the excavation. The back slope shall be such that the excavation shall be safe from caving. The type of material being excavated shall govern the back slope used, but in any case the back slope shall be no steeper than 1 foot horizontal to 1 foot vertical without sheeting or shoring.

**3.06 DE-WATERING**

The Contractor shall keep excavation free from water by use of cofferdams, bailing, pumping, well pointing, or any combination as the particular situation may warrant. All de-watering devices shall be installed in such a manner as to provide clearance for construction, removal of forms, and inspection of exterior of form work. It is the intent of these specifications that the foundation be placed on a firm dry bed. The foundation bed shall be kept in a de-watered condition a sufficient period of time to ensure the safety of the structure. The excavation shall be protected from excessive rainfall, drainage and drying. The excavation shall be inspected and approved by the Owner's representative before work on the structure is started. It is the intent of these specifications that the Contractor provides a relatively smooth, firm foundation bed for footing and slabs that bear directly on the undisturbed earth without additional cost, regardless of the soil conditions encountered. The Owner's representative will be the sole judge as to whether these conditions have been met.

**3.07 UNAUTHORIZED EXCAVATION**

Excavation for slabs, footings, etc., that bear on earth shall not be carried below the elevation shown on the drawings. In the event the excavation is carried on below the indicated elevation, the Contractor shall bring the slab, footing etc., to the required grade by filling with concrete having a minimum compressive strength of at least 3,000 psi at 28 days.

**3.08 BACKFILL MATERIAL**

Unless shown otherwise on the drawings, suitable backfill in accordance with the Manufacturer's Installation Guidelines shall be used for backfill around the wet well for a distance of two feet from the outside surface and extending from bottom of the excavation to the bottom of the top slab. The material chosen shall be free of large lumps or clods (which will not readily break down under compaction), clay or rocks larger than 3/4-inch size. This material will be subject to approval by the Owner's Representative. Backfill material shall be free of vegetation or other extraneous material.

**3.09 SCHEDULE OF BACKFILLING**

The Contractor may begin backfilling of wet well as soon as the concrete has been allowed to cure and the forms removed.

**3.10 BACKFILL**

Backfill shall be placed in accordance with the recommendations contained within the Report of Geotechnical Investigation (if applicable). Otherwise backfill shall be placed at a minimum in layers of not more than 12 loose measure inches and mechanically tamped to at least 95 percent Modified Proctor Density. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the structure.

**END OF SECTION**

**SECTION 11280**  
**SLIDE GATES AND WEIR GATES**

**PART 1      GENERAL**

**1.1      SCOPE OF WORK**

- A.      Furnish all labor, materials, equipment and incidentals required for the slide gates, weir gates, operators, operating stems and appurtenances as shown on the Drawings and as specified herein.

**1.2      SUBMITTALS**

- A.      Submit copies of all materials required to establish compliance with this Section. Submittals shall include the following:
  - 1.      Complete description of all materials.
  - 2.      Certified shop and installation drawings showing all details of construction, dimensions and anchor bolt locations.
  - 3.      Descriptive literature, bulletins and/or catalogs of the equipment.
  - 4.      A complete total bill of materials.
  - 5.      The weight of each component.
  - 6.      Description of surface preparation and shop prime painting of gates and accessories.
- B.      In the event it is not possible to conform with certain details of this Section, describe completely all non-conforming aspects.
- C.      Operation and Maintenance Data
  - 1.      Operating and maintenance instructions, for each type of equipment, shall be furnished to the Engineer as provided for in Section 01730.
  - 2.      A factory representative who has complete knowledge of proper operation and maintenance shall be provided for 1 day to instruct representatives of the Owner and Engineer on the proper operation and maintenance of the equipment. This work may be conducted in conjunction with the inspection of the installation and test runs as provided under PART 3.

**1.3      WARRANTY**

- A.      The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.

## 1.4 QUALITY ASSURANCE

- A. Referenced manufacturers are Whipps, Inc., Waco, Hydrogate, ISE Aquanox, RW Gate Company, Waterman and Plasti-Fab.

## 1.5 MAINTENANCE

- A. Tools and Spare Parts
  - 1. Special tools required for normal operation and maintenance, shall be furnished with the equipment by the supplier.
  - 2. Spare parts routinely requiring replacement during one year's operation at design loading shall be furnished by the supplier

## PART 2 PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

- A. Gates
  - 1. The slide gates and weir gates shall have the characteristics, dimensions, and materials as shown on the Drawings and specified herein.
  - 2. All slide gates and weir gates shall be of the conventional or self-contained frame type with rising or non-rising stem, fabricated of 316 Stainless Steel or FRP and designed to have adequate strength to prevent distortion in handling and placing and under any condition of service.
  - 3. Gate frames shall be manufactured of the same material specified for the gate. The frame shall be sufficiently strong so that where the guide extends above the operating floor to support the hoisting yoke, no further reinforcing of the frame will be required. The arrangement of the yoke shall be such that the disc and stem can be removed without disconnecting the yoke. The invert of the frame shall be an angle completely welded to the ends of the guides. The invert shall form a seating surface for the resilient seat mounted on the disc. Frames embedded in the concrete forming the channel walls and invert shall have keyways to hold the frames in the concrete. All portions of the frame bolted to a wall shall have a neoprene gasket between the frame and the concrete. "J" or "P" type hollow bulb neoprene seals shall be provided on the guides of all slide gates. Seals shall be easily removable in case of replacement.
  - 4. Guides in the gate frame shall be of a double slot design. The primary slot shall accept the plate of the disc and the second slot shall be sufficiently wide so that the reinforcing ribs of the disc may extend into it. Guides shall be supplied with polyethylene bearing strips to reduce friction along the guide surfaces.
  - 5. The disc or sliding member shall be as tabulated, of the same composition as the frame, reinforced with U-shaped extrusion. Reinforcement shall be



- spaced not more than 16-in apart and shall be welded to the plate. The disc shall be designed so that it will not deflect more than  $L/360$  of the span of the gate under the design head, Reinforcing ribs shall extend into the guides so that they overlap the seating surface of the guide. All parts of gates shall have a minimum thickness of 1/4-in.
6. Rising stems shall be connected to the disc by means of a cast aluminum stem connection, threaded and bolted to the stem and welded to the disc. Non-rising stems shall have a bronze nut. The stems shall have adjustable bronze stop collars above and below the lift nut to prevent overopening or overclosing the gate.
  7. Slide gates shall have a flush invert consisting of a specially molded resilient seal mounted in the invert extrusion. The seal shall be readily renewable.
  8. The slide gates and weir gates shall be designed such that under the design seating head, the leakage rate shall not exceed 0.1 gpm/lf of seating perimeter. Additional seals shall be provided as required to ensure that the above leakage requirement is met.
  9. All required attaching bolts and anchor bolts shall be furnished with the equipment and shall be 316 stainless steel,
  10. Gate operators shall be bench stands mounted on the gate yoke, floor stands, non-rising stem floor boxes, or electric operators as specified above for sluice gates.
  11. All stems shall be provided with fracture resistant clear butyrate plastic stem covers complete with indicator markings to indicate gate position. Stem covers shall not discolor or become opaque for a minimum of 5 years after installation. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting.
  12. All stainless steel components shall be Type 316 and shall conform to the appropriate ASTM standards except as otherwise specified herein.
- B. Floor stands shall be furnished for all gate operators not supported on the gate yoke. Floor stands shall be cast-iron or cast steel construction. The pedestal height shall be such that the crank shaft will be approximately 36-in above the operating floor. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be furnished in cast iron or welded steel construction, designed to withstand all normal operating loads. Where shown on the Drawings, floor stands shall be offset type mounted on the floor surface, and offset to align with the gate stem. The floor stand shall be mounted on a heavily ribbed reinforced cast iron bracket anchored to the concrete with Type 304 stainless steel anchors. The bracket and anchor bolts shall be sized to transfer the upward or downward thrust required to ultimately fail the stainless steel stem. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and acceptable to the Engineer. The bracket, anchors, backplate and accessories shall be supplied as part of the gate assembly by the gate manufacturer.

## SLIDE GATES AND WEIR GATES

- C. Stem guides shall be Type 316 stainless steel, two piece, bronze bushed guides, adjustable in two directions. Space so that L/R ratio of stem does not exceed 200.
- D. Manual operators shall be furnished where shown and shall consist of a handwheel or crank operator mounted on the gate yoke or on a floor stand.
  - 1. Handwheel operators shall have a minimum 18-in diameter handwheel and shall operate the gate under *the* specified operating head with not greater than 40 lbs of force on the handwheel. The operator shall be fully enclosed, equipped with roller bearings above and below the operating nut and mechanical seals. Alternatively, polyethylene bearing pads may be used. The hand wheel shall be readily removable so that a power wrench may be used to open and close the gate by the wrench to the nut.
  - 2. Crank operators shall have either single or double gear reduction depending upon the lifting capacity required. Double reduction operators shall also be two speed type, with a square nut drive on the high speed and low speed shafts. Each type shall be provided with a Threaded cast bronze lift nut to engage the operating stem. Bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts. Operators shall be designed for a maximum crank effort of 40 lbs under the specified operating conditions. Gears, where required, shall be steel with machined cut teeth designed for smooth operation. The pinion shafts on crank-operated floor stands, either single or double ratio, shall be supported on tapered roller bearings and enclosed in a cast iron case and cover. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist. Lubricating fittings shall be of check-type Alemite. The crank shall be removable.
  - 3. Operators shall be equipped with fracture resistant clear butyrate plastic stem covers which shall not discolor or become opaque for a minimum of 5 years after installation. The top of the stem cover shall be closed; the bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting. Stem covers shall be complete with indicator markings to indicate gate position,
  - 4. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction of rotation to open the gate. The direction of rotation to open shall be clockwise.
  - 5. On gates as shown, provide dual operators to maintain stability of the disc. Operators shall be crank operators as specified above, joined together by a shaft such that operating a crank on one will cause both operators to move together.
  - 6. On gates as shown, provide non-rising stem type operators consisting of a stem with 2-in square nut on top mounted in a cast iron floor box set in the concrete floor above the gate. Provide one tee wrench for each gate.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Installation of all gates and guides shall be done in a workmanlike manner. Handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's drawings and recommendations. Frames and guides shall be installed in a true vertical plane and shall be installed with 90 degree corners.
- B. Gates with embedded guides and inverts shall be installed in accordance with the recommendations of the manufacturer subject to the Engineer's approval.
- C. The installation of all gates shall be under the supervision of a representative of the manufacturer furnishing the gates.

**3.2 INSPECTION AND TESTING**

- A. Furnish the services of a factory representative, as provided under PART 1, who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test of the equipment. These services may be combined with those provided under PART 1.
- B. After installation, all slide gates and weir gates shall be field tested at maximum differential head to ensure that all items of equipment are in compliance with this Section, including the leakage requirements.
  - 1. Maximum allowable leakage for slide gates and weir gates shall be 0.1 gpm/ft of perimeter under the design seating head.
- C. In the event that any unit fails to meet the above requirements, the necessary changes shall be made and the unit retested. If the unit remains unable to meet the test requirements to the satisfaction of the Engineer, it shall be removed and replaced with a satisfactory unit at no additional cost to the Owner.

**END OF SECTION**

**SECTION 11320  
GRIT CONCENTRATOR**

**PART 1 GENERAL**

**1.01 SCOPE**

- A. Work described in this section includes furnishing all labor, equipment, materials, tools and incidentals required for a complete and operable installation of the grit removal system as shown on the drawings and specified herein. The manufacturer shall supply the equipment and the general contractor shall install the equipment.

**1.02 DESIGN REQUIREMENTS**

- A. The Grit Removal and Dewatering System shall:
1. Removal efficiency, as outlined in each components section below, shall be based on the following gradation:

% Passing Cumulative									
	75	106	150	212	300	425	600	1000	
Southeast US Region	1.9	7.1	21.2	42.6	62.7	71.9	81.2	93.2	Physical Average
Southeast US Region	1.7	7.9	31.9	56.6	83.4	90.3	94.1	97.9	SES Average

- B. The Grit Removal System shall be comprised of the following components:
1. Grit King® Separator
  2. Decanter
  3. Control Panel
- C. The grit removal system shall be protected by a ½" or finer screen. The maximum velocity through the open area of the screen shall not exceed 4 ft/s.
- D. The Grit Separator shall be a free standing vessel and receive the incoming screened flow. The Grit Separator shall remove the specified grit particles from the specified peak flow and collect them in a sump at the bottom of the unit. The de-gritted effluent from the Grit Separator shall be discharged via an overflow channel as shown on the drawings.
- E. The Grit Separator shall be all-hydraulic, self-activating and shall not require instrumentation, internal moving parts or external power.
- F. The Grit Separator shall be self cleaning and consist of corrosion resistant components.
- G. The Decanter shall receive concentrated grit slurry from the Grit Separator. It shall allow the washed grit to settle in its clarifier and discharge the de-gritted overflow upstream of the Grit Separator.

- H. The Grit Removal System and all appurtenances shall be supplied by a single supplier.
- I. The system to be furnished hereunder shall be made by a manufacturer regularly engaged in such work and who has furnished similar installations and had them in successful and continuous operation for a minimum period of ten years.
- J. Data on performance testing, service history and operation of existing installations using the submitted equipment shall be made available to the Engineer, upon request, for use in determining that the Grit Removal System offered meets the intent of the contract, performance requirements and criteria stated in these specifications.
- K. The Grit Separator technology shall be designed utilizing Computational Fluid Dynamics (CFD) and field data to verify its flow regime, headloss and grit removal characteristics. Upon request, data on the computation methods used and generic simulation results shall be made available to the engineer.
- L. Equipment using paddles or air to supplement or induce a vortex shall not be accepted.

1.03 SUBMITTALS AND OPERATION AND MAINTENANCE MANUALS

- A. Submittals shall be provided in accordance with the General Conditions and shall include the following:
  - 1. Manufacturer's catalog data and descriptive literature including equipment weights and performance data.
  - 2. General arrangement and dimensional drawings of the grit removal system.
  - 3. Written recommended procedures for job site storage, handling, and installation of the equipment.
  - 4. Hydro International's Intellectual Property licensing agreement.
- B. Operation and maintenance manuals shall be provided at the completion of the job and in accordance with the General Conditions. The manuals shall include the following data:
  - 1. Alignment, adjustment, and repair instructions.
  - 2. MANUFACTURER'S installation instructions.
  - 3. Assembly diagrams.
  - 4. Troubleshooting guide.
  - 5. Lubrication instructions.
  - 6. Recommended spare parts lists and predicted life of parts subjected to wear.

1.04 QUALITY ASSURANCE

- A. Warranty
  - 1. Any product that proves defective in material, workmanship or design within twelve (12) months after delivery shall be, at the discretion of the

MANUFACTURER, modified, repaired or replaced, or Buyer's payment for the products shall be refunded. This shall be Buyer's sole remedy.

**B. Certificate of Compliance**

1. The MANUFACTURER shall warrant that the Grit Removal System to be supplied shall be manufactured in strict compliance with the Contract Specifications.

**C. The system shall be furnished by a MANUFACTURER who is ISO 9001:2015.**

**D. MANUFACTURER shall be successful in the experience of manufacture, operation, and servicing of Grit Removal Systems of type, size, quality, performance, and reliability equal to that specified for a period of not less than ten (10) years. The MANUFACTURER shall submit evidence of experience having supplied a minimum of ten (10) installations in North America of similar size to the proposed system.**

**E. In the absence of verifiable experience, the MANUFACTURER shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the MANUFACTURER was found lacking in experience from the specified ten (10) year period. The performance bond shall commence with acceptance of the equipment and time described herein and beyond the standard warranty period.**

**F. If equipment other than that shown on the Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the MANUFACTURER requesting approval to submit with the request a revised design and layout of the mechanical equipment acceptable to the ENGINEER. Revised drawings shall show the proposed location of the alternate unit, and area required for withdrawal space of replacement or serviceable components. This drawing shall also show clearances of adjacent equipment and service area required by that equipment. Changes in architectural, structural, electrical, mechanical and plumbing requirements for the alternate shall be the responsibility of the Manufacturer requesting approval. This shall include the cost of redesign by affected designers. Any additional cost incurred by affected subcontractors shall be the responsibility of the MANUFACTURER and not the OWNER.**

**G. Approved equal MANUFACTURERS shall furnish performance test results by an independent party documenting that the System has achieved the specified performance requirement in a minimum of three installations. MANUFACTURERS that are approved as equal are not excused from providing the specified products as outlined below.**

**1.05 MANUFACTURER**

- A. The entire Grit Removal System shall be manufactured by Hydro International, Hillsboro, OR. 2925 NE Aloclek Drive #140, Hillsboro, Oregon, 97124, telephone 503-615-8130. Being named or bidding as an equal does not relieve the manufacturer of meeting these specifications.

- B. Alternate manufacturers shall require the engineer's written approval 30 days prior to bid opening

## PART 2 PRODUCTS

### 2.01 GRIT SEPARATOR

#### A. Design Data

1. Number of Units: 1
2. Size: 10' diameter
3. Configuration: Free Standing
4. Performance: 95% removal of all grit (specific gravity 2.65)  
≥ 75 microns at current winter ADF
5. Performance: 95% removal of all grit (specific gravity 2.65)  
≥ 75 microns at current summer ADF
6. Performance: 95% removal of all grit (specific gravity 2.65)  
≥ 75 microns at Design AAD
7. Performance: 95% removal of all grit (specific gravity 2.65)  
≥ 75 microns at Design MMDF
8. Performance: 95% removal of all grit (specific gravity 2.65)  
≥ 212 microns at Design PDF
9. Current Winter ADF/Unit: 0.7 mgd with no more than 1" headloss
10. Current Summer ADF/Unit: 0.9 mgd with no more than 1" headloss
11. Design AAD/Unit: 1.3 mgd with no more than 1" headloss
12. Design MMDF/Unit: 1.5 mgd with no more than 2" headloss
13. Design PDF/Unit: 4.0 mgd with 8" headloss
14. Depth of Flow  
@ PDF/MMDF/AAD/Summer ADF/Winter ADF: 9" / 5" / 5" / 4" / 3"
15. Recommended Underflow Rate: 75 gpm
16. Influent Connection: 16" flanged pipe
17. Effluent Connection: 32" wide channel w/ 20" overflow drop pipe
18. Underflow Connection: 3"
19. Underflow Layout: Gravity

## GRIT CONCENTRATOR

- |                                |                               |
|--------------------------------|-------------------------------|
| 20. Underflow Control:         | Hydro-Brake® SXV Vortex Valve |
| 21. NPW Connection:            | 1" NPT                        |
| 22. Materials of Construction: | 304 SS                        |

### B. OPERATION

1. The Grit Separator shall be designed to separate grit and sand from screened raw wastewater using Hydro-dynamic separation and boundary layer effects to aid gravitational forces.
2. All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials.
3. The Grit Separator shall be characterized by a predetermined flow path caused by the vessel geometry and flow modifying components to maximize the concentration and removal of settleable solids.
4. The Grit Separator shall include a fluidizing system to prevent the collected grit from compacting in the collection area, release entrapped organics, and aid in transporting the accumulated grit to the Grit Dewatering Unit.

### C. CONSTRUCTION

1. The Grit Separator shall consist of a free standing vessel with a sloping base fabricated from stainless steel. The vessel walls shall be 3/16 inch thick.
2. A center shaft and cone shall be mounted so that its edge is clear of the sloping base of the vessel. It shall be removable from the top of the unit.
3. A collection pot for the separated grit shall be located under the cone.
4. All flanges shall conform to ANSI B16.1 bolt patterns.

### D. VALVES AND ACCESSORIES

1. The Grit Separator shall be supplied with the following valves:
  - a) One (1) 3" cast iron round full port plug valve with electric actuator, 120 V, 60 Hz, 1PH, NEMA 4X, to control the underflow.
  - b) One (1) 1" NEMA 4X brass solenoid valve to automate the fluidizing water supply.
  - c) One (1) 1" brass pressure regulator to adjust the fluidizing water pressure.
  - d) Two (2) 1" bronze ball valves to shut off the fluidizing water and isolate the solenoid valve.



## GRIT CONCENTRATOR

2. The following pressure gauges shall be provided for the grit removal system:
  - a) One (1) 0-100 psig pressure gauge to monitor the fluidizing water delivery pressure.
3. The Grit Separator shall be provided with a Type SXV Hydro-Brake® Vortex Valve to be installed on the underflow pipe to regulate the flow rate to the dewatering unit. The valve shall be rated at a maximum flow of 75 gpm. The material shall match the Grit Separator.

### 2.02 DECANTER GRIT DEWATERING UNIT

#### A. Design Data

- |                              |   |
|------------------------------|---|
| 1. Number of Units:          | 2 (1 duty, 1 standby)                       |
| 2. Size:                     | 1.5 cy                                      |
| 3. Style:                    | Front Loading, Rear Loading or Self Dumping |
| 4. Overflow Connection:      | 3" NPT                                      |
| 5. Drain Connection:         | 2" NPT                                      |
| 6. Screening:                | 0.10" 304 SS Wedgewire                      |
| 7. Material of Construction: | Galvanized Steel                            |

#### B. Operation

1. The Grit Dewatering Unit shall be designed to dewater concentrated, washed grit slurry from the Grit Separator.
2. The Grit Dewatering Unit shall capture and dewater all grit removed by the Grit Separator.
3. During normal operation the drain connection shall remain closed to allow the solids to settle from the grit slurry.
4. When the Grit Dewatering Unit fills, decanted water shall flow into the overflow weir and discharge via the overflow line.
5. Before the Grit Dewatering Unit is emptied the drain valve shall be opened to let the standing water drain through the wedgewire drain screen.

#### C. Construction

1. The body of the Grit Dewatering Unit shall be constructed of 14 gauge steel with 12 gauge top reinforcements and 3/16" wrap around corner reinforcements.
2. The Grit Dewatering Unit shall be provided with an overflow weir at least 3.5 feet in length.
3. The Grit Dewatering Unit shall be equipped with (4) four 6" diameter wheels; each rated at 1,200-lbs. carrying capacity. All / The rear wheels shall swivel.
4. The Grit Dewatering Unit shall be manufactured within the requirements of

front or rear-loading local garbage/compactor trucks and shall conform to ANSI Z245.60 Compatibility Dimensions and ANSI Z245.30 Safety Requirements.

**D. Valves and Accessories**

1. The Grit Dewatering Unit shall be supplied with the following valves:
  - a) One (1) 2" plug valve to shut off the drain connection.

**2.03 CONTROLS AND INSTRUMENTATION**

**A. Control Panel**

1. One (1) control panel shall be furnished, completely pre-wired and tested.
2. The control panel shall adhere to the following specifications:
  - a) Enclosure Rating: NEMA 4X
  - b) Material: 304 SS
  - c) Voltage: 120 Volt
  - d) Phase: Single Phase
  - e) Frequency: 60 Hz
  - f) Load: 10 Amp Max
  - g) Logic: Programmable Relay
3. The Control panel shall contain all timers, switches, indicator lights, and other components necessary to operate the following equipment:
  - a) One (1) Grit Separator
4. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact is provided for each relay.
5. Where remote monitoring is required, the panel shall be provided with all dry contacts necessary.
6. The panel door layout shall include the following items:
  - a) Front panel mounted combination main disconnect switch and circuit breaker
  - b) Back lit Power Maintained 2-way switch
  - c) System three position HOA switch
  - d) System Emergency Stop push button
  - e) System Alarm Reset push button (optional)
  - f) Grit Removal Cycle Start push button
  - g) Grit Separator fluidizing water valve Open/Close switch
  - h) Grit Separator fluidizing water valve OPEN indicating light
  - i) Grit Separator underflow plug valve Open/Close switch
  - j) Grit Separator underflow plug valve OPEN/CLOSE indicating lights

**2.04 SEQUENCE OF OPERATION**

1. The system shall be controlled to provide automatic or manual operation, manual starting and stopping and system shut down when a fault is detected.
2. Clarified plant water shall be supplied to the Grit Separator.

3. Grit Separator
  - a) Screened raw wastewater shall be gravity fed into the Grit Separator continuously.
  - b) A time clock (TC) shall initiate when grit discharge cycles occur. The time clock shall be adjustable to initiate cycles up to every 20 minutes.
  - c) Concurrently, the control panel shall send a signal to open the solenoid valve located on the fluidizing line for an adjustable time period (typically 60 seconds).
  - d) After the fluidizing time runs out and the solenoid valve closes, the electrically actuated plug valve shall open for an adjustable time period (typically 120 seconds).

## 2.05 UTILITY REQUIREMENTS

### A. WATER

1. The Grit Separator shall require an intermittent supply of minimum 50 gpm clarified non-potable water at 50 psig supplied to the grit fluidizing pipe via a NPT connection.

### B. ELECTRICAL

1. The system shall require one (1) 120 VAC, single phase electrical service connection to operate

## 2.06 MATERIALS AND FINISHES

### A. MATERIALS

1. All stainless steel used for the fabrication of the equipment shall conform to the following standards:

Plate and Sheet	ASTM A 167
	ASTM A 240
Bar	ASTM A 276
	ASTM A 479
Tube	ASTM A 312

### B. EXTERIOR SURFACES FINISHES

1. All surfaces shall be free of sharp edges, weld spatter and residue. All welds shall be ground smooth.
2. All stainless steel surfaces shall be acid washed.

## PART 3 EXECUTION

### 3.01 DELIVERY AND INSTALLATION

- A. The equipment and material shall be shipped complete except where partial disassembly is required by transportation regulations or for protection of components.
- B. Spare parts shall be packed in containers bearing packing lists clearly designating contents and pieces of equipment for which they are intended.
- C. The CONTRACTOR shall inspect equipment prior to unloading and notify the MANUFACTURER of any damage to equipment within 5 days to effect proper remedial action. Failure to notify the MANUFACTURER of damage to equipment prior to unloading shall void all warranties pertaining to subject equipment.
- D. The CONTRACTOR shall unload, store and safeguard equipment, materials, and spare parts in accordance with MANUFACTURER'S recommendations.

### 3.02 START-UP, TRAINING AND MANUFACTURER'S SERVICES

- A. A factory trained representative for the equipment specified herein shall be present at the jobsite and/or classroom designated by the Owner for a maximum of two (2) 8-hour man-days (one (1) visit) for installation inspection, plant startup, functional testing, and operator instructions; travel time excluded. A minimum of 30 days notice is required to schedule manufacturer's services. Any services with less than 30 days notice shall be billed for service time and actual travel costs.

### 3.03 FUNCTIONAL TESTING

- A. Prior to plant startup, all equipment shall be inspected for proper alignment, operation, connection, and satisfactory operation by means of a functional test. It is the General Contractor's responsibility to duly notify the MANUFACTURER of any inability to perform functional testing prior to operator training.

### 3.04 MANUFACTURER'S CERTIFICATE(S)

- A. Provide MANUFACTURER'S certificate of installation and commissioning following functional testing and startup.
- B. Provide MANUFACTURER'S OEM Software Licensing Agreement following acceptance and final payment.

## SECTION 11330 GRINDER

### PART 1 GENERAL

#### 1.01 SCOPE OF WORK

- A. Provide one sewage grinder for waste activated sludge ahead of sludge feed pump as shown on the drawings.
- B. Grinder shall be supplied by the Screw Press manufacturer. The grinder operation shall be integrated into the screw press control system.

#### 1.02 RELATED WORK

- A. Screw Press, Section 11542.

#### 1.03 SUBMITTALS

- A. Approval Documents
  - 1. Supplier shall submit approval documents in .pdf format. Submittals shall include equipment descriptions, functional descriptions, dimensional and assembly drawings, catalog data, job specific drawings, manufacturer's instructions.

#### 1.04 QUALITY ASSURANCE

- A. Reference manufacturer is JWC Environmental, Muffin Monster Grinder Model 30004T-1204, Motor Controller Model PC2200 and equal products from Franklin Miller.

#### 1.05 WARRANTY

- A. Manufacturer's standard 12-month limited warranty shall be provided with the equipment.
- B. Warranty Documentation
  - 1. The supplier shall submit a warranty statement clearly identifying the scope and term of the warranty.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging and Shipment
  - 1. Equipment shall be packaged in containers or on skids suitable for normal shipping, handling, and storage.
  - 2. Equipment shall be protected from rain, snow, impact, and abrasion while in the possession of the carrier.
- B. Delivery and Acceptance Requirements

1. Contractor shall review the contents of the shipment at time of delivery and promptly notify the carrier and supplier of any discrepancies.
- C. Storage and Handling Requirements
  1. Equipment shall remain in the packaging provided by the supplier until it is installed.
  2. Equipment shall be stored in a dry environment.
- D. Packaging Waste Management
  1. Contractor shall be responsible for discarding all packaging materials in an environmentally friendly manner and in accordance with local regulations.

## **PART 2 PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

- A. General
  1. Grinder shall reduce or shred waste activated sludge for protection of downstream equipment.
- B. Design Summary
  1. Sludge Flow Rate            50 - 100 gpm
  2. Solids Concentration       1% - 3%
  3. Number of grinders        1
  4. Number of motor controllers   0 (included with Screw Press)
  5. Environment rating for grinders    Non-hazardous
  6. Environment rating for motor controllers   Non-hazardous
  7. Supply power characteristics    460 volt / 3 phase / 60 Hertz
- C. Equipment
  1. Housing flange size 4" ANSI Class 150 bolt pattern
  2. Cutter type 11-tooth
  3. Spacer type Smooth
  4. Shaft seal type Mechanical, Tungsten Carbide
  5. Seal maximum pressure 90 psi (620 kPa)
  6. Speed reducer type and ratio Cycloidal, 29:1
  7. Installed horsepower 3 hp (2.2 kW)
  8. Motor type TEFC
  9. Motor service factor 1.15
  10. Minimum motor efficiency (at full load) 84.0%

11. Minimum motor power factor (at full load) 82.0%
12. Minimum peak shaft torque 4,756 lb-in/hp (721 Nm/kW)
13. Minimum peak force at cutter tip 2,020 lbf /hp (12,047 N/kW)

## 2.02 GRINDER

### A. General

1. Grinder shall be two-shafted design consisting of individual cutters and spacers. The cutters shall actively grab and pull material into the stack for shredding. Grinder shall have a single piece main body housing with integral pipe flanges and inspection ports. Cutter cartridge shall be removable with the main body housing remaining in situ. Cutter cartridge shall have an upper and lower end housings to retain shaft support bearings and seals. Grinder shall have motor and speed reducer for cutter drive. The equipment shall operate at low speed with a maximum cutter shaft speed of 60 rpm.

### B. Components

#### 1. Cutters and Spacers

- a. Cutting stack shall be of nominal height listed in Performance Requirements.
- b. Cutters shall have 11 teeth and be 0.310" (7.87 mm) nominal thickness.
- c. Spacers shall be 0.319" (8.1 mm) nominal thickness.
- d. Cutters and spacers shall be individual disks constructed of heat-treated alloy steel.
- e. Cutter tooth height shall be not greater than ½-inch (13 mm) above the root diameter of the cutter.
- f. Cutter outside diameter shall not exceed a maximum 4.71" (120 mm).
- g. Cutter thickness tolerance shall be +.000/-.001" (+.000/-.025 mm). Spacer thickness tolerance shall be +.001/-.000" (+.025/-.000 mm).
- h. Cutters shall be heat treated to 45-53 HRc.
- i. Spacers shall be heat treated to 34-53 HRc.
- j. Spacers shall have a smooth outside diameter.
- k. Cutter to cutter clearance shall be a maximum of 0.011" (0.28 mm).

#### 2. Shafts

- a. Shafts shall be hexagonal, 2" (50.8 mm) across flats.
- b. Shafts shall be of heat treated 4140 alloy steel with a minimum tensile strength of 149,000 psi (1,027 kPa).
- c. Shaft hardness shall be 38-48 Rockwell C.

3. Intermediate Shaft Yokes (as applicable)
  - a. Intermediate shaft yokes shall provide radial support to the shafts during severe grinding demands.
  - b. Intermediate shaft yokes shall be constructed of 304 stainless steel, 660 bronze, and 17 4PH Stainless steel.
  - c. Intermediate shaft yokes shall be factory lubricated with high temperature marine grade grease.
  - d. Grease fittings shall be provided on intermediate shaft yokes for periodic maintenance.
  - e. Intermediate shaft yokes shall only be supplied on 24-inch (610 mm) cutter stacks.
4. Shaft Bearings and Seals
  - a. Radial and axial loads shall be borne by sealed, oversized, deep-groove ball bearings.
  - b. Shaft seal type shall be mechanical.
  - c. Each bearing and seal arrangement shall be incorporated into a cartridge-style housing.
  - d. Cutter shafts shall be supported on both ends. Cantilever-style arrangements shall not be permitted.
  - e. Dynamic and rotating seal faces shall be Tungsten Carbide with 6% Nickel binder.
  - f. Seal cartridges shall be rated to a maximum pressure of 90 psi (620 kPa).
  - g. O-rings shall be of BUNA-N.
  - h. Seal cartridges shall not require flushing.
  - i. Seals shall be rated to operate wet or dry.
5. Housings and Covers
  - a. Housings and covers shall be of ASTM A536 ductile iron.
  - b. Main body housing shall have integral inlet and outlet flanges.
  - c. Flange bolt pattern shall be as listed in Performance Requirements.
  - d. Main body housing shall have integral side wall deflectors to direct solids into cutters.
  - e. Inspection port covers shall be on both inlet and outlet sides of main body housing.
  - f. End housings shall have integral bushing deflectors to guide solids away from seal cartridges.



- g. Housings shall not contain grit or debris traps requiring periodic cleaning.
- 6. Transfer Gears
  - a. Transfer gears shall be of involute profile and fabricated from heat treated alloy steel.
  - b. Transfer gear tooth design, thickness and hardness shall be suitable to transfer torque between shafts up to the rated breakdown torque of the motor.
  - c. The interface between transfer gears shall be factory lubricated with grease to minimize wear.
  - d. The transfer gear ratio shall be such that the ratio of cutter tip speed of the low speed shaft to cutter tip speed of the high speed shaft shall be greater than 0.90 and less than 1.00 to promote tearing of material as it passes through the cutter stack and at the same time facilitate cleanout of material from between the cutters.
- 7. Low Speed Coupling
  - a. Low speed coupling shall be a 3-jaw type.
  - b. The 3-jaw halves shall be of hardened 4140 alloy steel.
  - c. Each low speed coupling half shall be encapsulated on its mating shaft to facilitate proper engagement of coupling lobes (1/16" - 1/8").
  - d. The interface between low speed coupling halves shall be factory lubricated with grease to minimize wear.
- 8. Speed Reducer
  - a. Speed reducer shall be manufactured by Sumitomo Machinery Corporation of America.
  - b. Speed reducer shall be a cycloidal type.
  - c. Gear motor speed reduction ratio shall be 29:1.
  - d. Speed reducer shall be grease lubricated.
- 9. Motor
  - a. Motor shall be manufactured by Baldor Electric Company.
  - b. Shall have the characteristics as listed in Performance Requirements.
- 10. High Speed Coupling
  - a. High speed coupling shall be a 3-jaw type with elastomer spider.
  - b. The 3-jaw halves shall be of sintered iron.
  - c. The spider shall be of BUNA-N.

C. Lifting Brackets

1. Grinder shall be fitted with two (2) fabricated lifting rings.

2.03 MOTOR CONTROLLER

A. Description

1. Grinder to be controlled by the Screw Press control panel.

B. Operation

1. Grinder control shall be in accordance with the setting of the On-Off/Reset-Remote selector switch.
  - a. In the OFF/RESET position the grinder shall not run. Motor controller faults shall be cleared.
  - b. In the ON position, the grinder shall run forward.
  - c. In the REMOTE position, the grinder shall operate as controlled by a remote start/stop dry contact.
2. When an obstruction jams the grinder, the controller shall stop the grinder and reverse the rotation to clear the obstruction. If the obstruction is cleared, the controller shall return the grinder to normal operation. If three (3) reverses occur within a 30 second interval, the controller shall stop the grinder motor and activate the grinder FAIL indicator and relay.
3. When a motor overload or motor over-temperature condition occurs, the motor shall be de-energized, the MOTOR FAULT indicator lamp shall be illuminated, and the FAIL contact shall be closed.
4. When a power failure occurs while the system is operating, the system shall return to normal operation when power is restored.
5. When a power failure occurs while the grinder is in a fail condition, the system shall return to a fail state when power is restored. The fail state shall not be cleared until reset.
6. Reset of the grinder shall be accomplished from the controller only.

2.04 FINISHES

A. Paint Coatings (Ferrous Materials)

1. Ferrous metal surfaces shall be prepared to SSPC-SP6 (Commercial Blast Cleaning) and coated with minimum 6-8 mils TDFT (total dry film thickness) paint of type and color listed in Performance Requirements.

B. Paint Coatings (Previously Coated Components)

1. Previously coated components (motors, speed reducers, etc.) shall be prepared to SSPC-SP1 (Solvent Cleaning) and SSPC-SP2 (Hand Tool Cleaning) and coated with minimum 6-8 mils TDFT (total dry film thickness) paint of type and color listed in Performance Requirements.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. The Contractor shall coordinate installation of the equipment in accordance with the manufacturer's installation instructions, drawings and related specification sections, and in accordance with all OSHA, local, state, and federal codes and regulations.

#### **3.02 SYSTEM START-UP**

- A. The equipment supplier shall provide the services of a factory or manufacturer's representative for a minimum of one (1) day to inspect the equipment for proper installation, apply power for the first time and check for proper motor rotation, oversee the initial introduction of material into the system and confirm the equipment operates as intended. Representative shall also provide services as detailed in Training below.

#### **3.03 OPERATION AND MAINTENANCE**

- A. The supplier shall submit one (1) copy of a suitable operation & maintenance manual. An electronic version shall be supplied to create additional copies. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, recommended lubricants, and recommended spares.

#### **3.04 TRAINING**

- A. Field training shall be provided for operations, maintenance, and supervisory staff members. Field instruction shall cover key components of the equipment, operating and maintenance requirements and troubleshooting techniques.

**END OF SECTION**

## SECTION 11335 STATIC SCREEN

### PART 1      GENERAL

There will be furnished two (2) Model SHS 12042 Sidehill Screen, as manufactured by JWCE Canada. The sidehill screen will consist of screen housing with integral headbox, inlet, outlet and drain fittings, hinged screen panel and flow distribution baffle. The sidehill screens will be a free standing unit designed and constructed to withstand all static and hydraulic forces.

### PART 2      CONSTRUCTION AND MATERIALS

#### 2.01    Screen Housing

- A.    The screen housing will be constructed of minimum 3/16 inch type 316 stainless steel. The housing side panels will be flanged at the base, fully gusseted and pre-drilled for anchoring connectors.
- B.    The housing will have a headbox to receive influent and to distribute flow evenly across the full width of the screen deck. The crest of the headbox will be well rounded, leading to a minimum 6 inch approach spillway.
- C.    The housing will have a 10 inch diameter influent connection, a 12 inch diameter effluent (filtrates) connection and a 2 inch FNPT drain connection. The influent and effluent connections will be stub ends with stainless steel flanges, drilled to 150# ANSI standard. The influent and effluent pipes will be constructed of a minimum 11 gauge type 316 stainless steel.
- D.    The housing side panels will include mounting holes for the screen deck and flow distribution baffle.
- E.    All welding will use shielded arc, inert gas, MIG or TIG methods. Welds will be built up to provide equal or greater thickness than the connected metal plate. All welds will be continuous on both sides. Butt welds will be full penetration (bevel penetration). All weld protrusions shall be ground. After welding the frame will be cleaned to a uniform finish including removal of weld discoloration.
- F.    Screen shall be equipped with 10 gauge 316SST enclosure doors with (2) two opening assist gas struts.
- G.    Screens shall be equipped with a washer mechanism that utilizes water and compressed air to operate a 316 SST 30 nozzle oscillating spraybar. The unit shall be supplied with solenoid valves and timers to allow the wash duration and interval to be set by the plant operator.
- H.    A complete pneumatic system shall be provided and shall include an air compressor. This package shall include pump, motor, valves, air tank, all controls and piping as necessary to provide a complete and operating system. The unit shall be supplied with a weather tight fiberglass housing (Tracom 200-095 or equal), appropriate ventilation fan and 316SST fasteners, suitable for exterior mounting to the concrete. The compressor unit shall include a low-pressure switch, system pressure gauge, and pressure relief. The air compressor unit will be mounted away from the screens to eliminate

wash down spray. The installation contractor shall supply 316 SST air tubing from the air compressor unit to the screens.

## 2.02 Screen Deck

- A. The screen element will be a curved panel, positioned in the frame, to provide a decreasing deck slope in the direction of flow. The slope of the screen at the spillway is 70° and progressively decreases to 45° at the discharge.
- B. The screen deck will be provided with hinged mounting so that the deck slope can be modified to a maximum variation of 5°.
- C. The screen element will be 120 inches wide by 42 inches long and manufactured from type 316 stainless steel. The panel will be of resistance welded wedgewire design. The profile of the wedgewire will be chamfered and positioned to maximize self-cleaning capability and throughput.
- D. The deck will have an 8 inch long discharge ramp to carry captured solids away from the deck and housing. The deck will be reinforced to allow the screen to be adjusted and cleaned without sagging or bending.
- E. The deck will have a 6 inch drip lip mounted at the bottom end of the deck to control the excess water from running off the screen panel and direct free water into the drainage area.

## 2.03 Screen Distribution Baffle

- A. The sidehill will have a diverter baffle, positioned at the screen/weir interface, to even flow onto the screen surface. The baffle will be constructed of a minimum 12 gauge, type 316 stainless steel and will be mounted onto the housing using 1/2 inch type 316 stainless steel round bars with threaded ends using 5/8 inch jam nuts.

## 2.04 Surface Finish

- A. Surface Treatment of Stainless Steel Components
  - 1. Welds shall be acid passivated with pickling paste by brushing on all welds and overlapping into heat affected zones. Paste shall be left on for 1 to 2 hours before water flush and neutralization with soda ash solution.
  - 2. All surface blemishes and weld tacks shall be blended smooth and the complete surface shall be glass bead polished to a uniform finish. After polishing the surface shall be rinsed then passivated using citric acid solution. Solution shall be sprayed onto screens and left for 30 minutes before water flushing the complete surface.
  - 3. After drying, all surfaces shall be coated with a thin film for superior corrosion resistance.
- B. OEM Components

The motor, gear reducer and all unit-mounted electrical devices will have the manufacturer's standard finish.

## 2.05 Screenings Conveyor

- A. Shaftless 316 SST unit shall comply with: Shaftless Screw Conveyors Section 14555
- B. Unit shall be equipped with appropriate deflectors that direct screenings from the screen to the conveyor trough. The deflectors and attachments shall maintain a watertight seal between the screen and conveyor.
- C. Conveyor shall be controlled by operator set timer that adjust run time and interval timing.
- D. Conveyor drain shall discharge to the nearest floor drain with a 2" 316 SST pipe.
- E. Conveyor shall discharge to a 16" DR 32.5 HDPE or 11GA 316 SST chute that extends to the screening dumpster below. The chute shall be equipped with a bagger fill adaptor and holder bagger assembly (Longopac, or approved equal). Provide (3) three Longopac maxi strong bag cassettes prior to startup.

### Conveyor Performance and Design Table:

Item No.	CNV1
Conveyor Model No.	U250-SPX/SS Or equal
Conveyor Length (ft)	24.5
Inclination (degrees)	2
Connects to	Static Screens
Trough & lid Mat'l	316SS
Trough Thickness	10ga
Lid Type / Length	Bolted / 5ft max
Lid Thickness	11ga
Liner Type	Duraflo SPX
Liner Thickness	1/2 in
Inlet Qty	2
Outlet Qty	1
<b>Material</b>	
Conveyed Material	Wet Screenings
Vol. Flowrate (ft3/hr)	71
Bulk Density (lb/ft3)	62.4
Fill Factor	46
<b>Spiral</b>	
Spiral Type	AB
Spiral Material	HTMAS
Spiral Dia/Pitch (in)	222/150 mm
X-section (mm)	50x20/30x8
RPM	18
<b>Drive</b>	
Drive Type	Helical Gear
Gearset Model	FA67
Motor hp	1.5
Power Supply	460v/3/60
Transport Direction	Push

**PART 3        FACTORY ASSEMBLY, TESTING AND INSPECTION**

The unit will be factory operated and inspected prior to shipment. The Engineer and/or Owner may, at their option and own expense, witness the factory test.

**PART 4        INSTALLATION**

The equipment shall be installed per JWCE Canada's recommendation. All electrical connections shall be made as specified herein, identified on the drawing.

**PART 5        MANUALS**

Two (2) copies of the operation and maintenance manual.

**PART 6        OPTIONS**

**END OF SECTION**

**SECTION 11345**  
**ROTARY LOBE BLOWERS**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment, and incidentals required and install complete, ready for operation and field-test three (3) new rotary lobe compressors and appurtenances, as shown on the Drawings and as specified herein.
- B. The entire package and its components shall comply with all applicable safety and environmental regulations.
- C. Tag Numbers:
  - 1. Blower M-700-1
  - 2. Blower M-700-2
  - 3. Blower M-700-3

**1.02 RELATED WORK**

- A. Valves, except as otherwise specified herein, are included in Section 15100 - Valves and Appurtenances.
- B. Instrumentation work, except as otherwise specified herein, is included in Division 16.
- C. Electrical work, except as otherwise specified herein, is included in Division 16.

**1.03 SUBMITTALS**

- A. Submit in accordance with Section 01300, copies of all materials required to establish compliance with this Section. Submittals shall include at least the following information:
  - 1. Certified general arrangement drawings showing materials, details of construction, dimensions and connections.
  - 2. Complete Performance Data at the Design Point and all specified operating points including:
    - a. Actual Operating Speed (RPM) and % of maximum rated speed
    - b. Capacity – scfm and icfm
    - c. Design inlet conditions, pressure, temperature, and relative humidity (%)
    - d. Discharge pressure
    - e. dB(A) noise pressure level
    - f. Blower Shaft HP, Motor HP and Package HP
  - 3. List of recommended spare parts broken down into on hand parts and long term for 2 years operation and 3 to 5 years operation.



4. Descriptive Brochures
  5. Motor Data
  6. Instrumentation and Wiring Diagram
  7. ISO-1217 Factory Performance Test Results. Slip test results shall not be unacceptable as an alternate. Manufacturer shall provide documented results for the purchased machines. Typical or average data shall not be acceptable.
  8. ISO-8573-1 Class Zero Oil Free Certificate
  9. Declaration of Conformity, per Machinery Directive 2006/42/EC, Annex II, No.1 A.
- B. Complete blower package operating and maintenance instructions professionally published, hard copy and electronic copy, shall be furnished for all equipment included under these specifications in accordance with Section 01730.

#### 1.04 QUALITY ASSURANCE

##### A. Qualifications

1. Package shall be Aerzen Delta Hybrid Model D 76 S. Regardless of manufacturer, the package shall be produced by the manufacturer of the blower stage, to ensure single source responsibility for blower performance and compatibility of associated accessories. Packagers shall not be permitted to bid.
2. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings.
3. The rotary lobe compressors shall be covered by a warranty for 24 months from date of commissioning, or 30 months from date of shipment, whichever occurs first.

#### 1.05 BLOWER PERFORMANCE CRITERIA

1. Quantity of Machines	3
2. Design Inlet Temperature	100 °F
3. Site elevation	0 ft
4. Design Inlet Pressure	14.69 psia
5. Design Relative Humidity (%)	80 %
6. Design Flow	2100/2330 scfm/icfm per machine
7. Minimum Turndown	866/961 scfm/icfm per machine
8. Design Discharge Pressure	10.0 psig
9. Maximum Blower Speed	5250 RPM
10. Brake Horsepower (Max)	104 bHp
11. Motor Size (Max)	125 Hp

## ROTARY LOBE BLOWERS

12. Free Field Noise Guarantee 73 dB(A) at 1 meter (at design point)

(1) Package BHP to include pressure loss through a clean inlet filter / silencer, pressure loss of the exhaust silencer and check valve.

(2) Package Performance shall be guaranteed to ISO 1217 with a tolerance is +/- 5% on volume flow and +/- 5% on package horsepower. Manufacturer of blower shall provide data for purchased machine.

(3) Sound data shall be from an ISO 2151 method of measurement, in an ISO 3745 qualified test facility. Sound data shall be compliant with a Declaration of Conformity assessment standard.

### 1.06 DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be completely factory assembled, skid mounted, crated, and delivered to protect against damage during shipment.
- B. All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture or debris. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- C. All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

### 1.07 MAINTENANCE

- A. Spare Parts
  - 1. Furnish the following spare parts for each blower package specified:
    - a. Complete set of matched V-belts
    - b. One inlet air filter element
    - c. One oil filter element
    - d. One volume of oil for first service interval
  - 2. Spare parts shall be properly bound and labeled for easy identification without opening the packaging.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. Rotary Lobe Compressor Packages shall be designed to minimize the life-cycle costs and maximize plant reliability. The design and the selection of the components shall be based on a minimum useful life of 20 years and a Mean Time Between Overhauls of 5 years of continuous operation. Bearing life shall be submitted by manufacturer of the blower stage, based on specified conditions.
- B. No special foundations shall be required. The packages will be installed directly on a concrete slab without grouting the base frame. There shall only be 4 easily accessible anchor points.
- C. Manufacturer shall guarantee that the rotary lobe compressor shall provide oil-free operation and be certified to ISO 8573-1 Class Zero.

### D. Blower Casing:

1. The casing shall be of one-piece construction, with separate sideplates that are bolted and pinned to the housing.
2. Casing materials shall be close-grained cast iron ASTM A48 suitably ribbed to prevent distortion under the specified operating conditions.
3. Inlet and outlet shall be flanged connections, not threaded.
4. Airflow shall be vertical top to bottom with inlet and outlet connections offset so that the flow travel horizontally across the blower stage. Casings that do not utilize a horizontal internal flow shall not be allowed.
5. The vibration level as measured at the casing, in the X/Y planes of the bearings, shall not exceed 0.3 "/ sec RMS when operating at the specified operating pressure and speed. The vibration level shall be checked at start-up and documented in the field start up report.

### E. Factory Testing:

1. Each rotary lobe compressor stage shall be factory performance tested in accordance with ISO 1217 standards to verify flow and brake horsepower. A slip test shall not be acceptable, nor is average data for the manufactured size.
2. The acceptance criteria are +5% tolerance on power and -5% tolerance on flow regardless of the size of the machine.
3. The manufacturer shall submit free field noise data for the complete blower package. The results have been obtained using an ISO 2151 method of measurement, in an ISO 3745 qualified test facility. The performance data shall include a Declaration of Conformity, per Machinery Directive 2006/42/EC, Annex II, No.1 A.

### F. Rotors:

1. Each rotor (male and female) shall be of the "stiff" design with first lateral critical speed at least 120% of the maximum allowable operating speed.
2. The rotors shall operate without rubbing nor shall they require lubrication.
3. Rotors shall be drop forged in one single piece of AISI 1043 or equivalent, machined to final tolerance. Minimum material tensile strength shall be 620Mpa. Lesser precision cast iron rotors with surface coatings shall NOT be accepted.
4. Open rotors shall not be acceptable.
5. For maximum strength and reliability, the female rotor shall be driven by the drive motor and the male rotor shall be driven by the timing gear set. Stages that utilize a male driven rotor shall not be accepted.
6. A male and female rotor configuration with internal compression ratio and axial flow entry must be used to increase the adiabatic efficiency of the blower stage. Twisted rotor profiles applied for pulsation cancelation only shall not be allowed. Radial flow entry type rotors shall not be allowed
7. Only precision-machined rotors with sealing strips to optimize clearance and performance shall be accepted. Manufacturers using coated rotors are required to

## ROTARY LOBE BLOWERS

include the following additional services in their proposal, with a broken-out adder to their proposed cost:

- a. For the first 5 years of service, the manufacturer (not the packager) will visit the site. Each machine will be shut down and visually inspected for evidence of degradation. Inspection will include clearance measurement with feeler gauges. An annual report will be submitted, including photographs, for each machine.
  - b. An annual performance test will be performed on site, including flow and power measurement, for each machine. The results will be compared to the original ISO-1217 test results for each machine, and a report submitted to the owner and the engineer.
  - c. Any sign of performance loss or coating degradation will be monitored. If the engineer or owner determine that the results pose a threat to the reliability of the aeration system over the first five years, the manufacturer will, at their own expense (including parts and labor) replace the designated compressor stage, or overhaul and recoat the existing stage, depending on the number of units affected by the degradation.
8. Rotors shall be statically and dynamically balanced per ISO1940/ANSI S2.19 G2.5.

### G. Bearings:

1. Each rotor/shaft shall be supported by anti-friction bearings and fixed to control the axial location of the rotor/shaft in the unit.
2. Regardless of theoretical bearing life calculations, the bearings shall be sized for a minimum expected life of 5 years between overhauls.
3. The applied design conditions shall yield a bearing load and minimal L-10 bearing life calculation of 100,000 hrs. Calculated bearing life shall be submitted, based on specified operating conditions.

### H. Timing Gears:

1. The rotors shall be timed by a pair of single helical gears with quality equivalent to AGMA 12. Spur cut gears shall not be acceptable.
2. Gears shall have hardened and ground teeth and a minimum AGMA service factor of 1.70.
3. Gears shall be mounted via hydraulic expansion onto the shafts with a tapered interference fit and secured by a locknut. Pinned gears shall not be acceptable.

### I. Seals:

1. Seals shall be designed to prevent lubricant from leaking into the air stream as well as to prevent oil from leaking out of the machine.
2. The seal shall be a cartridge type consist of two rotary slip rings mounted in a retainer on the air end, an atmospheric air gap in the center with top and bottom ventilation and a noncontact labyrinth seal with no wearing parts on the oil end. Internal lip seals shall not be permitted.
3. The rotor input shaft shall have a noncontact labyrinth seal with no wearing parts.

J. Lubrication:

1. The timing gears and the bearings shall be oil lubricated. Grease lubrication shall be not acceptable.

K. Oil Sight Glass:

1. An oil sight glass shall be provided on the exterior of the noise enclosure so the operator can easily view the oil level.
2. Sight glasses inside the enclosure or that cannot be easily viewed by the operator shall not be acceptable.

L. Painting:

1. Painting shall meet the following criteria:
  - a. Except for machined sealing and machined mounting surfaces, the package shall be painted dark blue.
  - b. Aluminum, stainless steel, and brass shall not be painted.
  - c. The supplied motor shall not be over sprayed and will be supplied with the motor manufacturer's standard protection and paint color.
  - d. Painted Cast Iron and Carbon Steel shall be Alkyd Resin Primer and Final coat with a total dry film thickness of 70µm. Surface preparation SSPC10 or better.
  - e. Sound enclosure shall be powder-coated polyester base total dry film thickness 80µm.
  - f. Galvanized components shall only be painted with appropriate surface preparation.
  - g. Anti-corrosive C5-grade paint scheme shall be applied according to ISO 12944 for the external sound enclosure, internal blower package components and motor.

## 2.02 BLOWER ACCESSORIES

A. Inlet Filter / Silencer:

1. Each package shall be supplied with one combination inlet filter and silencer.
2. The inlet filter silencer shall be mounted directly to the inlet flange of the blower.
3. The filter media efficiency shall meet the requirements of ASHRAE 52.2 MERV7 50-70% @3-10 microns corresponding to EN779 G4.
4. The silencer portion shall be located upstream of the inlet filter.
5. The filter element shall be designed to trap dirt on the inside so that upon changing, dirt does not fall into the machinery. Filters where dirt accumulates on the external surface of the filter shall not be permitted.
6. Filter and silencer performance losses (clean element) shall be included in the entire package performance calculation.

B. Base Frame / Discharge Silencer:

## ROTARY LOBE BLOWERS

1. Each package shall be supplied with one combination base frame / discharge silencer.
  2. The silencer shall be a chamber type design for maximum sound attenuation and shall not use internally any absorption materials of any kind (fibrous or otherwise). Internal absorption material has been shown to degrade, reduce the attenuation quality of the silencer, and internally foul diffusers. Silencers that utilize internal absorption material shall not be permitted.
  3. The silencer shall be fabricated of a single shell of pressure vessel quality steel with continuous welds.
  4. The silencer must be subject to a pressure test for tightness and strength at a minimum of 1.65 times the maximum design pressure.
  5. The silencer shall have a machined flanged inlet connection and bolt directly to the discharge flange of the rotary lobe compressor, with no intermediary or interconnecting pieces. Threaded connection between the compressor stage and the discharge silencer is subject to leakage and misalignment and shall not be permitted.
  6. Discharge silencer performance losses shall be included in the entire package pressure calculation. Blower accessories shall be supplied by the manufacturer of the blower stage.
  7. The base frame shall be constructed from welded carbon steel that shall be designed to maintain alignment of the blower internal components and the drive during operation.
  8. The base frame shall be designed to resist distortion while being installed on vibration isolating mounts.
  9. The manufacturer shall supply a stainless-steel grounding lug fully welded to the base.
- C. Flexible Connectors:
1. Each package shall be provided with a flexible ANSI style discharge connector.
  2. Flexible connectors shall prevent the transmission of noise and vibrations from the blower package into the piping.
  3. Flexible discharge connectors shall be Proco Style 240, Type EE, EPDM, with a standard ANSI flange discharge connection, rated for 300 °F at 20 psig. Soft face range with galvanized split ring reinforcement.
- D. Electric Motor:
1. Each package shall be supplied with a WEG manufactured TEFC NEMA Premium Efficiency motor that shall operate on 460 Volts, 3 Phase, 60 Hertz current, 3600 RPM. Operation of motors above 60 Hertz shall not be allowed under any circumstance.
  2. Motors shall be horizontal, foot mounted, rigid base, Torque NEMA B, Temperature rise Class B, TEFC IP55, watertight and dust tight enclosure.
  3. Class F, inverter rated insulation, Class H applied varnish, 3:1 constant torque VFD-duty.

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4. Regreasable bearings, positive pressure lubrication system with automatic drain plugs – pressure compensated (frame sizes 254T and larger).
5. All frame sizes shall be domestic NEMA standard frame sizes, suitable for overhung belt drive and with the conduit box on top of the motor. IEC frame motors shall not be allowed.
6. The motor will be mounted on a pivoting base to provide automatic tensioning of the belts. The motor nominal rating after any corrections for ambient conditions shall be 10% above the maximum operating horsepower.
7. The motor shall have a 1.25 service factor for sizes up to 100 HP and a 1.15 service factor for sizes above 100 HP.
8. Motor windings shall be supplied with a normally closed thermostat, one per phase, wired in series to form a fail-safe motor protection circuit for the external fault circuit of the motor controller on all frame sizes at or above 324T. Thermostat shall be a Klaxon Precision Thermostat by Sensata Technologies.
9. If the motor is VFD driven, the motors shall be equipped with an Aegis ring to mitigate the effects of stray motor currents. If the motor is 100 HP or greater than an insulated NDE bearing shall also be provided.
10. Blower manufacturer shall be responsible for coordinating the starting torque requirement of the blower and the motor.
11. The use of the TEFC motor to cool the blower system or circulate the enclosure air shall not be allowed.
12. Regardless of VFD supply, the manufacturer shall publish the VFD program settings in the submittal documentation to verify operation is within the intended RPM range of the motor.
13. Under no circumstances shall operation above 60Hz be permitted to achieve the required flow rate. Motor operation shall be limited to a maximum of 60Hz by the motor controller.

### E. V-Belt Drive:

1. Each package shall be supplied with a V-belt drive that shall be of the high-capacity type, oil, and heat resistant.
2. Drive shall be designed for a minimum service factor of 1.4 times operating power (bHp), or 1.1 times the motor nameplate Hp, whichever is larger to allow a minimum of 1.4-service factor based on the maximum blower bHp.
3. Belt tensioning shall be automatic without the use of any spring devices or interaction on the part of the operator. Slide rails or spring tensioners shall not be used as a tensioning device.
4. Sheaves shall be dynamically balanced regardless of the operating speed and hydraulically mounted on the compressor drive shaft.
5. The automatic tensioning system shall yield a v-belt life of 16,000 hrs of operation.

### F. Belt Guard:

1. The belt drive shall be guarded in compliance with OSHA regulations.

## ROTARY LOBE BLOWERS

2. Portions of the guard shall be easily removable allowing for belt inspection and replacement.
3. Guard material shall be perforated galvanized carbon steel.

### G. Vibration Isolators:

1. Each package shall be supplied with vibration isolating feet with a minimum efficiency of 80%.
2. The manufacturer shall be responsible for attenuating noise and vibration in the package such that no special installation base shall be required, nor shall any additional measures be required to reduce vibrations from the package being transmitted to the base or the piping.

### H. Pressure Safety Valve:

1. Each package shall be supplied with a single pressure safety valve on the discharge side of the blower mounted downstream of the discharge silencer and upstream of the check valve.
2. The safety valve shall be set to protect the machine from exceeding its maximum pressure rating and shall be sized to pass 100% of the design flow.
3. The valve shall be field adjustable, spring loaded, and have a certificate of conformity to PED if operating above 15 psig.
4. If the package is supplied with a sound enclosure. The pressure safety valve shall be housed inside and attenuated by the sound enclosure. The safety valve shall relieve hot air into a segmented and sealed section of the sound enclosure so that the hot air cannot reenter the inlet of the machine. Weighted relief valves inside the enclosure shall not be permitted. Diaphragm electronically actuated relief valves shall not be permitted.
5. The valve shall be manufactured by Aerzen.

### I. Check Valve & Butterfly Valve:

1. Each package shall be supplied with one check valve that shall be installed on the discharge line.
2. The check valve shall be of the full-bore low pressure-drop, flapper type design with a steel body, and steel flap embedded in EPDM with full-contact seal.
3. The valve shall be easily removable without disturbing the piping. Check valves requiring installation in the discharge piping shall not be considered unless installation cost of the external valve is included in supplier's proposal.
4. Pressure losses produced by the check valve shall be included in the entire package performance calculation. The check valve shall be manufactured by Aerzen.
5. Provide each blower with a wafer-type stainless steel discharge isolation valve.

### J. Local Control Panel:

1. Each package shall be supplied with the following control functions and features:



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- i. Intuitive TFT color touch screen display with NEMA 4X protective cover suitable for outdoor installation, HMI including sun cover.
- ii. Display, monitoring, alarm, and shutdown of inlet pressure, discharge pressure, discharge temperature, enclosure cooling fan thermal overload, main drive motor thermal overload, oil temperature and oil pressure.
- iii. Display run hours
- iv. Log errors and first out indication
- v. Track and log maintenance
- vi. E-Stop button mounted on front of blower enclosure
- vii. Operation of enclosure cooling fan motor starter and oil demister
- viii. Ability to transfer measured values, fault and status messages, as well as remaining times of the service intervals to the customer control system via Modbus RTU. Controllers that use a non-industrial protocols such as CAN shall not be allowed.
- ix. Permissive control function of customer start and stop signals to a motor controller
- x. Digital potentiometer
  - i. LOCAL Operation: speed control of the VFD via the HMI screen.
  - ii. REMOTE Operation: transfer of VFD speed command from external controller to the VFD
  - iii. These signals can be communicated using either hard wire connection or the communication protocol
- xi. The local control panel shall be provided with the following digital outputs:
  - i. Common alarm
  - ii. Common fault
  - iii. Ready to run
  - iv. Transfer of external start/stop command
  - v. Status remote
  - vi. Alternatively, these outputs can be obtained using the communication protocol
- xii. The local control panel shall be provided with the following digital inputs:
  - i. Remote start/stop
  - ii. Motor controller fault
  - iii. Customer E-stop
  - iv. Alternatively, these inputs can be supplied using the communication protocol

2. Control Enclosure
  - a. NEMA 4X
  - b. Factory installed, integral to sound enclosure
  - c. Wiring done in accordance with UL508A standards
3. Control Supply Power
  - a. 460 VAC, 10 Amp feed with 24 VDC transformer
4. Monitoring Sensors
  - a. Inlet Pressure Transducer
  - b. Discharge Pressure Transducer
  - c. PT 1,000 Discharge Temperature RTD
  - d. PT 1,000 Oil Temperature RTD
  - a. Oil Pressure Transducer
5. Local control panel shall be the Aerzen AERtronic Digital Controller
- K. Each blower shall receive its initial oil filling at the factory. Oil to be fully synthetic and rated for 16,000 hours of operation between change intervals.
- L. Acoustical Sound Enclosure:
  1. Each package shall be supplied with a sound enclosure covering the entire blower package.
  2. The enclosure shall provide suitable protection for outdoor installation under wind loads of 150 mph and snow loads of 25lbs/ft<sup>2</sup>.
  3. Enclosure shall be designed for a nominal design wind speed ( $V_{asd}$ ) of 150 mph as shown in contract documents.
  4. The enclosure shall be designed so as to be able to install them side-by-side with all maintenance done from the front or back of the package.
  5. Details shall be as follows:
    - a. Enclosure Panels shall be made of galvanized steel sheet, powder coated in a light reflecting, blue color per RAL 5001. The skid shall be of the same color.
    - b. The enclosure and the blower package shall both be mounted on a skid / oil-drip pan designed for meeting environment protection standards and for easy transportation and installation.
    - c. A grounding strap shall be installed between the blower base and the package skid to bypass any vibration isolating mounts for grounding continuity.
    - d. Quick release panels, each less than 50 lb (as mandated by MSHA) must provide easy and quick access for routine maintenance of the blower and the package components.
    - e. Enclosure Cooling / Ventilation Fan:
      - i. Ventilation fan shall be provided for cooling the sound enclosure.

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- ii. The fan shall be sized for sufficient heat removal from the sound enclosure, even when the blower is operated with a VFD.
- iii. The cooling fan shall be driven separately by a 460V, 3Ph, 60Hz electric motor powered by the same 460 VAC electric feed as the local control panel. A 120V single phase motor for this application will not be acceptable as the current draw and motor operating temperature are too high.
- iv. The enclosure cooling fan shall be a dedicated device. The use of the TEFC drive motor to cool the blower or circulate the sound enclosure shall not be allowed.
- f. To prevent possible operator damage, electrical components, instrumentation, and instrument connections shall not be mounted or interface with moving panels of the sound enclosure.
- g. Both blower oil sumps shall be piped to a common fill and drain, located at the front of the package for easy maintenance. An oil level indicator shall be mounted on the outside of the enclosure, which gives an accurate oil level indication while the blower is in operation. All oil lines shall be industrial-quality hydraulic hose and fittings.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. The Contractor shall install the rotary lobe compressors in accordance with the manufacturer's written instructions.
- B. The Contractor shall make all electrical and process connections to the blower package prior to the arrival of the manufacturer's representative.
- C. Manufacturer's authorized service technician shall verify proper installation, electrical connections and equipment alignment prior to start up.

### 3.02 FIELD SERVICE & TESTING

- A. After installation of all equipment has been completed and as soon as conditions permit, the manufacturer shall provide One (1) trip for a total of Two - (2) 8-hour days to verify the installation of blowers and conduct an acceptance test under actual operating conditions.
  - 1. The Manufacturer shall perform a physical check of the blower installation, perform safety checks, power up the equipment and perform functional testing.
  - 2. The functional test shall consist of 4 hours of operation of each blower with vibration, temperature, and pressure readings as well as motor amp readings taken and recorded at 60-minute intervals.
  - 3. The Manufacturer shall provide operations and maintenance training to the plant personnel. The training shall consist of 1 hour of classroom training using the Operation and Maintenance Manual for reference and 2 hours of hands-on training at the blower package.

## **ROTARY LOBE BLOWERS**

- B. If required, Contractor shall make any changes, at his own expense, to the installation that may be necessary to assure satisfactory operation. Contractor shall be held liable for changes needed in the installation.
- C. Manufacturer shall provide a written field test / start up report after completion of testing.
- D. The blower manufacturer shall have rental blower packages available that can be onsite within 24 hours.

END OF SECTION

**SECTION 11356**  
**FIBERGLASS BAFFLE WALLS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals required and install, complete and ready for operation, and field test, all baffles, supports and butt plates of the sizes, shapes and the quantities as shown on the Drawings and as specified herein.

**1.2 SUBMITTALS**

- A. Submit copies of all materials required to establish compliance with this Section. Submittals shall include the following:
  - 1. Dimensions of all components.
  - 2. Complete installation instructions.
  - 3. Complete description of materials and resins used, including physical properties and methods of manufacture for the fiberglass walls.
  - 4. Certification that materials of fiberglass reinforced polyester is resistant to chemical attack from sewage and chemicals.
  - 5. Statement that fabrication is in accordance with this Section.
  - 6. Complete bill of materials.
  - 7. Complete assembly drawings.
  - 8. Submit certified test reports of manufactured laminates, as specified herein. Submit one 6-in by 6-in by 114-in sample of polyester laminate to be used in the baffles.
- B. Operating and Maintenance Data
  - 1. Operating and maintenance instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, descriptions that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data and full preventive maintenance schedules.

**1.3 QUALITY ASSURANCE**

- A. All fiberglass weirs, baffles and supports shall be furnished by the Contractor from a single manufacturer who is fully experienced, reputable and qualified in the fabrication of such equipment.
- B. Fiberglass weirs, baffles and supports shall be by Strongwell, Inc. or equal.

**1.4 WARRANTY**

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.

**1.5 SYSTEM DESCRIPTION**

- A. Baffles and support brackets for the tanks shall be of fiberglass reinforced polyester resin with 316 stainless steel hardware, constructed to the dimensions shown on the Drawings.

**PART 2 - PRODUCTS**

**2.1 FIBERGLASS BAFFLE WALLS**

- A. Baffle Wall Panels for the aeration basin shall meet the minimum following design criteria:
  - 1. Wall Quantity - 12 walls, 16'-7" wide and 20-6" tall
  - 2. Material - FRP
  - 3. Resin - Polyester
  - 4. Color - Gray
  - 5. Glass Fiber Reinforcing Content - 40% minimum
  - 6. U.L. Certified to ANSI NSF Standard 61
  - 7. Depth - 4"
  - 8. Cover Width - 24"
  - 9. Thickness - 1/8"
  - 10. Water Differential Across Baffle - 2"

## FIBERGLASS BAFFLE WALLS

11. Wind Load – 10 PSF
  12. Minimum L/D – 90
  13. Minimum Safety Factor – 2.0
  14. There shall be cut-outs as shown on the drawings. Depth of cut-out as indicated on the drawings. Provide stiffeners between wall and baffle at open end of wall.
- B. FRP Angles shall be fabricated as follows:
1. Resin – Polyester
  2. Color – Gray
  3. UL Certified ANSI/NSF 61
  4. Thickness – 3/8" and 90 degrees
- C. Except for bolts and hardware specified herein, the baffles and supports shall be polyester plastic resin, reinforced with fiberglass.
- D. FRP baffle panels and associated components shall be ANSI/NSF Standard Certified for wastewater application.
- E. FRP Materials shall include UV stabilized polyester resin; surfacing veil at top and bottom sides; gray color.
- F. Factory cut edges and drilled holes shall be sealed with ANSI/NSF approved material.
- G. FRP Angles shall be 3/4" thick and 90 degrees.
- H. Manufacturer shall maintain a continuous quality control program and shall furnish the Engineer with certified test reports consisting of physical tests of samples as listed below and otherwise as required to show quality of plastic being furnished.
- I. Hardness test shall be made with the resin-rich surface of the product. Flexural tests shall be made with the resin rich surface in compression. Test samples shall be full thickness of the item produced and shall not be machined on the surface.
- J. Procedure to be used in determining the properties listed in the following tables shall be in accordance with the following ASTM Standards: ASTM D638, ASTM D790, ASTM D256 and ASTM D570.

## FIBERGLASS BAFFLE WALLS

- K. Minimum physical properties at a temperature of 70 degrees F for the plastic shall be as follows:
- |    |   |                    |
|----|---|--------------------|
| 1. | FRP Baffle Panels                         |                    |
| a. | Stiffness (EI)                            | 5,591,000 lb-in/ft |
| b. | Moment Capacity                           | 19,700 lb-in/ft    |
| 2. | FRP Structural Materials                  |                    |
| a. | Tensile Strength                          | 40,000 psi         |
| b. | Flexural Strength                         | 45,000 psi         |
| c. | Flexural Modulus                          | 1,690,000 psi      |
| d. | Impact, Notches, Izod foot pound per inch | 25                 |
| e. | Water absorption, percent 24 hours        | 0.25               |
- L. All hardware shall be 316 SS and all fasteners shall be adhesive type and spaced on 18" centers.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations, by mechanics skilled in the installation of this type of work, in the locations shown on the Drawings. Anchor bolts shall be furnished by the manufacturer and set in accordance with the manufacturer's recommendations.
- B. Contractor shall provide smooth, level, and straight concrete walls and floors and shall be 4000 psi minimum strength.
- C. Contractor shall be responsible for all mounting of columns to floors and walls, and all walls to columns using the supplied angles and fasteners. All field installation of the supplied items is the contractor's responsibility. Coordination of thickened wall and floor bosses shall be coordinated with the tank supplier and FRP baffle suppliers requirements.
- D. Any field penetrations of field bevel cuts shall be the contractor's responsibility. If sloped floors are in the tanks, the contractor is responsible for supplying all leveling solutions for columns and panels. No gaps shall be present between the floor and FRP baffle wall.
- E. Any sealants, grouts or gaskets required to fill gaps between any supplied items and the concrete wall or floor is to be supplied by contractor.

#### 3.2 FIELD INSPECTION AND TESTING



## **FIBERGLASS BAFFLE WALLS**

- A. Upon completion of installation, fill each basin with water to observe the proper installation of the baffles. Furnish all labor and materials for such tests and correct defects in the fabrication and installation. Baffles exhibiting excessive deflection, as determined by the Engineer, shall be removed and replaced at no additional cost to the Owner.

**END OF SECTION**

**SECTION 11370**  
**FINE BUBBLE AERATION SYSTEM**

**PART 1      GENERAL**

1.01    SCOPE OF WORK

- A.    Furnish and deliver all materials and equipment for the fine bubble aeration system in the tanks
- B.    Furnish all equipment as shown on the drawings and as specified herein.
- C.    Provide services and testing associated with the equipment.
- D.    All items furnished by the equipment supplier under this section are for installation by the Contractor.

1.02    EQUIPMENT COMPONENTS INCLUDED

- A.    304LStainless steel drop leg
- B.    PVC manifolds and air distributors
- C.    PVC diffuser holders, subplates and retainer rings
- D.    304 Stainless steel supports and anchors
- E.    Bolts, nuts and gaskets for aeration system flange connections
- F.    Liquid purge systems
- G.    Membrane disc diffusers with integral O-ring gaskets

1.03    RELATED WORK AND COMPONENTS NOT INCLUDED

- A.    Section 15110\_Piping and Accessories
- B.    Section 15100 Valves and Appurtenances

1.04    SUBMITTALS

Submit information to establish compliance with the specifications in accordance with the provisions of Section 01300 Submittals.

- A.    Submittal drawings showing plan, elevation and cross sections of the equipment.

## FINE BUBBLE AERATION SYSTEM

- B. Component details of the aeration equipment showing diffusers, diffuser holders, gaskets, retainer rings, supports, threaded union and/or flanged joints and a purge system.
- C. Materials and Manufacturing specifications.
- D. Equipment booklet including:
  - 1. Equipment data sheets.
  - 2. Performance data including oxygen transfer calculations.
  - 3. Headloss calculations and pressure requirements.
  - 4. Descriptive literature and bulletins.
  - 5. Customer contact list with telephone numbers (minimum of 10 contacts from similar size facilities).
- E. Operation and maintenance manual with installation instructions. Submit after approval of equipment and prior to shipment.
- F. Detailed list of any exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.
- G. Membrane longevity tests reports in accordance with Section 2.02.A.4.h.
- H. Heat transfer calculations in accordance with Section 2.

### 1.05 PREQUALIFICATION REQUIREMENTS

- A. The following manufacturer(s) are pre-qualified:
  - 1. Xylem Sanitaire Products
  - 2. SSI Aeration Inc.
- B. Other manufacturers shall pre-qualify prior to bidding, as specified below.
  - 1. Provide equipment furnished by a single manufacturer qualified and experienced in the production of similar equipment.
  - 2. Complete set of drawings, specifications, catalogue cut sheets, and detailed descriptive material of proposed major equipment items. This information shall identify all technical and performance requirements stipulated on each drawing and in each specification section.
  - 3. The detailed drawings and equipment list must be signed and sealed by a professional engineer .

## FINE BUBBLE AERATION SYSTEM

4. Any proposed changes to the equipment detailed on the contract documents, if approved, shall be accomplished at no additional cost to the OWNER. The CONTRACTOR shall assume the cost of, and responsibility for, satisfactorily accomplishing the necessary structural, mechanical, piping, and electrical changes required by the proposed system as approved by the ENGINEER.
5. Manufacturer shall furnish the ENGINEER the following information 15 days prior to opening of bids:
  - a. List of at least twenty (20) U.S. installations of the proposed type of fine bubble aeration equipment, all of which must have been in successful operation for a minimum of five (5) years and all of which shall have been designed for with an equal or greater no. of fine bubble diffusers than the specified equipment under this specification. In lieu of this experience requirement the aeration system supplier shall furnish a bond, in the amount of two times the value of the purchase order for the system equipment, guaranteeing the replacement cost of the system should it fail to perform as specified. This bond shall remain in force for three (3) years after startup of the aeration system.
  - b. Three (3) of the existing installations listed above shall be submitted with:
    - (1) Satisfactory operational data
    - (2) Photographs of overall view of the installed system
    - (3) Details of the diffuser element, diffuser element holder, retainer, gasket and orifice.
    - (4) Details showing how the diffuser element holder is attached to the distribution header.
    - (5) Details of the stainless steel manifold supports and the stainless steel distribution supports (guide and fixing).
    - (6) Details of the distribution header joints.
    - (7) Engineering reports stating clear water oxygen transfer efficiency, including description of test facility, methods of sampling, and calculations and certified oxygen transfer curves.
    - (8) A statement of the equipment manufacturer listing any deviations or exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.
    - (9) Testimonials from the end users.
  - c. List of at least twenty (20) U.S. installations where the aeration manufacturer or manufacturer's representative has completed a cleaning service for the fine bubble diffused aeration system, with at least five (5) of the services being provided over ten (10) years ago. In lieu of this experience requirement the aeration system supplier shall

## FINE BUBBLE AERATION SYSTEM

furnish a bond, in the amount of two times the value of the purchase order for the system equipment, guaranteeing the replacement cost of the system should it fail to perform as specified. This bond shall remain in force for three (3) years after startup of the aeration system.

- d. Three (3) of the existing installations listed above shall be submitted with:
  - (1) Satisfactory operational data showing reduction in dynamic wet pressure (DWP) after cleaning
  - (2) Photographs of overall view of the cleaning system
  - (3) A statement of the equipment manufacturer listing any deviations or exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.
  - (4) Testimonials from the end users.
- C. Within five (5) days prior to the opening of bids, the ENGINEER shall issue an addendum listing manufacturers who have pre-qualified. CONTRACTORS listing equipment manufacturers who have not pre-qualified shall be considered non-responsive and shall subject their bid to automatic rejection.
- D. Incomplete pre-qualification submittals shall not be evaluated by the ENGINEER and shall automatically represent rejection of the submittal.

### 1.06 EQUIPMENT WARRANTY

- A. The requirements of the General and Supplementary Conditions and the requirements as specified hereinafter shall apply.
- B. Manufacturer shall guarantee all equipment furnished to be free from defects in materials and workmanship under normal use and service for a period of twelve (12) months after the date first placed in service, or eighteen (18) months after delivery, whichever occurs first.

## PART 2 MECHANICAL EQUIPMENT

### 2.01 FINE BUBBLE AERATION SYSTEM DESIGN AND PERFORMANCE REQUIREMENT

- A. Design Conditions
  - 1. The aeration tanks are configured as follows (dimensions in feet):

## FINE BUBBLE AERATION SYSTEM

Tank/Pass	Inner Diameter	Outer Diameter	SWD	Grids	Diffusers /Pass	Holders/Pass
Oxic Zones	90	55	19	4	800	800
		Tank Total		4	800	800
		Tank Count			2	
		Project Total		8	1600	1600

2. Design aeration system to transfer not less than the following pounds of oxygen per day in clean water at 14.7 PSI, 20C and zero dissolved oxygen at the specified submergences, air rate and pressure.

	Std. O2 Transfer Rate (SOTR)	Volumetric Air Flow	Operating Pressure At top of Drop	Diffuser Submergence	SOTE
	lb/day/tank	scfm/tank	psig	ft	
SOR	9100	1032.5	8.5	18.19	35.2
Air Flow	11109	1288	8.5	18.19	34.4

3. Design air distributors with centerline spacing not to exceed 4 feet to maximize oxygen transfer efficiency and mixing efficiency to minimize solids deposition between air distributors.

### B. Materials, Fabrication, and Finishing

#### 1. Stainless Steel – Pipe, Fittings and Supports

- a. Fabricate all welded parts and assemblies from sheets and plates of stainless steel with a 2D finish conforming to ASTM A240, 554, 774, 778.
- b. Fabricate non-welded parts and flanges from sheets, plates or bars of stainless steel conforming to ASTM A240 or ASTM A276.
- c. Welds & Welding Procedure
  - (1) Weld in the factory with ER 316L filler wire using MIG, TIG or plasma-arc inert gas welding processes. Provide a cross section equal to or greater than the parent metal.
  - (2) Provide full penetration butt welds to the interior surface with gas shielding of interior and exterior of joint.
  - (3) Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.

## FINE BUBBLE AERATION SYSTEM

- d. Corrosion Protection and Finishing: Clean all welded stainless steel surfaces and welds after fabrication by using the following procedure:
  - (1) Pre-clean all outside weld areas to remove weld splatter with stainless steel brushes and/or deburring and finish grinding wheels.
  - (2) Finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2 and Section 8.3.
  - (3) Corrosion protection techniques not utilizing full immersion methods are unacceptable and will be cause for rejection of the equipment.
2. Natural Rubber – Furnish all fixed and expansion joint O-ring gaskets of natural rubber/SBR with a Shore A durometer of  $45 \pm 5$ .
3. Polyvinyl Chloride (PVC) – Pipe and Fittings
  - a. Produce PVC pipe and fittings from PVC compound with a minimum tensile strength of 7000 psi.
  - b. Provide lower drop pipe, manifold and air distributors as follows:

<u>Diameter</u>	<u>Wall Thickness</u>	<u>ASTM</u>
4 inch	SDR 33.5	D3915, 3034,124524
6 inch & larger	Schedule 40	D1784, D1785, D2466,12454-B

- c. Design air distributors and manifolds to withstand 130° F mean wall temperature.
  - d. Add two parts by weight of titanium dioxide per 100 parts of resin to PVC compounds for manifolds, air distributors, joints and PVC diffuser assembly components to minimize ultraviolet light degradation.
  - e. Factory solvent weld all PVC joints and fittings. Field solvent welding will NOT be permitted.
4. EPDM - Membrane Diffusers and Gaskets
  - a. Manufacture circular membrane diffuser discs with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Thermoplastic materials (ie plasticized PVC or polyurethane) are not acceptable.

## FINE BUBBLE AERATION SYSTEM

- b. Add carbon black to the material for resistance to ultraviolet light.
- c. Design diffuser as one piece injection molded part with a minimum thickness of 0.080 inches for 9 inch diameter unit.
- d. Limit the maximum tensile strength of the diffuser to 10 psi when operating at 2.4 SCFM/ft<sup>2</sup> of material. Furnish proportionately thicker material for larger diameter disc diffusers to limit the maximum tensile stress and to resist stretching.
- e. Produce diffusers free of tears, voids, bubbles, creases or other structural defects.
- f. Furnish diffuser material to meet the following:

Item	Value/Units	ASTM
Base Polymer	EPDM	D573
UV Resistance	Carbon Black	
Specific Gravity	1.25 or less	
Durometer – Minimum	58% ± 5%	D2240
Modulus of Elasticity	500 psi	D412
Ozone Resistance (72 hrs: 40°C pphm)	No cracks @ 2X magnification	D1171 Test A
Tensile Strength	1200 psi	D412
Elongation - % - Retained 70 hrs @ 100°C - minimum at break	75% Max 350%	D573 D412

- g. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.
- h. Membrane Longevity
  - (1) Longevity of the proposed membrane diffusers shall have been demonstrated in at least three full-scale municipal installations operating continuously for a minimum of three years.
  - (2) Test reports, prepared by an independent testing agency, shall confirm membrane longevity through compliance with the following maximum allowed percent (+/-) change in each membrane property. Tests conducted in-house by the Supplier



## FINE BUBBLE AERATION SYSTEM

shall not be acceptable.

- (3) Data for a minimum of three diffusers from each installation shall be provided.

Property	Maximum Change
Durometer	5%
Weight	5%
Permanent Set	0.5%

- (4) Test reports shall be submitted with the Bid Proposal.

### C. System Components

1. Droplegs - Provide a 316L stainless steel dropleg from the air main connection to the dropleg connection on the manifold.
  - a. Provide a Van Stone style flange with a 150 pound bolt pattern for the top connection.
  - b. Provide a band clamp coupling with gasket for the lower dropleg to manifold connection.
  - c. Provide a sway brace type of support for droplegs greater than 20ft long.
2. Contractor shall coordinate with walkway designer for airmain supports to carry the full weight of the dropleg. Dropleg must be supported to maintain a plumb position so that lateral loads are not imposed on the air manifold. Airmain and supports to be furnished by the General Contractor.
3. Manifolds – Provide PVC manifolds for connection to the air distribution headers.
  - a. Fabricate manifolds with 4 inch diameter fixed threaded union or flanged joints for connection to the air distributors.
  - b. Design manifold, distributor connections and supports to resist thrust generated by expansion/contraction of the air distributors over a temperature range of 125° F
  - c. Support manifold with a minimum of two supports.
  - d. Connect manifolds with fixed threaded union or flanged joints to prevent rotation or blow apart.

## FINE BUBBLE AERATION SYSTEM

4. Air Distributors and Diffuser Holders - Provide 4 inch diameter PVC air distributors perpendicular to the air manifold
  - a. Fabricate distributors with single PVC diffuser holders solvent welded to the crown of the air distributor for complete air seal and strength.
  - b. Provide minimum solvent weld area of 15 square inches.
  - c. Design distributors and holders to resist a dead load of 200 lbs applied vertically to the outer edge of the diffuser holder.
  - d. Provide 4 inch diameter threaded removable end caps complete with gasket, threaded coupling and end plate for clean out at the end of each distributor.
5. Air Distributor and Manifold Connection Joints
  - a. Join air distributor sections with positive locking fixed threaded union or flange type joints for all submerged header joints to prevent blow apart and rotation.
  - b. Bell and spigot, slip on or expansion type joints are not acceptable for submerged joints.
  - c. Design threaded union joints with spigot section connected to one end of the distribution header, a threaded socket section connected to the mating distribution header, an O-ring gasket and a threaded screw on retainer ring. Solvent welding shall be done in the factory.
  - d. Fixed joints shall be designed to resist 80 ft-lb (5.5 kg-m) torque without joint movement or failure.
  - e. All fixed joints shall have interlocking splines and grooves to prevent rotation of the air distributors. All rotational forces shall be transferred through the interlocking splines. Joints that require the o-ring to transfer rotational forces between the splines are not acceptable. If positive locking fixed joints are not used, all distributor connections shall be 125 lb flanges.
  - f. Design flanged joints with a 125 lb drilling angle face ring, follower flange and stainless steel hardware.
6. Supports- Provide each section of manifold and air distributor with a minimum of two (2) supports.
  - a. Limit maximum support spacing to 8 feet.

## FINE BUBBLE AERATION SYSTEM

- b. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125° F and to minimize stress build up in the piping system.
- c. Design supports to be adjustable without removing the air distributor from the support .
- d. Design supports to allow for complete removal from the tank, less the anchor bolt, to facilitate installation of additional headers and in-tank maintenance. Support structures which consist of rods Epoxied directly into the tank floor are not acceptable.
- e. Manifold Support – 6 inch diameter and larger
  - (1) Design supports to include hold down guide straps, support structure and anchor bolts.
  - (2) Design guide straps with a 2 inch minimum width to eliminate point load on manifold and minimize binding.
  - (3) Design support for 2 inches plus or minus vertical adjustment for leveling of manifold.
  - (4) Attach supports to tank floor with two stainless steel anchor bolts.
- f. Air Distributor and Manifold Supports – 4 inch diameter.
  - (1) Design supports with hold down straps, support structure and anchor bolt.
  - (2) Design support for 1 1/2 inch (plus or minus) vertical adjustment for leveling air distributor to plus or minus 1/4 inch.
  - (3) Guide support
    - i) Guide straps to have 1 1/2 inch wide top and bottom contoured bearing surface with chamfered edges to minimize binding and resistance to movement of air distributor under full buoyant uplift load.
    - ii) Design strap with 1/8 inch clearance around distributor so strap is self-limiting and cannot be over tightened.
  - (4) Fixed supports
    - iii) Fixed straps to have 1 1/2 inch wide top and bottom contoured bearing surface with punched burrs to positively grip the air distributor when tightened.
    - iv) Design strap to be self-limiting to prevent stressing the distributor if the clamp is over tightened.
  - (5) Attach air distributor supports to tank floor with one stainless steel anchor bolt. Attach manifold supports to tank floor with

## FINE BUBBLE AERATION SYSTEM

two stainless steel anchor bolts.

7. Diffuser Assemblies - Furnish diffuser assemblies including diffuser with integral diffuser gasket, holder, retaining ring and air flow control orifice.
  - a. Membrane Diffuser
    - (1) Incorporate an integral check valve into the membrane diffuser.
    - (2) Design and test diffusers for a dynamic wet pressure (DWP) of 12 inches  $\pm$  20% water column @ 1.0 SCFM/ diffuser and 2 inches submergence.
    - (3) Visual Uniformity - Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM and 2 inches submergence. Active surface is defined as the perforated horizontal projected area of the diffuser.
    - (4) SCFM defined at 20°C, 1 atm, 36% RH
    - (5) Quality Control - Test diffuser using primary sampling criteria outlined in Military Standard 105E.
8. Anchor Bolts
  - a. Design anchor bolts for embedment in 4000 psi concrete with a pullout safety factor of 4.
  - b. Provide a mechanical stainless steel expansion type anchor bolt system.
9. Liquid Purge System - Provide a liquid purge system to drain the entire submerged aeration piping system for each aeration grid including airlift purge eductor line and manual control valve.
10. SPARE PARTS
  - Furnish 10 fine bubble diffusers
  - Furnish 2 SST repair coupling
  - One (1) Special tool set (if required)

### **PART 3 SERVICE, INSTALLATION AND PERFORMANCE**

#### **3.01 SHOP OXYGEN TRANSFER TEST**

- A. Conduct a performance test to demonstrate capability of the aeration equipment to meet the specified oxygen transfer requirements.
- B. Base all tests on the following criteria:
  1. Two design conditions that the consultant engineer selects at each diffuser density will be tested. In the case of more than three densities on a project, the Engineer will define zones to be tested after award of the project.

## FINE BUBBLE AERATION SYSTEM

2. A minimum of 3 test runs for each specified design condition to be run in complete accordance with ASCE Clean Water Test Procedure (2006 or latest edition)
  3. Conduct tests in a full scale aeration test tank (minimum of 300 sq. ft.) at the specified submergence and water depth with a diffuser density equivalent to the specified tank configuration. Diffuser density is defined as the ratio of the total tank surface area to the total active diffuser surface area.
  4. Conduct shop test with air rate and mass rate of oxygen transfer directly proportional to the ratio of the shop test tank volume and the design tank volume.
  5. Plot of standard condition pounds of oxygen transferred per day per 1000 cubic feet of tank volume versus standard condition cubic feet of air per minute per 1000 cubic feet of tank volume. (lbs-O<sub>2</sub>/day/1000 cubic feet-tank) vs. (SCFM/1000 cubic feet-tank)
    - a. Standard conditions of oxygen transfer are defined as 68° F, 1 atmosphere ambient pressure, clean water.
    - b. Standard air is defined as 68 °F, 1 atmosphere, 36% R.H., containing 23% oxygen by weight.
- C. Certify and stamp all tests by a Professional Engineer.
- D. Include all costs for testing (exclusive of witnesses' expenses) in the equipment price. All tests may be witnessed at Owner/Engineer option. Cost of travel and living expenses for Owner/Engineer to be paid by the Owner.
- E. Submit all test data from oxygen transfer tests for approval by the Engineer prior to manufacturing equipment.

### 3.02 OPERATION AND MAINTENANCE MANUAL

- A. Three (3) paper copies with an electronic copy of the Operation & Maintenance Manuals shall be furnished during start-up. These manuals shall include maintenance instructions for all equipment provided.

### 3.03 FIELD SERVICES, START-UP AND TRAINING

- A. The services of the field representative shall include minimum one (1) days, exclusive of travel time, completed in one (1) travel trips. The services provided include verification of proper equipment installation and training of the owner's personnel. The Owner shall notify the manufacturer a minimum of ten working days prior to the time that the field services are desired.

## **FINE BUBBLE AERATION SYSTEM**

- B. The Owner shall notify aeration equipment provider when the installation has been completed. A representative of the supplier shall inspect the installation. The Owner shall be advised in writing of any corrections or adjustments that are required for the equipment installation. After the installation has been completed to the supplier's satisfaction, a letter of certification that all equipment is installed in accordance with its instructions and that the equipment is ready for operation shall be furnished.
- C. The field person shall do a functional check of each item furnished and start-up of the process. During this time, the field representative will provide operation training, which shall include familiarization with the biological process controls, its requirement and review of the Operation and Maintenance Manuals.

**END OF SECTION**

**SECTION 11380**  
**FIXED HEADER AERATION SYSTEM**

**PART 1      GENERAL**

1.01    SCOPE

- A.    Furnish all materials and equipment for the fixed header aeration systems in the digester and process (post air) tanks.
- B.    Furnish all equipment as shown on the drawings and as specified herein.
- C.    Provide services and testing associated with the equipment.
- D.    All items furnished by the equipment supplier under this section are for installation by the Contractor.

1.02    EQUIPMENT COMPONENTS INCLUDED

- A.    Stainless steel dropleg, distribution header(s) and diffusers.
- B.    Stainless steel manifold and supports
- C.    Stainless steel supports and anchor bolts.
- D.    Stainless steel flanged and expansion joints.
- E.    Bolts, nuts and gaskets for aeration system flange connections.

1.03    RELATED WORK AND COMPONENTS NOT INCLUDED

- A.    Section 15110 Piping and Accessories
- B.    Section 15100 Valves and Appurtenances

1.04    SUBMITTALS

Submit information to establish compliance with the specifications in accordance with the provisions of Section 01300 Submittals.

- A.    Submittal drawings showing plan, elevation and cross sections of the equipment.
- B.    Component details of the aeration equipment showing diffusers, diffuser connectors, supports, expansion joints and flanges.
- C.    Materials and manufacturing specifications.
- D.    Equipment booklet to include:
  - 1.    Equipment data sheets

## FIXED HEADER AERATION SYSTEM

2. Performance data including oxygen transfer calculations.
  3. Head loss calculation and pressure requirements.
  4. Descriptive literature and bulletins.
  5. Customer contact list with telephone numbers (minimum of 10 contacts from similar size facilities).
- E. Operation and maintenance manual with installation instructions. Submit after approval of equipment and prior to shipment.
- F. Detailed list of any or exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.
- G. Certified Oxygen Transfer Performance Curve(s)
1. Submit certified oxygen transfer performance curves to demonstrate capability of the aeration equipment to meet the specified oxygen transfer requirements.
  2. Base oxygen transfer curves on the following criteria:
    - a. A minimum of 3 tests for each specified condition in complete accordance with ASCE Clean Water Test Procedure (1992 or latest edition)
    - b. Conduct tests by an independent aeration testing firm in a full scale aeration test tank (minimum of 200 sq. ft.) at the specified submergence and water depth with a diffuser density equivalent to the specified tank configuration. Diffuser density is defined as the ratio of the total tank surface area to the total active diffuser surface area.
    - c. Conduct shop test with air rate and mass rate of oxygen transfer directly proportional to the ratio of the shop test tank volume and the design tank volume.
    - d. Plot of pounds of oxygen per day per 1000 cubic feet of tank volume versus air per 1000 cubic feet of tank volume in tap water at 14.7 psia, 20°C and zero dissolved oxygen at the specified submergence.
  3. Certify and stamp all curves by a Professional Engineer.
  4. Submit curves for all specified conditions for approval by the Engineer prior to manufacturing aeration equipment.



## FIXED HEADER AERATION SYSTEM

### 1.05 DIGESTER SYSTEM DESIGN AND PERFORMANCE

#### A. Design Conditions

1.	Design Loading	Condition 1
a.	Standard Oxygen Demand (lb/day)	8,470
2.	Tank Design	
a.	Number of Tanks	1
b.	Number of Passes/Tank	1
c.	Dimensions/Pass	1
	Diameter, ft	70
	SWD, ft	19

\*See drawings for tank volume, dimension and compartment configurations

#### B. Design aeration system to transfer not less than the following pounds of oxygen per day in clean water at 14.7 PSI, 20°C and zero dissolved oxygen at the specified submergence, air rate and pressure.

		Condition 1
1.	Std. O <sub>2</sub> Transfer Rate (SOTR) (lb/day)	8,470
2.	Volumetric Air Rate (scfm)	2,350
3.	Oper. Press. At top of Dropleg (psi)	8.4
4.	Diffuser Submergence (ft)	18.0
5.	Diffuser Placement i.e. side roll, etc.	Midwidth

### 1.06 POST OXIC SYSTEM DESIGN AND PERFORMANCE

#### A. Design Conditions

1.	Design Loading	SOR	Airflow
a.	Standard Oxygen Demand (lb/day)		
2.	Tank Design		
a.	Number of Tanks		

b. Number of Passes/Tank

c. Dimensions/Pass

SWD, ft

19

- B. Design aeration system to transfer not less than the following pounds of oxygen per day in clean water at 14.7 PSI, 20°C and zero dissolved oxygen at the specified submergence, air rate and pressure.

		SOR	Airflow
1.	Std. O <sub>2</sub> Transfer Rate (SOTR) (lb/day)	370	583
2.	Volumetric Air Rate (scfm)	100	140
3.	Oper. Press. At top of Dropleg (psi)	7.9	8.0
4.	Diffuser Submergence (ft)	18.0	18.0
5.	Diffuser Placement i.e. side roll, etc.	Midwidth	Midwidth

## **PART 2 PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- Sanitaire Division of ITT Industries, Brown Deer, Wisconsin
- SSI Aeration Inc., Poughkeepsie, NY

### **2.02 MATERIALS, FABRICATION AND FINISHING**

#### **A. Stainless Steel**

1. Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240.
2. Fabricate non-welded parts and flanges from sheets, plates or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.
3. Provide droplegs, manifolds and headers of the diameter shown on the drawings with dimensional tolerances conforming to ASTM A554 and fabrication procedures in accordance to ASTM A774 & A778.
4. Furnish air distribution headers with the following minimum nominal wall thicknesses.
  - a. For gusset-reinforced diffuser connectors and header systems as specified in Section 2.03E.

## FIXED HEADER AERATION SYSTEM

Header Diameter	Wall Thickness
<u>(Inches)</u>	<u>(Inches)</u>

4 Thru 18	0.109
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- b. For diffuser connectors and headers that are not gusset reinforced as specified in Section 2.03E, the minimum allowable header wall thickness is 0.25 inches to minimize potential for connector failure.
- 5. Furnish diffuser connector from cast 316L Stainless Steel.
- 6. Furnish all flanges from stainless steel per paragraph 2.02 A 2.
- 7. Furnish all nuts, bolts and washers including anchor bolts in 18-8 series stainless steel.
- 8. Furnish 304L stainless steel diffusers conforming to the material as listed in paragraph 2.02 A 1,2, and 3 with a cast 304L Schedule 80 threaded inlet nozzle.
- 9. Welds & Welding Procedure
  - a. Weld in the factory with ER 316L filler wire using MIG, TIG or plasma-arc welding inert gas processes. Provide a cross section equal to or greater than the parent metal.
  - b. Provide full penetration butt welds to the interior surface with gas shielding to interior and exterior of joint.
  - c. Provide smooth, even distribution interior weld beads with an interior projection not exceeding 1/16 inch beyond the I.D. of the air header or fittings.
  - d. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.
  - e. Field welding is NOT permitted.
- 10. Corrosion Protection and Finishing

Clean all welded stainless steel surfaces and welds after fabrication by using the following procedure:

  - a. Pre-clean all outside weld areas to remove weld splatter with the use of stainless steel brushes and/or deburring and finish grinding wheels.
  - b. Finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits,

## FIXED HEADER AERATION SYSTEM

oxide film and contaminants to regenerate a uniform corrosion resistant chromium oxide film.

1. Completely immerse all stainless steel assemblies and components in an acid solution as described in Section 6.2.11 of ASTM A380-88. The acid shall be a nitric-hydrofluoric solution as defined in Table A.2.1 of Annex A2 of ASTM A380.
  2. Provide a final thorough rinse using ordinary industrial or potable water and dry in conformance per Section 8.3 of ASTM A380.
- c. Corrosion protection techniques not utilizing full immersion methods are unacceptable and will be cause for rejection of the equipment.
- d. Engineer/Owner at their option may choose to observe the equipment cleaning procedure by notifying the manufacturer of their intent to visit thirty (30) days prior to the date. Cost of the travel and expenses are by the owner.
- B. Neoprene – furnish all gaskets of fiber reinforced neoprene – 45 to 50 durometer (Shore A).

### 2.03 FIXED AERATION HEADERS, MANIFOLD AND DROPLEGS

- A. Provide a dropleg from the air main connection or air control valve to the aeration system as shown on the drawings.
1. Provide a stainless steel Van Stone style flange design with a 150 pound drill pattern flange ring for the top connection.
  2. Provide a stainless steel band clamp coupling with gasket for the lower dropleg to header connection for ease of installation and alignment.
  3. Contractor shall coordinate with walkway designer for airmain supports to carry the full weight of the dropleg. Dropleg must be supported to maintain a plumb position so that lateral loads are not imposed on the air manifold. Airmain and supports to be furnished by the General Contractor.
- B. Fabricate manifold and air distribution headers in sections up to 41 feet in length.
1. Provide eccentric reducers for changes in diameter for constant invert elevation.

## FIXED HEADER AERATION SYSTEM

2. Provide 8 inch diameter and smaller headers with removable end caps and 10 inch diameter and larger headers with welded end caps.
- C. Join sections of manifold or air distribution headers with flanged joints or expansion joints. Design individual header sections for rotation independent of adjacent sections for alignment purposes during installation.
  1. Provide flanged joints consisting of face rings, rotating ring flanges, bolts and gaskets.
  2. Provide expansion joints consisting of a welded flanged expansion barrel, "O" ring gasket, "O" ring locking flange and hardware to accommodate  $\pm$  2 inch of movement.
- D. Furnish expansion/contraction system for all headers designed for temperature range of 125° F consisting of simple and fixed supports and expansion joints.
  1. Lengths of header can extend up to 80 feet from restraining point without an expansion joint.
  2. Limit maximum distance between restraining points on a continuous length of header to 120 feet maximum.
  3. Provide an expansion joint on continuous lengths of header between two restraining points.
  4. Provide simple supports to restrain header from buoyant uplift forces in compliance with Section 2.04.
  5. Provide fixed supports in compliance with Section 2.04.
    - a. Limit movement to prevent expansion joint blow apart and transmit expansion forces from the header to the fixed support stand.
      1. Provide a mechanical link to connect the header and fixed support stand.
      2. Reinforce the header at the attachment point of the mechanical link.
- E. Duplex Diffuser Connectors
  1. Factory weld to the invert centerline of the air header.
  2. Design diffuser connectors for two diffusers.
  3. Furnish PVC plugs for all unused diffuser connectors.
  4. Provide connectors of length appropriate to the header diameter and positioned so that air exiting the diffusers clears the header.

5. Design header and diffuser connectors as follows:
  - a. Reinforce the connector header weld joint by providing and continuously welding gussets between the vertical side wall of the header and the connector ends to limit long term flexure failure. Minimum gusset thickness is 0.125 inch.
  - b. Weld connector to the header with a full penetration butt weld to minimize potential for crevice corrosion between header and connector. Use of fillet welds at the connection between the diffuser connector and header is NOT permitted.
  - c. Resist a vertical dead load applied to the threaded end of the connector that results in a bending moment of 1000 inch-lbs without exceeding 24,000 psi design stress in any part of the header wall or connector.
  - d. Header wall thickness for unreinforced connectors must comply with Section 2.02, A.4.b.

#### 2.04 SUPPORTS AND ANCHOR BOLTS

- A. Provide each section of air header with a minimum of two supports with the maximum spacing between supports not to exceed 17 ft – 6 inch.
- B. Limit header or manifold cantilever to no more than 4 ft.
- C. Provide header supports with a vertically adjustable header hold down locking mechanism mounted on a stainless steel supporting structure.
- D. Provide header supports with a vertically adjustable header hold down locking mechanism mounted on anchor bolts cast into 4000 PSI reinforced concrete pedestals.
- E. Design support hold down locking mechanisms with a minimum width of 2 inch and a minimum thickness of .109 inch on headers 12 inch diameter or smaller.
- F. Design support hold down locking mechanisms using a "U" bolt smaller diameter and larger.
- G. Provide supports with a mechanism to provide for  $\pm 2$  inch of vertical adjustment and  $\pm 1/2$  inch of lateral adjustment for alignment of the header in the field.
- H. Provide a wall or floor mounted support near the drop pipe to header connection for vertical support and restraint of movement due to thermal expansion and to prevent blowing apart.
- I. Anchor Bolts

## FIXED HEADER AERATION SYSTEM

1. Design anchor bolts for embedment in 4000 psi concrete with a pullout safety factor of 4.
2. Attach supports to the tank with two stainless steel anchor bolts.
3. Provide a mechanical stainless steel expansion type anchor bolt system.

### 2.05 AIR DIFFUSERS

- A. Provide diffusers fabricated of stainless steel material – refer to Section 2.02 Materials, Fabrication and Finishing.
- B. Design diffuser for operating range of 8 to 40 SCFM.
- C. Design diffusers with cast schedule 80 – 3/4 inch NPT threaded nozzle and acetyl orifice insert if required, an inverted air reservoir, air exit ports and a full length deflector.
  1. Design diffusers to provide full wide band aeration with a minimum air release perimeter of 48 inches per diffuser. Release air uniformly along a minimum two foot band beyond each side of the header.
  2. Locate exit ports discharging air into liquid on horizontal planes at two levels.
- D. Diffuser Deflector
  1. Provide deflector below each diffuser for its full length and width.
  2. Design deflector to direct the liquid being aerated along the diffuser reservoir walls so that the air exits through the ports and is sheared into small bubbles and distributed into the liquid.

### 2.06 SPARE PARTS

- A. Furnish 4 diffusers
- B. Furnish 8 header gaskets
- C. Furnish 2 SST Repair Couplings
- D. Furnish 1 special tool set (if required)

Package spare parts in a separate container clearly marked as “Spare Parts” and provide inventory list on exterior of the container.

**PART 3 EXECUTION**

**3.01 INSTALLATION PROCEDURE**

- A. Follow equipment manufacturer's recommendations for sequencing of equipment installation.
- B. Layout and install support anchors in accordance with equipment manufacturer's recommendations and anchor setting plan.
- C. Level aeration system such that all diffusers connected to a header are within plus or minus 3/8 inch of a common horizontal plane.

**3.02 INSTALLATION/START UP SERVICES**

- A. Provide services of a factory representative for one (1) day to verify the proper installation of the equipment.
- B. Provide services of a factory representative for one (1) day to instruct owner's personnel on operation and maintenance.

**3.03 WARRANTY**

Warrant all parts to be free from defects in materials and workmanship for a period of one year after installation or 18 months after delivery, whichever occurs first.

Furnish replacement parts to the Owner for any items found to be defective within the one year warranty period.

**END OF SECTION**



**SECTION 11385  
PROGRESSING CAVITY PUMPS**

**PART 1      GENERAL**

**1.01    DESCRIPTION**

- A.    SCOPE: This section specifies positive displacement progressing cavity pumps, complete with electric motors, and all specified appurtenances, as shown on the plans and specified herein. The pump shall be supplied by the screw press manufacturer. The pump shall be integrated seamlessly into the screw press control systems.
- B.    TYPE: The pumping units shall be of the positive displacement, progressing cavity type specifically designed for pumping the specified liquids.
- C.    EQUIPMENT LIST

<u>Item</u>	<u>Equipment Number</u>
Digested Sludge Pump (Screw Press Feed)	TSP-1

D.    PERFORMANCE AND DESIGN REQUIREMENTS:

1.    Sludge handling pumps shall be specifically designed and selected for continuous duty pumping of liquids with the following properties:

Percent Solids	Up to 10%
Specific Gravity	1.007-1.015
Viscosity @ 75F	0.915-1.098 cSt
Solids Size	3"
pH	6-8
Temperature	90-110 F

2.    The pumps shall be of the compact, close-coupled design. The gear reducer shall be sized for a minimum service factor of 1.5 and designed with a thrust load capability of 150 percent of the actual thrust load.
3.    The pumps, along with associated drive appurtenances, shall be mounted on common fabricated steel base plates.
4.    Manufacturers must currently have installations for the same liquids in service for a minimum of three years. Manufacturers not named in this specification must also provide a pre-submittal package to the engineer no less than three weeks prior to the bid date for approval. The pre-submittal package must include, at minimum, the following: dimensional drawing, annotated performance curve, O&M manual, electrical/drive details, installation list (for the same liquids as specified) with minimum three contacts and phone numbers.

- E. OPERATING CONDITIONS: The progressing cavity pumps shall have the following operating characteristics:

	<b>DS Screw Press Feed</b>
Basis of Design:	Seepex
Units:	1
Design Point #1:	200 GPM @ 50 PSI TDH
Design Point #2:	50 GPM @ 45 PSI TDH
Drive:	Variable Speed
Max Pump Speed:	300 RPM
Min Motor HP:	10 HP TEFC
Discharge Port Size:	4 inch
Suction Port Size:	6 inch
Motor Type:	3 ph/480v/60 Hz

## 1.02 REFERENCES

- A. This section contains references to the following documents. They are part of this section as specified and modified. In case of conflict between the requirements of the section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
AGMA 6010-E-88	Spur, Helical, Herringbone, and Bevel Enclosed Drive
AGMA 6019-E-89	Gear Motors Using Spur, Helical, Herringbone, Straight Bevel, or Spiral Bevel Gears
AGMA 6023-A88	Design Manual for Enclosed Epicyclic Gear Drives

## 1.04 SUBMITTALS

- A. The following information shall be provided in accordance with the General Requirements.
1. Manufacturer's data including materials of construction and equipment weight.
  2. Predicted performance curves developed for the specific application. Performance curves shall plot speed, capacity, head, and horsepower required for the specified operating range.
  3. Motor data as specified in Division 16.
  4. Universal joint warranty.
  5. A copy of this specification section with addenda updates, and all referenced sections with addenda updates, with each paragraph check marked to show specification compliance or marked to show deviations.

**PART 2      PRODUCTS**

2.01    ACCEPTABLE PRODUCTS

- A.      Progressing cavity pumps shall be SEEPEX , or Engineer approved equal.

2.02    MATERIALS

<b>Component</b>	<b>Material - Sludge Pumps</b>
Rotor	Hardened Tool Steel – chromium nitride coated
Stator	Buna N
Pump Body	Cast iron / Steel
Shaft Sealing	Packing

2.03    EQUIPMENT

- A.      ROTOR AND STATOR: Each pump shall be a two stage design employing a convoluted rotor operating in a similarly convoluted stator. The convolutions shall be configured to form a cavity between the rotor and stator, which shall progress from the pump's inlet to discharge port with the operation of the rotor. The fit between the rotor and stator at the point of contact shall compress the stator material sufficiently to form a seal and to prevent leakage from the discharge back to the inlet end of the pumping chamber. Stators for sludge pumps shall have Buna elastomer. The sludge pump rotors shall be constructed of harden tool steel. Additionally the sludge pump rotors shall have a chromium nitride coating and a minimum thickness of 250 µm (.0108"). Hard chrome plating or ceramic coatings are not acceptable due to the ease at which this coating will crack and the lack of diffusion into the rotor base metal.
1.      Stators shall be replaceable without dismantling the pump suction or discharge flanges or any associated piping. Pumps that require additional space for axial/horizontal removal of the stator shall not be allowed. Stator designs shall additionally incorporate a retensioning feature to compensate for wear in lieu of increasing pump speed.
  2.      Rotors shall be replaceable without dismantling the pump suction or discharge flanges or associated piping. Pumps that require additional space for axial/horizontal removal of the rotor shall not be allowed. The rotor design shall include provisions so that rotor replacement does not require the disassembly of either universal joint.
- B.      ROTOR AND DRIVE TRAIN: The rotor drive train shall be warranted for one (1) year from acceptance and shall consist of the following:
1.      Each pump rotor shall be driven through a positively sealed and lubricated pin joint. The pin joint shall have replaceable bushings, constructed of air-hardened tool steel of 57-60 HRC, in the rotor head and coupling rod. The pin shall be constructed of high speed steel, air hardened to 60-65 HRC. The joint shall be grease lubricated with a high temperature (450° F), PTFE filled synthetic grease, covered with Buna N sleeve and positively sealed with hose clamps constructed

of 304 stainless steel. A stainless steel shell shall cover the rotor side universal joint assembly to protect the elastomer sleeve from being damaged by tramp metals or glass. The universal joints shall carry a separate warranty of 10,000 operating hours. This warranty shall be unconditional in regards to damage or wear.

- C. CASING: A 150 (300) - pound (ANSI B16.5) flanged connection shall be provided at the discharge port. The discharge casings shall each be provided with a 3/8-inch (or larger) tap to permit installation of pressure instruments. The suction casing shall be fabricated from corrosion resistant steel plate and designed with a rectangular opening. The suction casing shall incorporate an "extension tube" between the hopper opening and the rotor and stator. A single helix auger shall run the entire length of the suction casing and the extension tube and shall transmit rotational movement from the drive shaft to the rotor. The auger and extension tube work in concert to apply additional shearing forces against thixotropic liquids to reduce the apparent viscosity of the material, minimize air entrainment and improve the volumetric efficiency of the pumping elements.
- D. SHAFT SEALS AND BEARINGS: Each pump shall be provided with oil lubricated thrust and radial bearings, located in the gear motor, designed for all loads imposed by the specified service. The shaft shall be solid through the stuffing box area, but of a two part design which allows the packing and all other wetted rotating parts to be removed from the pump without disassembly of the pump or gear motor bearings. The stuffing box shall be of ample depth for 5 rings of packing and be provided with lantern rings and seal water flush connections. The lantern ring shall be split for convenient removal. The stuffing box housing shall be drilled and tapped for water flush connections.
- E. MOTOR AND DRIVE UNIT:
  - 1. Gear motors or gear reducers shall be designed in accordance with AGMA 6019-E (Class II). Unless otherwise noted, motors shall be energy-efficient, TEFC motors.
  - 2. Pumps that require adjustable speed drives (ASDs) are noted in paragraph 1.01 E. ASDs shall be constant torque type as specified in Division 16. For ASD-driven units, the pump supplier shall be responsible for the provision of the fixed reduction between the motor and pump. The reduction ratio shall be that required to operate the pump at its maximum operating speed when the motor is operating at its nominal rated full speed in accordance with the schedule in paragraph 1.01 E. ASD-driven units may be operated at up to 90 Hz at the maximum speed.

**2.04 ACCESSORIES:**

- A. RUN DRY PROTECTION: The stator shall be fitted with a sensor sleeve and thermistor sensor. A controller shall also be provided and shall be installed by the contractor in the motor control center. The controller shall monitor the stator temperature and activate a shutdown and alarm sequence if the stator temperature reaches the adjustable limit on the controller. The controller shall include a manual local and remote reset function. Input to the controller shall be 1x115VAC/60 Hz.

- B. OVER PRESSURE PROTECTION: Each pump unit shall be supplied with a silicone-filled isolation ring with a dual mounted gauge and single point pressure switch. The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans, and be constructed with a carbon steel body and fittings with a Buna sleeve. The switch shall be SPDT, NEMA 4.

**2.05 PRODUCT DATA**

- A. The following information shall be provided in accordance with the General Requirements:
  - 1. Mill certifications confirming hardness of rotor.
  - 2. Applicable operation and maintenance information.
  - 3. Motor data.
  - 4. Installation certification form.

**2.06 STANDBY COMPONENTS**

- A. One set of packing tools shall be provided to service the pumps. In addition, the following shall be provided for each pump size (as appropriate for type of drive provided):
  - 1 – set of stator halves with TSE sensor sleeve
  - 1 – rotor
  - 1 – set universal joint assemblies
  - 2 – set packing
- B. Standby components shall be tagged and stored in accordance with provisions of the General Conditions.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. The pumps shall be installed as specified and in accordance with manufacturer's written recommendations. The installation and initial operation of all components shall be certified by the manufacturer's representative.

**3.02 TESTING**

- A. After completion of installation, the pumps shall be completely tested to demonstrate compliance with operating requirements as specified.

**PART 4 CERTIFICATION**

**4.01 Description**

- A. Consideration will be given only to products of manufacturers who can demonstrate that their equipment fully complies with all requirements of the specifications and contract documents. The equipment shall be supplied by a firm which has been regularly engaged

## **PROGRESSING CAVITY PUMPS**

in the design, fabrication, assembly, testing, start-up, and service of progressive cavity pumps, of the same model and size as proposed, operating in the U.S., with similar materials, for a period of not less than ten (10) years prior to the bid date of this contract. To insure that the highest standards are met each bidder shall be certified to ISO 9001 quality standards as a progressive cavity pumps manufacturer in the United States. The bidder shall submit data to substantiate the manufacturers experience in accordance with the contract documents.

- B. If a bidding progressive cavity pump manufacturer does not have a formal quality system in place, or documentation to prove so, a performance/maintenance bond in the amount of 100% of the installed price (including equipment, labor, piping, and wiring associated with the equipment covered under this specification) shall be included in the bid proposal. The bond should be made out to the owner for 100% of the amount bid, and shall be in force for a minimum of five (5) years from the date of first beneficial use of the equipment. The five (5) year minimum is to cover all warranties listed under this specification.

**END OF SECTION**

**SECTION 11520**  
**LIQUID POLYMER BLENDING SYSTEM**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

A. Polymer Unit

1. The polymer dilution and feed system shall be capable of effectively activating and fully blending with water a homogenous polymer solution ranging from 0.1% to 1% concentration of emulsion polymers with active contents up to 75%.
2. Polymer blending system shall be supplied by the screw press manufacturer. System shall be integrated seamlessly into the screw press control systems.

1.02 WARRANTY

- A. The system shall be covered by a one (1) year limited warranty against defects in materials and workmanship. The mixing chamber shall be warranted for the life of the system against failure for plugging for any reason. The warranty shall exclude failure to do over pressure or freezing.
- B. If purchaser is dissatisfied with unit's performance within 30 days of start-up, the unit may be returned for a full refund, or credit against another unit, provided unit has received reasonable use and care.

**PART 2 PRODUCTS**

2.01 MANUFACTURERS

- A. Provide polymer activation, blending and feed system(s) as manufactured by
  - a. VeloDyne of Boulder, CO;
  - b. Prominent; represented by Aqua Products, Pensacola Florida
  - c. preapproved equal.
- B. Polymer System shall be sized by the Screw Press supplier as required to match design capacity of the system.

2.02 EQUIPMENT

A. Multi-zone Hydro-mechanical Mixing Chamber:

1. The polymer blending system is a critical part of the process and must be designed to provide optimal performance and reliability under all

## LIQUID POLYMER BLENDING SYSTEM

operating conditions. These specifications are based on the VeloBlend technology. Other technologies shall be considered only if they are proven to provide the same level of performance and reliability under all operating conditions as the system specified herein.

2. A hydro-mechanical blending device shall be provided. The device shall be capable of operating on plant water pressure alone at 30 psid. In addition, the system shall be capable of producing its mixing energy independent of plant water pressure through a variable intensity, controllable mechanical mixer. The system shall be capable of producing high, non-damaging mixing energy at all flow rates without damage to the polymer's molecular structure.
3. The mixing chamber shall be clear to view the mixing action and blending effectiveness. Clear pipe shall not be acceptable to meet this requirement. The mixing chamber shall have a maximum rated pressure of 100 psi. All holes tapped in plastic shall have helicoil inserts for increased strength.
4. In order to handle the wide range of polymers available, independent of water pressure, a variable speed mechanical mixing impeller shall be provided. The mixer shall be designed specifically to effectively inducing high, non-damaging mixing energy over the systems full flow range. The specially designed impeller shall be controlled by an SCR or VFD controller. The impeller shall be driven by a wash-down duty motor. The mixer drive shaft shall be sealed by a mechanical seal which shall have an integrally mounted and factory plumbed seal flushing valve. A drain port behind the seal shall be provided in the mixing chamber to drain the polymer solution in case of a seal failure. A sensor shall be provided to sense a seal failure and initiate an alarm. The seal shall be easily accessible for replacement. Systems without a seal flushing system shall not be considered.
5. Systems that rely solely on plant water pressure to create mixing energy shall not be acceptable. Systems that rely solely on water pressure to create mixing energy will be considered only if provided with an integrally mounted dilution water booster pump and if the system meets the above polymer mixing criteria. A VFD motor controller shall be provided to control the pressure and therefore mixing energy generated by the booster pump. Booster pumps shall be multi-staged and of stainless steel construction. The booster pump shall be capable of generating 75 psid independent of water supply pressure which shall be verified at system start-up. In the event the booster pump cannot produce 75 psid of water pressure a properly sized booster pump shall be installed at supplier's expense. Under no circumstances shall systems that rely solely on plant water pressure to create mixing energy be acceptable.



6. Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. The valve shall be designed with an open, unobstructed path to the valve seat. The valve body shall be constructed of Teflon with Viton seals. The valve poppet and spring shall be stainless steel and designed to prevent polymer from flowing through the spring, causing build-up and plugging. Plastic spring covers shall not be used. The valve shall be readily accessible for cleaning and shall not require tools for removal, cleaning or replacement. Conventional check valves, valves that rely on ball seals, and or check valves that are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing will not be accepted. The locking pin used to hold the valve in place shall be attached to the mixing chamber with a lanyard.

### B. Dilution Water Assembly

1. The dilution water flow rate shall be monitored by a Rotameter type flow meter having a range of 2 - 20 GPM. A union shall be provided on the Rotameter to allow easy removal for cleaning.
2. Unit shall have an electric solenoid valve ball valve actuated variable rate control valve to automatically proportion water flow to a process signal and for on/off control of total dilution water flow.
3. A differential pressure type low water differential pressure alarm shall be provided. The switch shall be adjustable between 10 and 25 psid.
4. Provide a 2-1/2" stainless steel liquid filled pressure gauge to monitor dilution water inlet pressure.

### C. Progressive Cavity Neat Polymer Metering Pump

1. The unit shall have one (1) neat polymer metering pump(s) integrally mounted on the systems skid. The metering pump(s) shall have a range of 0.25 – 5 GPH. The pump shall be a positive displacement, progressive cavity type constructed of stainless steel and Viton. The pump seal shall be packing type. Mechanical seals shall not be used. The pump shall have a minimum of three stages to minimize slip. A TEFC or TENV 90 VDC Wash-down duty motor shall drive the pump. A right angle gear reducer shall be provided to produce a maximum pump shaft speed of not more than 600 RPM. The motor shall be controlled by an SCR motor controller located in the system control panel.
2. Provide a calibration column with two full port PVC ball valves having Viton o-rings. The column shall be calibrated for a one minute draw-down and read in GPH and milliliters.

## LIQUID POLYMER BLENDING SYSTEM

3. Provide a pressure gauge with diaphragm isolator to monitor polymer line pressure.
4. Provide a pressure switch with diaphragm isolator to alarm on high polymer line pressure.
5. Provide a metering pump priming assembly including vacuum device and valve.
6. Provide a thermal type loss of polymer flow sensor.

### D. Solution Discharge Assembly

1. Provide a post dilution water assembly. A dilution water flow meter shall be provided with a range of 2 - 20 GPM. A union shall be provided on the Rotameter to allow easy removal for cleaning.
2. Provide a static mixer for mixing primary polymer solution with post dilution water.
3. Provide a 2-1/2" stainless steel liquid filled pressure gauge to monitor system discharge pressure.
4. Provide a high discharge pressure switch
5. Provide a swing type check valve to prevent back flow. The check valve shall be sized for the total solution flow of the system, constructed of PVC and Viton.

### E. Controls

1. A control panel integral to the systems frame shall be provided. The enclosure shall be rated NEMA 4X and constructed of FRP. The control panel shall consist of all digital displays, potentiometers, switches, lights, relays, and other control devices required for a complete operable system. The control panel and all components shall be industrial duty. All skid mounted electrical components interconnected to the control panel shall terminate at numbered and labeled terminal blocks. The terminal blocks shall be sized for 14 ga. wire. Wires shall be neatly run through wire raceway and numbered with adhesive type labels. The control panel shall be positioned such that there are no obstructions in front of the control panel per related NFPA requirements. Control features shall include the following:

#### (Series E)

1. Operator Interface – Discrete Selector Switch:

## LIQUID POLYMER BLENDING SYSTEM

- a. System ON / OFF(reset) / Remote
    - b. Ten-Turn Potentiometer – Metering Pump Control
  - 2. Status / Alarm Indicators:
    - a. Main Power ON
    - b. LCD Display of Metering Pump Rate
    - c. Low Water Differential Pressure Alarm
    - d. Low Polymer Flow Alarm
  - 3. Inputs (signals by others):
    - a. Remote Start / Stop (discrete dry contact)
    - b. Pacing Signal Based on Process Flow (4-20mA)
    - c. Tote level high (discrete dry contact)
    - d. Tote level low
  - 2. Outputs:
    - a. System Running (discrete dry contact)
    - b. Remote Mode (discrete dry contact)
    - c. Common Alarm (discrete dry contact)
    - d. Polymer Pump Rate (4-20mA)
- F. Power:
- 1. 120 V, 1 Ph, 60 Hz.
  - 2. A circuit breaker on the main control circuit and on each motor shall be provided as manufactured by Allen Bradley or equal. Fuses shall not be used for circuit protection.
- G. Equipment Skid
- 1. The system's frame shall be of rugged 304 stainless steel construction. No mild steel shall be used. All piping shall be rigidly supported.
  - 2. The overall system dimensions shall not exceed 36"W x 24"D X 42"H.
- H. Accessories:

### **Tote Accessories**

- 1. Provide each unit a mixer for up to 375 gallon totes. The tote mixer shall have a 3/4 HP, 115 VAC, 350 RPM, TEFC gear motor with thermal overload protection. The mixer shaft shall be stainless steel and have a thrust bearing external from the motor for support. The bearing frame shall be stainless steel. Two 5" impellers shall be provided. The tote mixer controls shall be integral to the motor and include an ON/OFF switch, and 0-60 minute timer and 10' power lead. The mixer frame shall be constructed of stainless steel and have lifting handles. Moveable brackets shall be included to adjust the width of the mixer for the tote being used. A stainless steel wall mounting bracket with drip pan shall be

## **LIQUID POLYMER BLENDING SYSTEM**

supplied to support the mixer and collect polymer drips while the mixer is not in use.

2. Provide each unit a polymer tote pump suction assembly. The assembly shall include quick disconnect cam-lock fittings, a 1" full port ball valve, and 15 feet of 1" braided PVC hose.
3. Provide two (2) polymer tote trucks designed to transport up to 375 gallon totes and tilt the tote when in service to drain entire contents. Polymer totes shall be positioned on tote truck using a fork-lift or overhead crane. Tote truck shall include two fixed wheels and two swivel wheels. Swivel wheels shall be lockable. The tote truck shall be constructed of powder coated steel and rated for #4000 pounds.
4. Provide each unit a tote level sensor. The level sensor shall be the non-intrusive capacitance type. Two level points shall be supplied each fully adjustable. The controls shall include an ON/OFF switch to preclude false alarm signals while probe is being transferred from empty to full tote, a high level indicating light with NO output and a low level indicating light with NO output.

### **55 Gallon Drum Accessories**

1. Provide two (2) mixers for 55 gallon drums. The mixer shall have a ½ HP, 115 VAC, 1750 RPM, TEFC motor with thermal overload protection. The mixer shaft shall be stainless steel. One 3" collapsible impeller shall be provided. The tote mixer controls shall be integral to the motor and include an ON/OFF switch, and 0-60 minute timer and 10' power lead. A mount designed to screw into a 2" bung connection shall be constructed of stainless steel and be designed to position the mixer shaft at an angle for ideal mixing. A stainless steel wall mounting bracket with drip pan shall be supplied to support the mixer and collect polymer drips while the mixer is not in use.
2. Provide each unit a polymer drum suction assembly. The assembly shall include quick disconnect cam-lock fittings, a 3/4" full port ball valve, and 10 feet of 3/4" braided PVC hose.
3. Provide each unit a drum suction pipe constructed of clear PVC with a PVC tee at top and a polymer check valve on the bottom. The suction pipe shall include a 2" bung connection with compression fitting to allow suction pipe height adjustment in the drum.
4. Provide four (4) polymer drum truck / dispenser designed to transport up to 55 gallon totes and tilt the tote when in service to drain entire contents.

### **END SECTION**

## SECTION 11542

### SCREW PRESS

## PART 1 GENERAL

## 1.01 SCOPE OF WORK

- A. The contractor shall furnish and deliver, ready for installation, one (1) screw press dewatering system(s) and associated equipment as specified herein and in accordance with the Contract Documents. The screw press equipment specified in this section shall be provided by a single supplier to ensure coordination and compatibility of equipment.
- B. The dewatering system(s) shall be designed to concentrate and dewater wastewater sludge by means of a combination rotary drum thickener (RDT) and screw press. The connected ancillary equipment shall be supplied by the Screw Press Manufacturer to ensure system compatibility and system responsibility.

## 1.02 RELATED WORK

- |    |                                |               |
|----|--------------------------------|---------------|
| A. | In-Line Grinder                | Section 11330 |
| B. | Shaftless Screw Conveyor       | Section 14555 |
| C. | Progressing Cavity Pumps       | Section 11385 |
| D. | Liquid Polymer Blending System | Section 11520 |

### 1.03 SUBMITTALS

- A. Submit materials required to establish compliance with this Section. The submittal shall include the following:
  1. Certified shop and erection drawings showing all important details of construction, sludge feed, washwater, and drainage connections, wiring diagrams, itemized motor horsepower, dimensions, and anchor bolts.
  2. Descriptive literature, bulletins, and/or catalogues of the equipment. This material shall include, but not be limited to the following:
    - a. Color photograph of thickeners similar to those to be furnished.
    - b. Materials of construction and of all coatings of all major components, including bearings. Include sizes of materials and thickness of coatings.

- c. Details of the drive system for drum and for sludge conditioner, if any.
- d. Provide a complete and current listing of all operating rotary drum thickeners in order to define the manufacturer's experience. Include proof of successful operation of equipment of same capacity in full-scale operation thickening similar sludge. Include complete list including names of contacts and telephone numbers, date of installation, model numbers and all relevant design parameters.
- e. Information on field erection requirements, including total weight of assembled components, weight of the single largest component that will require removal during the life of the unit and gross operating weight.
- f. Statement of guarantees for units furnished.
- g. Total connected nameplate horsepower and operating horsepower for each motor. Itemize this information for each motor. Include motor data as required by Section 16150.
- h. Statement of washwater requirements.
- i. Description of gravity drainage system.
- j. For the baseplate of the screw press, furnish the loads including all horizontal and vertical components as follows:
  - 1) Dead loads due to unit weight empty.
  - 2) Dead loads due to unit weight full of sludge, drain pans full and similar circumstances.
  - 3) Dynamic loads.
  - 4) Combination of (2) and (3) above.
- k. Control panel data to include:
  - 1) Dimension and layout details.
  - 2) Materials of construction.
  - 3) Brand names, catalog literature and performance specifications on all included devices such as, but not limited to:
    - a) Fused disconnects
    - b) Motor starters
    - c) Flow Controllers
    - d) Panel indicators
    - e) Terminal blocks
    - f) WD/SCR controllers
    - g) Alarm
    - h) All switches and lights
    - i) Timers, relays, and related equipment

3. A complete total bill of materials for all equipment.
4. Complete data on motors and controls as specified.

#### 1.04 REFERENCE STANDARDS

##### A. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Structural Steel.
2. ASTM A48 - Standard Specification for Gray Iron Castings.
3. ASTM A120 - Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
4. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on and Steel Products.
5. ASTM A395 - Ferritic Ductile Iron Pressure Retaining Castings for Use at Elevated Temperatures.
6. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
7. ASTM A536 - Ductile Iron Castings.
8. ASTM D349 - Standard Test Methods for Laminated Round Rods Used for Electrical Insulation.
9. ASTM D638 - Standard Test Methods for Tensile Properties of Plastics.
10. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
11. ASTM D792 - Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

##### B. American National Standards Institute (ANSI)

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

##### C. The Society for Protective Coatings (SSPC)

1. SSPC SP-10 - Near White Blast Cleaning.

D. National Electrical Manufacturers Association (NEMA)

1. NEMA MG-1 - Motors and Generators.
2. NEMA - Control Panel Enclosures.

E. American Welding Society (AWS).

1.05 QUALITY ASSURANCE

A. Referenced manufacturer is BDP Industries Inc., Huber, Andritz or approved equal.

B. The screw press equipment shall be furnished by a single supplier who has a minimum of twenty years of experience in the manufacture of sludge dewatering equipment. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods, and shall be equal to that manufactured by BDP Industries, Inc.

C. The equipment manufacturer must meet all the following criteria:

1. All manufacturing and assembly of the screw press equipment must take place in the United States of America.
2. Full manufacturing service center located in the United States.

1.06 PROCESS PERFORMANCE AND GUARANTEE

A. Once a representative sludge has been established, the manufacturer shall operate the press at or above the required flow rate and solids loading for a minimum period of 6 hours with samples of feed, discharge cake, and filtrate collected hourly. Samples will be analyzed per ASTM standards for total suspended solids (TSS) and total solids (TS), and the results averaged. The average cake solids and polymer dosage must be better than the above requirements in order to demonstrate compliance. Should the screw press fail to meet the minimum standards specified, the following shall occur:

1. Plant operating procedures shall be reviewed to determine that the sludge is in fact representative of normal operation and within the design specifications.
2. If it is determined that the sludge is representative and within these specifications, the manufacturer shall make any modifications necessary to accomplish the specified performance levels.
3. If the sludge can be demonstrated as representative and within specified parameters and if the manufacturer cannot meet the performance, the owner may elect to have the manufacturer remove the unit and refund any monies paid.
4. All sampling and testing shall be included in the cost of the equipment.



## 1.07 SPARE PARTS

- A. Ten (10) spare spray nozzles.
- B. Two (2) relays of each type and size.

## 1.08 WARRANTY

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.

**PART 2 PRODUCTS**

## 2.01 DESCRIPTION OF SYSTEM AND PERFORMANCE CRITERIA

- A. The Screw Press shall meet the following operating parameters when processing the sludge specified.
  - 1. The screw press system shall be designed for operation on waste activated sludge.
  - 2. The screw press unit shall be capable of meeting the performance criteria as set forth below:

PARAMETER	REQUIREMENT
Sludge Feed Solids (%wt)	0.5 - 2.0
Sludge Flow Rate (gpm)	50 - 100
Solids Throughput (dry lb/hr)	331
Maximum Polymer Dosage (act. lb/dry ton)	35
Minimum Discharge Cake Solids (%wt)	20
Minimum Solids Capture (%)	95

## 2.02 SURFACE PROTECTION

- A. The main frame and other misc. metals, excluding drives, shall be stainless steel per ASTM A554-MT304 specification. Buyouts items will be covered with the following paint system:
  - 1. First coat of Tnemec #66 epoxy of contrasting color to a minimum of four (4) dry mils thickness.
  - 2. Apply a second coat of Urethane top coat, finished color, minimum of four (4) mils thickness. Total thickness of the two (2) coats will be a minimum of eight (8) mils dry.
  - 3. Flame sprayed galvanizing is not acceptable.

- B. The control panel enclosure shall be Nema 4 X constructed of type 304 stainless steel. Inside of the box will be white.

## 2.03 MECHANICAL DETAILS

### A. Main Structural Frame

1. The frame shall be fabricated from stainless steel structural members designed to adequately support all components and accessories. Steel shall meet the requirements of ASTM A554-MT304; all welding shall be performed in accordance with ANSI/AWS D1.6. Where frame components are bolted, stainless steel fasteners shall be used.
2. The fabricated steel frame shall be designed to withstand the maximum stresses imposed on the individual members with a safety factor of 5. Specifically, the maximum actual stress on any member, connection, plate, etc., shall not exceed 1/5 of the yield strength of the frame material used. The deflection ratio of any structural member shall not exceed L/600 where L is the member span.
3. Drip pans shall be fabricated of a minimum 14-gauge type 304L stainless steel and shall collect filtrate.
4. The framework shall be constructed in such a manner that it will insure absolute plane parallelism of all rotating elements by machined bearing pads.
5. The framework shall be of welded and/or bolted construction. No disassembled component, excluding the screw filter frame, shall weigh more than 5,000 lbs. Lifting lugs shall be provided as necessary to afford convenient access to maintenance points throughout the screw filter.

### B. Flocculation/Conditioning System

1. To achieve rapid contact between sludge particles and a solution of dilute polyelectrolyte, provide:  
  
One (1) 316L stainless steel, venturi mixer, shall be provided for each screw press. Each mixer shall be equipped with a Vortex polymer injection ring with four (4) tangentially mounted polymer injectors. The mixer shall be located upstream of the screw press. The screw press manufacturer shall recommend the proper layout of the system. The contractor shall provide spool pieces of the size and number shown on the drawings at alternate locations. Systems that utilize mixing/flocculating tank are not acceptable.

### C. Rotary Drum Thickener

1. Each press shall be furnished with an independently driven primary thickening unit consisting of either a rotating drum. Minimum effective drainage area shall be 14 sq. ft.
2. The primary thickening unit shall be equipped with a 0.75 HP, variable frequency speed drive, powered and controlled from the main press pan-el.

3. The drum mechanism shall be fabricated from 304L stainless steel and covered with a monofilament polyester material, secured by stainless steel fasteners.
4. If a gravity belt is used as the pre thickening device, its construction shall be in keeping with the overall frame construction covered previously and shall be an enclosed unit to limit wash water spray and odors.
5. The drum belt shall be cleaned by a nozzle shower bar assembly.
6. The primary drainage area shall be housed, such as to contain spray but still allow for proper cleaning and visual inspection.

D. Drum Transfer Pump and Transition Section

1. Each screw press shall be furnished with a chute to receive sludge from the pre thickening device.
2. A rotary lobe pump is to be provided to positively transfer and pressurize thickened sludge to the inlet of the dewatering screw. A feed system to the screw press that utilizes only gravitational forces will not be acceptable. The system must be capable of providing up to 10 psi inlet pressure to the screw. Comply with 2.8 of this section for pump capabilities.
3. The rotary lobe feed device is to be driven by a Variable Frequency Drive controlled at the main screw press control panel. Adjustment of the rotary lobe feed device will allow for varied throughputs and cake dryness.
4. The materials in contact with the sludge shall be fabricated from type 304L stainless steel. All fasteners, along with mounting and adjustment hardware shall be 304L stainless steel.
5. The use of vacuum assisted drainage sections is not acceptable.

E. Pressure Zone

1. Each screw press shall be furnished with a two-stage pressure zone following the primary thickening unit. The screw press shall be supplied with a tapered shaft design with a smaller diameter at the inlet and a large diameter at the discharge. Designs that utilize a variable pitch with constant shaft diameter, or designs with two-stage shaft diameters are not allowed.
2. The basket assembly around the screw must be constructed of stainless steel with slotted openings too allow for maximum porosity and avoidance of small diameter holes that tend to plug. Designs that utilize basket assemblies constructed of wedge wire or moving rings will not be allowed.
3. The first stage of the pressure zone shall be the low-pressure area. This section shall have dual flights to insure conveyance of the dilute slurry and adequate cleaning of the screen surface by the brushes on the screw flights during low pressure dewatering.
4. The second section of the pressure section will consist of the following features. The design of the screw auger shall be a tapered shaft to reduce the volume and therefore provide an increasing pressure profile on the solids. The tapered shaft

of the screw is designed to force the sludge closer to the slotted screen, thus reducing the path length for liquid to be expressed from the cake. The tapered shaft reduces the potential of plug formation, where the cake turns with the screw and is not conveyed to the discharge point.

5. The high-pressure section shall consist of a variable pressure cone shaped plate on the discharge opening of the screw press. The cone shall be pneumatically adjustable for automatic operation that avoids binding. Units that do not include a pressure cone will not be considered.

**F. RDT Filter Media**

1. Filter media of the RDT shall be fabricated of monofilament polyester, wear resistant plastic material or combination monofilament polyester and stainless-steel material. The mesh design shall be selected for optimum dewatering of the sludge to be processed with a minimum blinding of the filter fabric.
2. Filter media selection shall be based on the manufacturer's experience obtained at other installations dewatering similar sludge with similar polyelectrolyte conditioning chemicals.
3. The filter media shall be warranted for 2,000 hours of operation. Any belt that fails before that time, provided that the equipment has been operated per the instructions in the operation and maintenance manual, will be replaced on a pro rata basis.

**G. Shower Wash System**

1. A wash station shall wash each pre-thickening drum and the screw press section. The wash system shall use high-pressure water spray nozzles. The spray assembly shall be housed in an enclosure in a manner that contains the spray pattern and mist within the housing assembly. The housing and nozzle assembly shall be readily removable. The housing shall be fabricated from type 304 stainless steel.
2. Wash water required shall not exceed a max flow of 50 GPM per unit at 120 psig.
3. Each screw press shall be provided with a 5 HP wash water booster pump that will installed as shown on the contract drawings. The wash water booster pump shall be a Goulds model 3656 or equal. Booster pump piping connections shall be installed with unions and appropriate supports.
4. Each shower header shall include a motorized ball valve for remote control of the shower as well as for pre-set timed intervals to wash the equipment.

**H. Drives**

1. The RDT drive shall be a 0.75 HP drive and the screw press drive shall be a 3 HP variable speed with a variable frequency AC drive unit. The Rotary Lobe transfer device shall have a 0.75 HP drive. Multiple belt drives shall not be acceptable.

2. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Each drive unit shall be designed for 24-hour continuous service.
3. Each gear reducer shall be totally enclosed, water spray proof, oil lubricated with anti-friction bearings throughout. All motors shall be TEFC.
4. The screw auger drive shall be a 3 HP, shaft-mounted motor and gear reducer assembly. The drive must be on the discharged end of the screw shaft to reduce wear on the screen and flights due to deflection of the screw shaft.
5. The drives shall be furnished with provisions for use on 480-volt, 60 hertz, 3-phase power supply.

I. Safety Guards

1. All equipment having exposed moving parts such as fans, V belts, gears, couplings, chains, and including the pressure roll section, shall be provided with safety guards as required by OSHA standards.

J. Bearings

1. The shafts shall be equipped with heavy-duty grease able type, self-aligning ball or roller bearings in sealed, splash proof housings. The housing shall be sealed to provide adequate protection from moisture and grime.
2. All bearings shall have a minimum B 10 bearing life of 500,000 hours based on ANSI B13.6 1972. The B 10 bearing life of 500,000 hours shall be based on the maximum summation of all forces applied to the bearing.
3. Bearings and housings shall be US manufactured and shall be manufactured by FMC Corporation, Link-Belt Division, Indianapolis, Indiana; Reliance Electric Industrial Company, Dodge Division, Greenville, South Carolina or equal.

K. Drainage Pans

1. Drainage pans shall be supplied as necessary to contain all filtrate and wash water within the unit and to reduce rewetting of downstream cake. Filtrate and wash water pans shall be constructed of minimum 14-gauge type 304 stainless steel. All drainage piping shall be furnished adequately sized for the intended service and rigidly attached to the press frame. Drainage piping shall be extended as required and directed to the buildings screw press drain sump.

2.04 ELECTRICAL REQUIREMENTS

A. Provide Control Panel in accordance with 16910.

B. Control panel shall accept a 480V feed from the Motor Control Center (MCC).

C. General Requirements

1. Provide one control panel constructed of 304 stainless steel, NEMA 4X construction. Include starter and controls for grinder and conveyor.

2. The panel shall be a full operating panel complete with all motor control and supervisory devices for press-mounted and ancillary equipment. All electrical work shall be performed in accordance with applicable local and national electric codes. The control panel shall include an Allen Bradley PLC and a 12" color OIT Panel View Plus touch screen. An Ethernet and/or fiber optic connection shall be provided for communication with plant control system. Allen Bradley AC Power Flex 40 Variable Frequency Drives shall be used for each of the following individual components in the local control panels: Rotary Drum drive, Drum Transfer Pump drive, Screw Press drive, and the Filtrate Recycle Pump drive (RDT and Transfer pump for BDP press).
  - a. All vendor supplied control panels shall be supplied with an Allen Bradley Micro 870 Series PLCs along with all necessary Allen Bradley Micro 800 series I/O modules. The Micro 870 PLC shall be capable of communicating via Ethernet/IP to facilitate integration into the plant SCADA system. Any other Ethernet/IP based devices located in the vendor supplied control panel should be configured to prevent local Ethernet/IP traffic from exiting the control panel. If additional hardware is necessary (such as a managed switch) it shall be provided to eliminate unnecessary traffic from entering out onto the SCADA network.
  - b. The Control panel shall include a fiber/copper media converter compatible with multi-mode fiber optic network depicted on Network Architecture Diagram. Coordinate with System Integrator.
3. The ancillary equipment to be controlled by this panel includes the sludge feed pumps, polymer systems, wash water booster pumps, discharge conveyor system, polymer tote level, polymer mixing and air compressor system. The sludge pumps and polymer solution pumps shall have Allen Bradley PowerFlex 40 AC Variable Frequency Drives (VFD). The wash water booster pumps, air compressor and conveyors will have motor starters in the control panel. All motor starters and VFDs will be protected by in-line dedicated circuit breakers. The PLC will include logic for all necessary system interlocks and will control process and emergency shutdowns.
4. The controls shall be such that selection of the desired ancillary equipment is easily accomplished at the OIT touchscreen for the Screw Press.
5. Three phase, 480-volt, 60-Hertz power shall be supplied to the control panels. A control transformer will be provided for GFI 120-volt, single phase power source for motor starter coils, lights, relays, timers, controllers, and other related items.
6. Each control panel shall be provided with terminal blocks for power wiring to and from the panel. The incoming terminal blocks shall be provided with a single magnetic circuit breaker disconnect switch. Circuit breaker protected motor starters with thermal overloads shall be supplied for each motor furnished with the unit.
7. All electrical equipment controls located on each screw press shall have Nema 4X enclosures and wired, through PVC conduit, to a single common Nema 4X terminal box.

8. All devices within the panel shall be permanently identified. Nameplates shall be provided on the face of the panel or on the individual device as required. Nameplates shall be made of laminated phenolic materials with a white face and a black core.
9. The panel shall be designed for manual starting and stopping of all drives. A master manual / auto system switch shall be supplied to override the alarm system and allow operation of any drive through a momentary contact pushbutton. The control panel shall contain start/stop pushbuttons, run lights, and alarm indications for the sludge pumps, polymer systems, conveyors, and the booster pumps.
10. The operator interface terminal (OIT) touchscreen shall be equipped with a start/stop switch and run light for each adjustable piece of equipment. The screw drive, primary dewatering drum drive, polymer system and sludge pump drives as hereafter specified, shall also incorporate speed control and speed indication (RDT and Transfer pump for BDP press). The control panel shall include start/ stop pushbutton, run lights, speed control and 4 to 20 mA signal generators for the polymer solution and sludge pumps controls.
11. Alarm lights, sensors, and related circuitry shall be provided for the following functions: zero speed, emergency stop push button on each side of the press, low water pressure, and low air pressure. In the event of any of the above malfunctions, the machine will shut down and an alarm sound. The alarm system shall include an audible horn rated at 90 DBA at 10'. The system shall include silencing provisions, but the function alarm indicating light shall remain lit until the alarm condition is satisfied. A separate set of alarm contacts shall be provided for remote alarm indication.
12. Arrange control panel to allow either manual or automatic control of screw press equipment. When "MANUAL" operation is selected, all equipment associated with the screw press shall be controlled by "START/STOP" pushbuttons. When "AUTOMATIC" operation is selected, control of equipment shall be "AUTOMATIC/START" and "AUTOMATIC/STOP" pushbuttons, and programmable controller:
  - a. Local screw press control panels shall include OIT touchscreens with the following:
    - 1) One control mode selector switch marked "AUTOMATIC/ MANUAL." When "MANUAL" operation is selected, all equipment associated with screw press shall be controlled by "START/STOP" pushbuttons. Provide one "START" and one "STOP" pushbutton for each of the following:
      - a) Rotary Drum Drive.
      - b) Drum Transfer Pump Drive.
      - c) Screw Press Drive.
      - d) Filtrate Recycle Pump Drive.
      - e) Wash Water Pump.
      - f) Sludge Pump #1 Drive

- g) Polymer System #1 Drive.
    - h) Receiving Conveyor.
    - i) Transfer Conveyor.
    - j) Distribution Conveyor.
    - k) Distribution Slide Gates
    - l) Grinder.
  - 2) One speed potentiometer for manual adjustment of each drive speed.
  - 3) Digital indicators for sludge feed flow rate. Indicators shall accept 4 to 20 mA DC field input and shall be calibrated in gpm.
  - 4) Green indicating lights for "RUNNING" status for each unit operated from panel, including wash water solenoid valve energized indication.
  - 5) Red indicating lights for "OFF" status for each unit operated from panel, including wash water solenoid valve de energized indication.
  - 6) One each "AUTOMATIC/START" and one "AUTOMATIC/STOP" momentary pushbuttons, for automatically starting and stopping each screw press system. Sludge cake conveyor shall be manually controlled when screw press control mode selector switch is in either the "AUTOMATIC" or "MANUAL" position.
  - 7) One "EMERGENCY STOP" red mushroom pushbutton.
13. Automatic Controls and Sequencing:
- a. General:
    - 1) Program the PLC for automatic control of screw press, system sequencing, and interlock functions as specified.
    - 2) Configuration and programming of PLC system shall be responsibility of screw press manufacturer. System documentation including memory loading, I/O configuration and programming shall be provided.
    - 3) Provide and install auxiliary relays and wiring for equipment and devices specified in this Section required for implementing functional requirements specified.
  - b. "AUTOMATIC START/AUTOMATIC STOP" Cycle (typical for all screw presses):
    - 1) Automatic start cycle request to PLC shall be initiated by "AUTOMATIC/START" pushbutton.
    - 2) Control logic for an "AUTOMATIC/START" cycle shall start screw press in the following order after "AUTOMATIC/START" command has been initiated and interlocks are complete.
      - a) Wash water pump.
      - b) Screw Shower "Pre-Wash"
      - c) Load out conveyor.
      - d) Receiving and Transfer conveyor.
      - e) Distribution conveyor.
      - f) Screw press drive.
      - g) Rotary drum drive.
      - h) Polymer system drive.



- i) Sludge feed pump.
      - j) Grinder
    - 3) Each drive shall not start until previous drive is running and necessary time delay has elapsed. The screw press manufacturer shall determine where time delays are required and shall program settings to provide smooth start-up of equipment.
    - 4) Once all drives are confirmed running by motor run contacts from their respective starters, PLC shall cause the run indicating light to illuminate. Loss of run status contact for a drive once cycle logic is complete shall shut down screw press and associated equipment.
    - 5) Upon "AUTOMATIC /STOP" command, system shall shut down in order that is reverse of specified start-up order with necessary time delays.
  - c. Interlocks: The following interlocks shall be satisfied when control mode selector switch is in either "AUTOMATIC" or "MANUAL" position. Failure of any one signal during start cycle or after cycle is complete shall shut down all associated screw press equipment.
    - 1) Sludge cake conveyor servicing the screw press shall be operating and confirmed by conveyor zero speed switches.
    - 2) Wash water pump must be on and sufficient washwater pressure must be sensed at a specified level.
    - 3) Air pressure must be sensed at a specified level.
    - 4) Control mode selector switch shall be in "AUTOMATIC" position. "EMERGENCY STOP" pushbutton shall be in operating position.
  - 14. Annunciation and Alarms:
    - a. Provide audible alarm and detailed alarm history in screw press control panel for alarming of the following:
      - 1) Rotary Drum drive failure.
      - 2) Screw drive failure.
      - 3) Drum Transfer pump failure.
      - 4) Local emergency stop initiated at either belt filter press control panel or pull cord switch.
      - 5) High discharge pressure at sludge feed pump.
      - 6) Low wet well level for sludge feed.
      - 7) Low washwater pressure.
      - 8) Low air pressure.
      - 9) Discharge conveyor, inclined conveyor, load-out conveyor zero speed switches.
      - 10) Polymer pump failure.
      - 11) Sludge pump failure.
    - b. Wire all alarms to PLC system for relaying to remote location.
  - 15. Additional stations shall be included as hereinafter specified for other ancillary drives or systems.
- D. Electric Motors furnished with this equipment shall meet the following requirements:

1. Rated for continuous duty at 40°C ambient and insulated with a minimum of Class F insulation, with Class B temperature rise. All motors shall be totally enclosed, fan cooled or non-ventilated. All motors supplied shall be rated at 150% nameplate horsepower of the required horsepower maximum service condition.

## 2.05 AIR COMPRESSOR

- A. A complete pneumatic system shall be provided and shall include an air compressor. This package shall include compressor, motor, valves, air tank, all controls and piping as necessary to provide a complete and operating system. The unit shall include a low-pressure switch, system pressure gauge, and pressure relief. The air compressor will be vertical floor mounted unit, mounted away from the press to eliminate wash down spray. The installation contractor shall supply 316 SST air tubing from the air compressor unit to the press. The compressor shall be 208/240V 1ph.

## 2.06 FLOW METER

- A. The screw press manufacturer shall supply a totalizing flow meter as supplied by Siemens or approved equal. The flow meter shall include a 4" ANSI flange connection, a digital display, and 30 feet of display cord.
- B. The electromagnetic induction flow meter shall generate a voltage linearly proportional to flow for full-scale velocity setting from 2 to 33 feet per second. Standard accuracy of plus output shall be  $\pm 0.5\%$  of rate for all meters.
- C. The meter shall incorporate a high impedance amplifier of 1012 ohms or greater, eliminating the need for electrode cleaning systems the meter shall utilize bipolar pulsed DC coil excitation with auto-integrated zeroing each half-cycle. Manual zero adjustments shall not be required – even at start-up. Power consumption shall be no more than 15 VA, independent of meter size. Input power required will be from 85 to 260 VAC, 46-65 Hz, with DC input option available.
- D. The magnetic flow meter shall be microprocessor based with integral electronics. The electronics shall be interchangeable for all sizes from 1/12" to 78". The housing is to be powder coated cast aluminum with a NEMA 4X rating.
- E. The meter's analog and pulse outputs shall be independently selected by push buttons. The analog output shall be an isolated 4-20mA DC into 700 ohms load. The pulse output shall be an open collector output with a maximum frequency of 1,000 Hz with configurable pulse width (0.5 to 2 sec). An open collector status output shall indicate either system or process error or flow direction. An auxiliary input shall be available to positive zero return. A low flow cutoff will be standard which can be turned on or off by pushbuttons.
- F. A 2-line, 16-digit LCD backlit display shall indicate flow rate and/or total flow. The totalizer value is protected by EEPROM during power outages and utilizes an

overflow counter. The display shall also be capable of indicating error messages such as empty pipe condition, error condition and low flow cutoff.

## 2.07 POLYMER FEED SYSTEM

- A. The press manufacturer shall provide as part of the total dewatering equipment package a polymer feed system capable of automatically metering, diluting, activating, and feeding a liquid polymer with water. Units shall be Fluid Dynamics, Velodyne, or approved equal.
- B. Polymer Make-Down Units
  1. Polymer and water shall be mixed in a chamber designed to create sufficient mixing energy. This design shall include a progressive cavity metering pump, solenoid valve and pressure regulator.
- C. Polymer Feed Pumps
  1. The polymer system shall be equipped with progressive cavity capable of pumping up to 10 GPH. The pump shall be designed with a high viscosity wet end pump capable of pumping neat polymer solution to the mixing chamber. The pump shall be a Seepex, Bornemann, Moyno or approved equal.
  2. The drive motor shall be a variable speed, 1/2 horsepower, complete with an SCR control unit. The SCR control unit shall have local speed adjustment, ON-OFF switch and running indication.
  3. Polymer injection valve on sludge feed line.
- D. Dilution Capability
  1. The primary dilution shall feed into the mixing chamber and shall be capable of 1,800 GPH. The dilution capability shall be adjustable with a clear rotameter with a stainless-steel float. Each flow meter shall be independently adjustable.
  2. Furnish a solenoid valve or ON-OFF control of dilution water supply.
- E. Control Panel
  1. The polymer systems shall be supplied with a NEMA 4X control panel that provides an automated mixing system. The controls for the polymer make-down system shall be supplied in the screw press control panel.
  2. The control panel shall include all timers and relay for a complete manual and auto system. The polymer mixer chamber and metering pump shall turn on and the water solenoid valve shall open.
  3. The polymer feed pump shall include start/stop indicating lights, potentiometer, and local/remote control. The polymer units shall be start and stopped based on the level in the polymer solution holding tanks. The level shall be recorded with pressure level sensors.

4. The polymer mixer and polymer metering pumps shall be provided with start/stop pushbuttons, indicating lights and motor starters.
5. Single phase, 120 volt, 60 Hertz power shall be supplied to the main control panel.
6. All devices within the panels shall be permanently identified. Nameplates shall be made of laminated phenolic materials with a black face and white core.

2.08 SLUDGE FEED PUMP

- A. Pump shall be positive displacement, variable speed, progressive cavity type designed to pump wastewater sludge up to 4% solids.
- B. Sludge Feed Pump shall be progressive cavity, variable speed, positive displacement sludge feed pump. Pump will be capable of 200 GPM at 300 RPM or less and 60 psi discharge pressure. Pump will include 10 HP TEFC drive motor. Pump will be Bornemann, Netzsch, Seepex, Moyno or approved equal.

2.09 EQUIPMENT SKID

- A. The manufacturer shall supply a complete skid-mounted dewatering system. The skid-mounted unit shall be designed to operate as a complete dewatering package. Affixed to the skid shall be the screw press unit, electrical control panel, washwater booster pump, sludge pump, polymer system, and filtrate recycle system. The following items will be mounted remotely with interconnections to be completed by the CONTRATOR: air compressor and discharge conveyors. The frame of the skid shall be channel and I-beam construction, type 304L stainless steel. The skid shall include a 304L stainless steel sump pan. All wiring shall be contained in PVC conduit.
  1. General - The screw press supplier shall mount the screw press unit, electrical control panel, washwater booster pump, sludge pump, polymer system, and filtrate recycle system on a 304L stainless steel equipment skid.
  2. Plumbing - The skid shall be pre-plumbed with SCH 80 PVC on the sludge feed line and 1 1/2" wash water line. All drain pipes will be schedule 40 PVC.
  3. Equipment Skid Frame - The skid side rails shall be constructed of a minimum 10" channel, 304L stainless steel. Internal cross supports will be 304L stainless steel members. The collection pan of the skid will be a 14 gauge, 304 stainless steel filtrate sump.
  4. Skid Design - The equipment skid shall have an operator walkway on both sides of the screw press unit. The walkways shall have aluminum grating over the skid collection sump pan.
  5. Testing - The equipment affixed to the skid will be factory pre-wired to the control panel and all equipment will be pre-plumbed. The system will be tested prior to shipment. Electrical conduit will be pre-wired with PVC conduit to make a complete equipment skid.

**PART 3 INSTALLATION****3.01 INSTALLATION SUPERVISION**

- A. The manufacturer shall provide the services of a qualified factory representative to advise the installing contractor on proper installation, setting, piping, and wiring procedures. The installing contractor is responsible for all interconnections between the supplied equipment and plant utilities, including but not limited to, all piping, valves, wiring, conduits, foundation work, building and concrete work. The manufacturer shall provide one (1) day of onsite service for installation supervision.

**3.02 OPERATION & MAINTENANCE MANUALS**

- A. Five (5) copies of operation and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include detailed operating and maintenance instructions and specifications relative to the assembly, alignment, checking, lubrication, placing in operation, adjustment, and maintenance of each unit of equipment and auxiliaries furnished under this contract, together with complete parts lists and copies of dimension drawings.

**3.03 START-UP SERVICES**

- A. Before the equipment is started up, the manufacturer shall make a thorough inspection of the installation to make sure the press has been installed properly and that all equipment relating to it has been installed according to the needs of the press. The equipment manufacturer shall provide one (1) day onsite over one (1) trip for mechanical check-out and pre-startup inspection.
- B. The manufacturer shall provide two (2) days over one (1) trip of onsite services of a qualified factory representative to place the units in operation. The owner shall assist the manufacturer by starting up and operating all support systems such as water, sludge feed pumping, polymer mixing, electrical power and instrumentation, and other ancillary equipment as needed. The services provided by the manufacturer shall be as detailed in the O&M manuals and shall include at least the following:
  - 1. Check equipment alignment and ensure that there are no unusual internal stresses.
  - 2. Calibrate all instrumentation.
  - 3. Check systems to ensure proper operation.
  - 4. Check lubrication in all drives.
  - 5. Check Motor rotations, etc.
  - 6. Adjust spray wash angles and discharge cone pressure system.
  - 7. Start the drives and assure they are operating properly with no binding and with correct rotation.

8. Ensure that all ancillary systems have been properly adjusted, including polymer and sludge feed.

**3.04 TRAINING SUPERVISION**

- A. During the startup procedures, the equipment manufacturer shall provide training to the owner's employees for proper operation and maintenance of the sludge dewatering equipment.
- B. At a minimum, the manufacturer shall make an additional one (1) follow up training and inspection trip after the equipment has been in operation for at least 60 days.

**END OF SECTION**

**SECTION 11600**  
**SCRAPER TYPE CLARIFIERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF WORK**

- A. There shall be provided Two (2) 55' diameter by 15.0' Side water depth circular spiral blade cage drive clarifiers. The equipment shall include but not be limited to a center drive unit with torque control, walkway and platform with handrail, stationary center influent column, center feedwell, inlet distribution well (IDW), drive cage, rake arms and blades, rotating sludge manifold, scum skimmer(s), scum box, scum baffle, weir plate, anchor bolts and all other appurtenances required or shown on the drawings.
- B. The mechanism shall be capable of removing settled activated sludge solids from the tank floor and delivering them to a central pocket where the sludge shall be removed through the return sludge pumps. A skimming device shall collect floating solids to the scum box to be removed through the scum pumping system.
- C. Clarifier equipment shall be manufactured by:
  - a. ClearStream Environmental, Inc., Sandy, UT
  - b. Walker Process Equipment, Aurora, IL
  - c. Westech Equipment, Salt Lake City, UT

**1.2 WARRANTY**

- A. The mechanism shall be warranted for two year(s) from the time the mechanism is put into service.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Clarification equipment shall be the center drive type supported on a stationary influent column with the flow entering the bottom of the influent column and flowing upwards to the inlet openings at the water surface.
- B. Major Components of the clarification equipment shall include but not be limited to:
  - a. Center drive mechanism, gear motor and overload alarm
  - b. Control panel and electrical controls
  - c. Walkway support with handrail and grating
  - d. Center support / influent column/RAS inlet
  - e. Center drive cage
  - f. Rotating Sludge Manifold
  - g. Feedwell and supports
  - h. Truss rake arms with spiral rake blades and squeegees
  - i. Scum skimmer
  - j. Scum trough
  - k. Weir plate and scum baffle

## SCRAPER TYPE CLARIFIERS

- l. Fasteners and anchor bolts
- m. And all other components necessary for a complete operating system.

### 2.2 GENERAL DESIGN CRITERIA

- A. Design flows (MGD)
  - a. Average Daily: 0.65
  - b. Normal Daily Maximum: 0.75
  - c. Peak: 2.0
  - d. Recycle Design: 0.65
- B. Equipment Design Criteria:
  - a. Diameter (feet): 55
  - b. Side Water Depth (feet): 15.0
  - c. Floor Slope (inch/inch): 1
  - d. Freeboard (feet): 1.5
  - e. Influent column diameter (in): 20
  - f. Feedwell
    - i. Diameter (feet): 10
    - ii. Depth (feet): 4.5
  - g. Scum box width (feet) 4
  - h. Influent Dispersion Well (IDW)
    - i. Diameter (feet): 4.5
    - ii. Depth (feet): 1.5
  - i. Rake arm tip speed (feet / minute): 8 - 10
  - j. Torque Requirements (ft-lbs)
    - i. Continuous Operating 100% (Alarm): 13,000
    - ii. Maximum Overload 120% (Cutout) 15,600
    - iii. Shear Pin Failure Backup 140% 18,200
    - iv. Mechanism Design Strength: 200% 26,000
- C. Drive Design Requirements:
  - a. Mechanism design shall be such that there are no chains, sprockets or bearings below or in contact with the liquid.
  - b. Gearing shall be designed and rated per the current American Gear Manufactures Association (AGMA) Standards.
  - c. Drive shall have a minimum operating life of 20 years at the continuous torque and speed rating listed above.
- D. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and properly match marked for ease of construction.
- E. Fabricated and Structural 304 stainless steel shall be per ASTM standards for structural and fabricated stainless steel.
- F. Minimum metal thickness shall be ¼" for all submerged plate and members unless otherwise specified.



- G. Submittal Requirements:
  - a. Mechanism
    - i. General arrangement drawings showing:
      - 1. All major tank and mechanism dimensions and elevations,
      - 2. Anchor bolts locations,
      - 3. Mechanism loadings on the tank,
    - ii. Engineering calculations showing the mechanism components meet the design torque requirements listed above
    - iii. Engineering calculations showing the walkway and platform meet the design criteria listed in the Bridge Walkway section.
  - b. Drive
    - i. Calculations shall be provided showing the drive components clearly meet the required torque requirements.

## 2.3 EQUIPMENT DESCRIPTION

- A. DRIVE MECHANISM
  - a. The drive mechanism shall consist of an electrical motor, a helical type primary reduction unit, planetary type secondary reduction unit, and a final reduction unit. All components are directly coupled, eliminating chains and V-belts. The drive unit output torque shall be limited by a torque overload protection device and shear pin.
  - b. The primary reduction unit shall be mounted on top of the secondary gear reducer with direct shaft coupling.
    - i. The primary reduction unit shall use helical gearing and be permanently lubricated.
    - ii. The primary reduction unit shall transmit torque to the input shaft of the intermediate gear reducer through a shear pin.
    - iii. The  $L_{10}$  life of the primary gearbox bearings shall be in excess of 100,000 hours at continuous torque rating of the drive unit.
  - c. Secondary reduction unit:
    - i. The Secondary reduction unit shall be a planetary gearbox and permanently lubricated.
  - d. Electrical motor: The drive motor shall be TEFC, 1.15 Service Factor, Class F insulation.
  - e. Torque indication and overload protection:
    - i. The torque overload protection device shall be attached to the primary reduction unit, and activated by the torque reaction of the primary reduction unit.
    - ii. The torque load of the drive unit shall be indicated on a stainless steel 6-inch diameter torque gauge in ft-lbs
    - iii. The overload protection device shall have two switches, which may independently energize an alarm circuit and motor cutoff circuit when the load of the mechanism reaches the customer specified torque settings.
    - iv. The switches shall be enclosed in a NEMA 4X housing.
    - v. In addition to alarm and cutoff, the drive unit is also protected by a shear pin.

## SCRAPER TYPE CLARIFIERS

- f. Corrosion prevention:
  - i. All fabricated steel parts will be abrasive blast cleaned to SSPC 10, near white finish.
  - ii. All external surfaces of fabricated parts shall be coated with one layer of zinc-rich urethane primer, 2.5 to 3.5 mils dry film thickness and one layer of moisture-cure aliphatic urethane, 2 to 3 mils dry film thickness.
  - iii. The standard color is gray.
- g. Design and manufacturing standards: All calculations of gear and bearing life shall be made in accordance with the current AGMA 2001-C95 and ABMA standards. Welding fabrication and design are in accordance with the latest AWS standards. Power train calculations of all components are available upon request in accordance with specification details listed above.
- h. All lubrication shall be of the totally enclosed grease / oil bath design.

### B. CENTER DRIVE PLATFORM

- a. The center drive platform shall provide access to the center drive assembly, lubrication fill and drain pipes, drive torque control and optional electrical control panel.
- b. The platform shall provide 30" clearance around the drive components.
- c. The platform shall consist of Aluminum grating supported by the platform members. Handrail shall be 2 - rail aluminum handrail with aluminum toe boards.

### C. BRIDGE WALKWAY

- a. The walkway bridge shall be constructed of structural 304 stainless steel members or two side structural trusses of welded 304 stainless steel with a 36" wide walkway consisting of Aluminum grating supported by the walkway members. Handrail shall be 2 - rail aluminum handrail.
- b. The bridge shall be supported by the center drive platform and the outer tank wall.
- c. The bridge shall be designed for a total dead load plus a live load of 50 lbs per square foot with the deflection no to exceed 1/360 of the span.
- d. Coordinate bridge connections and interface with connecting walkways with walkway supplier/fabricator. All walkways shall have seamless connections with similar materials, excessive gaps will not be accepted. All materials shall be aluminum or 304 SST.

### D. STATIONARY INFLUENT COLUMN

- a. The influent column shall have a minimum 1/4" wall thickness with the diameter as listed in the Equipment Design Criteria.
- b. The column shall be designed to support the weight of the entire structure resting upon it and to withstand the mechanism design strength criteria.
- c. Influent discharge ports shall be included at the upper end of the influent column. These ports shall diffuse the flow entering the tank and insure low velocity into the Influent Dispersion Well. Influent velocity shall not exceed 1.60 fps at the peak flow rate specified.

## SCRAPER TYPE CLARIFIERS

- d. RAS take-out ports/outlet pipe shall be located near the bottom of the column.
  - e. Two bolt on covers shall be located such that the coupling between the RAS outlet pipe connection can be accessed.
- E. CENTER CAGE
  - a. The center cage shall be a 304 stainless steel box truss construction with connections for the sludge removal arms.
  - b. The cage top shall bolt to the main gear.
  - c. The cage shall be designed to withstand the mechanism's design torque.
- F. ROTATING SLUDGE MANIFOLD
  - a. The manifold shall be attached to the bottom of and rotate with the center cage.
  - b. Sludge from the spiral collector blades shall be directed into ports located on the shell of the manifold. One port is required for each of the rake blades meeting the drum.
  - c. The manifold shall seal at the center column and have means to provide a close fit at the tank bottom.
- G. SLUDGE COLLECTOR BLADES AND SUPPORT ARMS
  - a. The sludge collector arms shall be of 304 stainless steel truss construction with spiral-shaped 304 stainless steel scraper blades and adjustable stainless steel squeegees. Squeegees shall be fastened to the rake blade with 304 stainless steel fasteners.
  - b. The scraper blade shall be designed for sufficient sludge transport capacity to handle the design solids loading rate, with the depth of the blade varying from a minimum at the tank periphery to a maximum at the tank center. Calculations shall be provided to show the design depth and attach angle of the spiral blade.
  - c. Blades shall properly convey settled sludge to the sludge manifold.
  - d. The arms shall be adjustable to assure an even grout thickness over the tank bottom.
- H. INFLUENT DISPERSION WELL
  - a. A rotating circular Influent Dispersion Well shall be of the size indicated in the Equipment Design Criteria. It shall be supported by the cage and diffuse the liquid into the feedwell in a tangential direction through diffusers. The bottom of the well shall extend to within 1 inch of the center column. There also shall be a set of baffles in line with each of the center column discharge ports in order to minimize flow from going straight out the IDW when the ports aligned.
  - b. The diffusers shall:
    - i. be curved at a constant radius,
    - ii. not restrict the flow,
    - iii. extend past the gate opening equal to the opening size,
    - iv. and have a bottom the length of the diffuser.

## SCRAPER TYPE CLARIFIERS

### I. FEEDWELL

- a. The feedwell shall be of the size indicated in the Equipment Design Criteria. It shall be supported by 304 stainless steel supports attached the center cage. The well shall be fabricated of  $\frac{1}{4}$ " 304 stainless steel plate with top and bottom reinforcing angles
- b. The feedwell shall include (4) 4" by 12" scum port openings to allow escape of surface scum inside the well. A removable scum baffle shall be provide over the ports.

### J. SKIMMER

- a. There shall be mounted on the sludge collector arm a skimming device arranged to sweep the surface of the of the clarification compartment once per revolution, automatically removing scum and floating material into a scum box at the tank periphery.
- b. The rotating skimmer shall consist of a 304 stainless steel channel supported and extended tangentially form the feedwell to a recessed adjustable pivoted scum scraper at the tank periphery.
- c. The scum scraper shall consist of aluminum scrapper, double acting hinged connection, support arms, neoprene wipers, outer wear strip and positive means to maintain the blade against the baffle.
- d. The scum scraper shall trap floating scum pushed outwards by the full radius tangential 304 stainless steel scum blade and efficiently deposit the solids into the scum trough.
- e. The scum trough shall be the size indicated in the Equipment Design Criteria and constructed of  $\frac{1}{4}$ " 304 stainless steel plate with a 6" outlet.
- f. Sprayer nozzles shall provide timed and/or continuous scum wash down across the length of the scum box and clarifier. Supply pipe and nozzles shall be Sch 80 PVC or SST construction.

### K. WEIRS AND BAFFLES

- a. The weirs, baffles and baffle supports shall be constructed of a minimum  $\frac{1}{4}$ " 304 stainless steel.
- b. The contractor shall coat all joints and gaps between the walls and weirs with a silicone rubber sealant to prevent leakage.

### L. ANCHOR BOLTS AND FASTENERS

- a. Anchor bolts shall be 304 stainless steel and be furnished the equipment manufacture. All fasteners to be 304 stainless steel.

### M. SURFACE PREPARATION AND COATING

- a. All fabricated steel to be:
  - i. Non-submerged steel: Shop blasted per SSPC-SP6 (commercial blast and primed with an inorganic zinc primer, 3 to 5 mils, DFT.
  - ii. Submerged Steel: Shop blasted per SSPC-SP10 (near white) and primed with an inorganic zinc primer, 3 to 5 mils DFT.
- b. Drive mechanism shall be painted with the manufacture's standard paint system

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Furnish, install, finish, and place into service the clarifier in accordance with the manufacture's recommendation.
- B. Provide factory-trained personnel to check and certify installation and instruct the plant personnel in the operation and maintenance. A minimum of 3 trip(s) for 6 day(s) total shall be provided.
- C. Coordinate all tank connections and supports with pre-stressed concrete tank supplier prior to submittals.

**END OF SECTION**

## 11601 – LABORATORY FUMEHOODS

### PART 1 - GENERAL

#### 1.01 SCOPE AND CLASSIFICATION

- A. Supplier shall provide cabinet-mounted factory fabricated fiberglass-lined laboratory fume hoods with exhaust blower systems. Hoods shall have by-pass design configuration with pre-wired vapor-proof electrical construction. Supplier shall provide all components necessary for fully functional fume hood including hood, base, fan, exhaust dampener required duct work and weather cap.
- B. All hoods shall be 4 feet wide, 33.2" deep and 59" high.
- C. This specification sets the intent for quality, performance and appearance.

#### 1.02 REQUIREMENTS

- A. Laboratory hoods shall be of double wall construction with epoxy-coated, cold-rolled steel exterior with ivory finish and gel-coated fiberglass reinforced polyester internal liner and baffle. Hoods shall have vertical rising sash assemblies shall feature 3/16" thick tempered safety glass sash with single counterbalance sash weight. Sashes shall have a fully open height of 28" and provide a viewing height of 32.15". Hoods shall be provided with an air foil across the bottom of the sash area with 5 rows of perforations to maintain airflow should the operator inadvertently block the airflow. Access for maintenance shall be from both the front and exterior sides of the hood. All hood-mounted service fixtures, where provided, shall be pre-plumbed except for the inlet tubing. All electrical services shall be vapor-proof and pre-wired to a single point internal junction box on the top of the hood. Hood shall be of one piece construction and shall pass through a 40" opening without disassembly.

#### 1.03 QUALITY ASSURANCE

- A. The hood manufacturer shall maintain a testing facility at its place of business for the testing of bench-mounted laboratory hoods in accordance with ASHRAE Standard 110-95. Both hoods and installation shall be in conformance to good construction practice and approved by the owner/user. Only hood manufacturers who have had fume hoods as a principal product for ten years will be considered. The hood manufacturer's manufacturing and test facilities and its quality control procedures must be available for owner/user inspection.

#### 1.04 REFERENCES

- A. The laboratory hoods shall conform to the following regulations and standards:

SEFA - #1 (Laboratory Fume Hoods)  
NFPA - #45 (Fire Protection for Laboratories Using Chemicals 2000)  
section 6-1 through 6- 14  
ASTM-E-84 - Surface Burning Characteristics of Building Materials

ASHRAE - 110-95 (Method of Testing Performance of Laboratory Fume Hoods)

ANSI - Std. Z 9.5 (Laboratory Ventilation)  
UL Standard 3101 (Electrical Wiring)  
UL-1805 (Hood Construction)  
CAN/CSA Standard C22.2 No. 1010.1

1.05 SUBMITTALS

- A. Laboratory hood specification sheets and product manuals shall be submitted by the hood manufacturer upon request. The hood supplier shall submit shop drawings when necessary for clarification. Wiring diagrams for each hood shall be provided.
- B. Sample pieces of the hood exterior wall material, interior liner and baffle material, work surface material, and color selection chips shall be available from the hood manufacturer upon request.

1.06 DELIVERY AND STORAGE

- A. Laboratory hoods and work surfaces shall be delivered adequately protected from damage during shipment.

1.07 WARRANTY

- A. Manufacturer's warranty against defects in material or workmanship on its fume hoods shall be for 1 year from date of installation or 2 years from date of purchase, whichever is sooner, shall include replacement of parts (except lamps) and labor.

PART 2 - PRODUCTS

A. ACCEPTABLE MANUFACTURER-BASIS OF DESIGN

Protector Premier Model 4880100 as manufactured by Labconco Corporation, 8811 Prospect Avenue, Kansas City, Missouri 64132. Equal hoods by Baker, Fisher-Hamilton, Kewaunee, and NuAir are acceptable.

2.02 MATERIALS

- A. Hood exterior construction shall be 20 gauge (or heavier) cold rolled sheet steel or galvanized steel supports. All exterior painted surfaces shall be ivory color, baked on, dry powder epoxy applied electrostatically. Base metal material shall be properly prepared for epoxy coating.
- B. Hood interior liner and baffle shall be molded fiberglass reinforced polyester resin with a white gel coated surface. Nominal thickness shall be 3/16". Flame spread shall be less than or equal to 25 per ASTM E-84.
- C. Corner posts shall be 16 gauge cold-rolled steel with epoxy-coated finish.
- D. Exhaust connection shall be epoxy-coated 316 stainless steel.

- E. Provide all hoods with ceiling enclosures constructed of epoxy-coated steel with ivory color to match hood cabinet.
- F. Provide all hoods with base cabinets which have locking type doors. Exterior finish panel shall be epoxy-coated steel with ivory color to match hood cabinet.
- G. Upon acceptance of bids, provide those hoods with rear exterior finish panel shall be epoxy-coated steel with ivory color to match hood cabinet. Other labs shall have wall type hoods and do not require rear panels.
- H. Hose connectors shall be chemically-resistant, glass-filled polypropylene.
- I. Hood sash shall be 3/16" thick tempered safety glass surrounded by an epoxy-coated aluminum and PVC frame. Sashes must have stopper devices to limit the sash from opening at the 18 inch restriction. Each unit must be initially calibrated by the manufactures representative at a sash height of 18 inches.
- J. Hood service fixtures shall feature 1/4" copper tubing with extruded brass valves and rotating seats, TFE coated silicone bronze stem and TFE packing. Gas valves shall feature brass service lines.
- K. Sash foil shall be 18 gauge epoxy-coated cold-rolled steel and have 5 rows of perforations.

## 2.03 SPECIFIC FABRICATION REQUIREMENTS

- A. Overall exterior dimensional information shall be 48" w x 59" h x 33.2" d with matching 48" x 22" standard height base cabinet. Base cabinet shall have double doors, shelf kit and filler panels.
- B. The bench-mounted laboratory hood with by-pass design shall minimize face velocity fluctuations as the sash is raised or lowered. With the sash positioned six inches above the air foil, the average inflow velocity shall not be less than twice the selected full open face velocity nor greater than three times that amount.
- C. Exhaust air volume for each hood shall be 730 cfm and static pressure losses shall be a maximum of 0.17" esp at 100 fpm.
- D. The exhaust connection for each 4 foot hood shall be 10.81" ID. Each hood shall have only one exhaust connection.
- E. Corner posts shall be pre-punched and plugged to accommodate service connections on each side of hood. For ADA compliance, water shall be supplied to the lower right and gas shall be provided to the lower left of the hood. Right-hand corner post shall have ADA-compliant light and blower switches. A duplex 115v GFCI receptacle shall be provided on the left side below the gas service connection.
- F. Interchangeable removable side panels and removable front panel shall provide access to plumbing fixtures, electrical wiring, and lighting fixtures, where specified on the individual hoods. All services shall be accessible from the front of the hood.



- G. The air foil shall be located directly across the bottom of the sash opening to allow the air to bypass underneath and through the foil and sweep across the work surface to prevent any back flow of fumes escaping from the front of the hood. The foil shall be at least 4" wide and extend back under the sash to prevent closure of the lower by-pass opening when the sash is in the fully closed position. The air foil shall have a large aerodynamic radius to sweep the air into the hood with minimal turbulence and perforated to pull inflow air from beneath so that clean air continually flows over the foil creating a constant protective barrier from contaminants. This airflow shall continue even if blocked by the presence of the operator.
- H. The front and side exterior of the hood shall feature baked on powder epoxy ivory colored paint applied electrostatically.
- I. The liner and baffle shall be one piece molded construction with smooth corners and no access panels. The tamper-resistant, preset baffle shall be one piece molded without slots or need for adjustment. The baffle shall provide uniform draw throughout the fume cavity. Baffle shall be easily removable for cleaning.
- J. The hoods shall have a single vertical-rising sash counterbalanced by a single weight suspended by two vinyl-coated stainless steel cables that pass through ball bearing pulleys. The sash shall operate smoothly without tilting when raised or lowered from either end and shall remain at rest in any open position. All sashes shall be framed with extruded epoxy-coated aluminum and PVC.
- K. The hoods shall be equipped with one cold tap water service fixture on the lower right hand side. Water flow rate shall be 3.5 GPM or 13.25 LPM at 67 psi at full open, 3.5 turns. Fixtures shall be rated at maximum pressure of 200 psi with a working pressure of 125 psi. Coefficient of flow for the valve,  $C_v=0.43$ . Services shall be provided through remote-controlled valves and 6-serration hose connectors located inside the fume hood cavity. Services shall be pre-plumbed except for the inlet tubing using 1/4" copper tubing. Fixture handles shall be plastic and color coded as well as labeled for the designated type of service.
- L. Hoods shall be vapor-proof with high-efficiency, instant-start, T8 fluorescent lighting systems (bulbs included) located behind a laminated safety glass shield on top of the hood liner. The fluorescent light assemblies shall be serviceable from outside the fume hood cavity. Hoods shall be provided with a light switch, blower switch, and all internal wiring to a single point internal junction box. Each 4 foot hoods shall have two 3-foot, 25-watt fluorescent lamps.
- M. Each hood shall have a 115 volt, three-wire polarized and grounded electrical duplex receptacle on the left hand side.
- O. Work surfaces shall be supplied for installation between hood cabinet and base cabinet. Work surface shall include a 6" x 3" oval epoxy cup sink with a 1-1/2" drain connection as well as other sink cutout requirements upon request. Work surface shall have a 1" leading edge radius.

- P. Provide factory installed face velocity alarms with digital display to monitor hood performance.

#### 2.04 FUME HOOD EXHAUST FANS

- A. Fans shall be factory fabricated centrifugal utility vent set type. Provide fans with neoprene isolators, flexible connectors, adjustable belt drives, motor cover, inlet and outlet stainless steel flanges, stainless steel companion flanges, spark resistant construction, TEFC motor, and group 3 epoxy corrosion resistant coating on entire fan. Capacity of fan shall be at cfm and static pressure to provide 100 fpm face velocity through hood at 18" high sash position.
- B. Provide manual duct damper to balance air flow. Install directly into the fume hood collar connecting directly to the exhaust and auxiliary air duct work. Damper shall be PVC and supplied by exhaust hood manufacturer.
- C. Provide a zero pressure weather cap which connects directly to the thermoplastic duct.

### PART 3 – EXECUTION

#### 3.01 INSTALLATION INSTRUCTIONS

- A. Provide a complete set of installation instructions for each hood.

#### 3.03 START-UP and ADJUSTING

- A. Provide factory start-up and adjustment as required to provide correct and efficient operation for its intended use and as required by the manufacturer.

#### 3.05 PROTECTION OF FINISHED WORK

- A. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure during shipment and delivery. Repair or replace any damaged components to owner's acceptance.
- B. Advise contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.

### PART 4 - TESTING CRITERIA

- 4.01 Reverse Airflows and Containment - When tested as "As Manufactured" "AM"), the hood shall provide containment less than or equal to 0.10 ppm when tested per ASHRAE Standard 110-95.
- 4.02 Test Criteria: The following test criteria shall apply when determining the AM performance rating.

Face velocity: 80 or 100 feet per minute  $\pm 20\%$   
 Ambient temperature: 68 to 74 degrees F

Test procedures: Labconco test procedure PH-1-86 copies are available upon request from Labconco Corporation, 8811 Prospect Avenue, Kansas City, Missouri 64132.

- 4.03 Containment Per ASHRAE 110-95 - At a tracer gas release rate of 4 liters per minute, the AM leakage shall not exceed 0.10 ppm (rating = 4 AM 0.10)
- 4.04 Flow Visualization - The following excerpt sections of ASHRAE 110-95 are used to define the AM test criteria for reverse airflow and exhaust capacity.

Install exhaust hood, fan, dampener, duct work and weather cap in strict accordance to the manufacturers instruction.

- 4.05 Flow Visualization - Swab a strip of titanium tetrachloride along both walls and the hood floor in a line parallel to the hood face and 6 inches (152 mm) back into the hood. (Titanium tetrachloride is corrosive to the skin and extremely irritating to the eyes and respiratory system.) Swab an 8" (200 mm) circle on the baffle of the hood on centerline and on each side. Define air movement toward the face of the hood as reverse airflow and define lack of movement as dead air space. Swab the work surface, making sure to swab lines around all equipment in the hood. All smoke should be carried to the back of the hood and out. Test the operation of the lower air bypass air flow opening by running the cotton swab under the air foil. Before going on to the next test, move the cotton swab around in the face of the hood. If there is any outfall, the exhaust capacity test should not be made.
- 4.06 Exhaust Capacity - Ignite and place a 30-second smoke bomb near the center of the work surface, making sure that the hole on the side of the smoke bomb faces into the hood. After the smoke bomb begins to work, pick it up with tongs and move it around in the hood. There should be no visual or odor indications of smoke outside the hood.
- 4.07 Installed Performance - Per ASHRAE 110-95, the "AU" (As Used) requirement involves the design of the room supply system and the toxicity of the materials handled in the hood. The AU specification should be tailored to suit the needs of the laboratory room location.

END OF SECTION

**SECTION 11625**  
**BIOTRICKLING FILTER ODOR CONTROL SYSTEM**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. Furnish all labor, materials, equipment and incidentals required to install and test the biotrickling filter odor control system (System) for the Influent Pump Station and Headworks Screens for Dauphin Island Water & Sewer. System shall be complete with all appurtenances as specified herein.
1. Manufacturer shall furnish odor control System equipment including foul air blower, biotrickling filter vessel, interconnecting ductwork between the blower and biotrickling filter, flexible connectors on the blower inlet and outlet, manual airflow damper, nutrient addition system, water addition system and control panel along with instrumentation and controls for a fully functioning system.
  2. The biotrickling filter System is designed as a once-through, non-recirculating system. If a recirculating system is proposed, any additional equipment, duty/standby pumps, pH probe and transmitters, etc. will be provided for a complete and operating system. The Contractor will be responsible for all changes or modifications to the equipment shown on the project plans and there shall be no additional costs to the Owner for deviations to the equipment shown.
  3. Manufacturer shall provide shop drawings and Operation and Maintenance manuals.
  4. Manufacturer shall provide startup and performance acceptance testing services as specified herein.
  5. Placement, installation, bolting to the pad and connection of ductwork, water piping, drainage piping, power and control wiring provided by Contractor.
- B. The System shall comprise of the following major components:
1. Single or multi-stage biotrickling filter vessels. The FRP vessels shall comprise at least one main module and one top piece and may contain additional modules as the design conditions require. Each media module shall house the structured synthetic media in series and contain a single water/nutrient injection spray system.
  2. Structured, engineered, plastic, synthetic media to optimize mass transfer and facilitate the growth of bacteria necessary for biological oxidation of odorous compounds. The media bed shall be uniform and structured throughout and made entirely of a plastic, synthetic, non-reactive material.

## BIOTRICKLING FILTER ODOR CONTROL SYSTEM

3. A UL, factory-labeled electrical control panel housing a single Programmable Logic Controller (PLC) system and other components required for the control and monitoring of the System.
4. A water panel(s) that houses all components necessary for the control and monitoring of the media irrigation system, including an Automatic Flow Control system with capability to automatically compensate for water supply pressure changes.
5. A single-pass irrigation system to allow the development of heterotrophic bacteria in the upper media zone. Systems that require recirculation will not be considered for this application.
6. Odor control blower(s) to move the odorous air from the source and be able to compensate for all pressure losses at the design airflow.

### 1.02 CONTRACTOR RESPONSIBILITY

- A. Installation of all Manufacturer-supplied equipment components, which includes among others, receiving, offloading, placement and bolting of all equipment to the concrete pad, connection of ductwork, water piping, drainage piping, and power and control wiring, all in accordance with the Manufacturer's installation instructions.
- B. If applicable, onsite storage and maintenance of all equipment, suitably protected, per the Manufacturers written instructions, from weather and any conditions that could adversely affect the material from its intended function.
- C. Supply of all odorous air ductwork including flex connectors and damper valves upstream of the blower.
- D. Site preparation and clearing.
- E. Construction of concrete equipment pad for placement of the biotrickling filter and supply of system anchor bolts.
- F. External water piping and drain piping to and from the biotrickling filter and Water Control Panels.
- G. Power supply to the electrical control panel, power to the odor control blowers and connection of all ancillary instrumentation mounted remotely to the System Control Panels.
- H. Installation of any additional items as noted on the contract drawings.
- I. Heat tracing and insulation of any air ductwork, water pipes/tubes, and/or nutrient storage tanks as required by this Specification or elsewhere in the Contract Documents.

J. Adjusting and Balancing of all upstream odor sources.

K. Temporary piping for startup of the system.

### 1.03 PROCESS DESCRIPTION

The odor control system shall remove hydrogen sulfide, organic reduced sulfur compounds (RSCs) and/or other odorous compounds from the foul air stream, as required per Section 2.04 below, using a biotrickling filter operating in a counter-current fashion. Co-current systems shall not be allowed.

The foul air shall enter the system at the bottom of each biotrickling filter reactor and flow upward through each of the media layers. The media bed shall be intermittently irrigated from above using suitable reclaimed plant effluent or potable water in a once-through fashion. The water then trickles through the media and is collected in a sump at the bottom of the reactor. The drain water from the system will pass from the sump in the bottom of the reactor vessel and be piped to a discharge point as detailed on the Contract drawings. Systems using recirculation of irrigation water through the reactor vessel shall not be allowed.

The hydrogen sulfide is oxidized by the autotrophic bacteria resident on the lower media layer(s). Because of the once-through irrigation configuration, a neutral-pH area of the media will be established, near the top of the media, providing conditions suitable for heterotrophic bacteria to oxidize other organic odorous compounds as required.

### 1.04 REFERENCES

The following is a list of standards which may be referenced in this section:

- A. ASTM E679: "Standard Practice of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits".
- B. EN13725-2003 - Air Quality - Determination of Odor Thresholds by Dynamic Dilution Olfactometry
- C. ASTM D-2563: "Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts".
- D. ASTM D-2583: "Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor".
- E. ASTM C582: "Revision of C582-02 Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment".

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- F. ASTM D-883: "Definition of Terms Relating to Plastics".
- G. ASTM D-3299: "Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks".
- H. ASTM D-2996: "Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
- I. ASTM D 4167 – Standard Specification for Fiber-Reinforced Plastic Fans and Blowers.
- J. ASTM D-4097: "Standard Specification for Contact Molded Glass Fiber Reinforced Thermoset Resin Corrosion-Resistant Tanks".
- K. ASTM D-3982: "Standard Specification for Contact Molded Fiberglass Ducts".
- L. PS 15-69: National Bureau of Standards Voluntary Product Standard "Custom Contact Molded Reinforced Polyester Chemical Resistant Process Equipment".
- M. American National Standards Institute (ANSI).
- N. American Society of Mechanical Engineers (ASME).
- O. Institute of Electrical and Electronic Engineers (IEEE).
- P. National Electrical Manufacturers Association (NEMA).
- Q. National Electrical Code (NEC).
- R. National Fire Protection Agency (NFPA).
- S. National Bureau of Standards (NBS).
- T. Underwriters Laboratories (UL).
- U. American Society for Testing and Materials (ASTM).

### 1.05 SUBMITTALS

- A. The Manufacturer shall submit information as required to show complete compliance with these specifications. Submittals shall be provided as one (1) hard copy and one (1) digital copy. At a minimum, this information should include the following:
  - 1. A detailed list of any and all deviations and/or exceptions from this specification along with an explanation for the deviation/exception. Clearly list all benefits to the owner and the dollar (\$) figure refund due to the owner for the exception.

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2. References for fifteen (15) systems using the proposed synthetic, biological stage media, treating a minimum of 2,000 cfm and that have been in operation for at least ten (10) years.
3. Manufacturer's catalog/data sheets and descriptive literature for each piece of equipment supplied.
4. Technical data on each major piece of equipment including weights of all items greater than 200 lb.
5. Structural calculations and drawings for the main reactor vessels, to include wind and seismic load calculations, dead loads, live loads and anchor bolt sizing. Consideration shall be given to the effect of all cutouts and openings in the vessel. Calculations shall be signed and sealed by a Professional Engineer licensed in the State of Alabama.
6. Modeling results, in graphical format, with velocity contour plots at 24" media height over the entire media cross section shall be provided to confirm that the airflow through the media is homogeneous at the average airflow rate. For the purpose of this specification, homogeneous is defined as being when the upflow velocity over the entire media cross sectional area is equal to the average upflow velocity  $\pm 10\%$ .
7. Detailed bill of material complete with material of construction.
8. Dimensional drawings showing elevation and plan views of the System and all applicable connections.
9. Process and Instrumentation Diagram (P&ID) showing all main equipment components, flow rates and instrumentation.
10. Process control narrative.
11. Complete details on the Electrical and Water Control Panels:
  - a. Heat calculations pertinent to installation in Alabama.
  - b. Indemnification certificate for all control strategies and programs made out to the owner.
  - c. Confirmation that all programming is done in-house, and programs are the property of the Manufacturer.
  - d. Details on the in-house Factory Acceptance Testing (FAT) procedures for review and approval of the engineer.
  - e. Description of Automatic Flow Control equipment to demonstrate compliance



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with Section 2.05.I.3.

12. A list of the Manufacturers recommended Spare Parts for one (1) year's operation
  13. Equipment offloading and installation instructions with sufficient detail to allow the Contractor to complete the mechanical and electrical installation of all System components.
  14. Annual utility and nutrient usage calculations (if applicable).
  15. Statement of Manufacturer's Warranty.
  16. Information on hazards associated with the System and appropriate safety precautions, including applicable Material Safety Data Sheets (MSDS).
  17. Proposed Performance Testing Plan, to include a list of sampling and logging equipment and all sampling and testing methods and protocols.
- B. The Manufacturer shall submit the following information, as a minimum, for the Operation and Maintenance Manuals.
1. As-built dimensional drawings showing plan and elevation views of the System and all applicable connections.
  2. As-built Process and Instrumentation Diagrams (P&IDs).
  3. Detailed bill of material along with specification of System components and materials of construction. The list to include the make, model number and descriptive literature of all items furnished by the Manufacturer.
  4. Performance data for the odor control blower, to include curves showing capacity, pressure, horsepower demand and efficiency over the entire operating range, including blower manufacturer's descriptive literature and blower model number(s).
  5. Special precautions for any components or materials associated with the System and its operation that should be subject to particular safety precautions, including MSDS.
  6. Manufacturer's Service Department contact information and service order form.
  7. Statement of Manufacturer's Warranty.
  8. System startup and restart instructions.
  9. Detailed information on proper settings and operation of the Automatic Flow Control System.

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10. Special maintenance procedures, including recommended weekly, monthly and annual preventative maintenance requirements.
11. Troubleshooting guide.
12. Individual Operation and Maintenance instructions for all major system components.
13. O&M manual shall be provided in digital copy for review/comment/approval. After approval, the Manufacturer shall provide two (2) hard copies for the owner's records.

### 1.06 SHIPPING, DELIVERY, STORAGE & HANDLING

- A. All equipment and materials shall be properly protected such that no damage will occur from the time of shipment until the time of installation.
- B. All exposed openings shall be protected to prevent entrance of debris, moisture or water during transportation and storage.
- C. Contractor shall be responsible for offloading all shipped equipment and shall inspect all equipment upon arrival. Contractor shall notify the Manufacturer within 24 hours of any damage to equipment or surface finish due to shipping.
- D. Contractor shall store all equipment such that, for the duration of the storage period, there will be no deterioration in equipment appearance or performance. Manufacturer shall supply detailed storage instructions, as necessary, at the time of shipment.

### 1.07 WARRANTY

The odor control System Manufacturer shall warrant that the equipment supplied meets these specifications and the performances detailed in section 2.04 and that it is new and unused, free from defects in materials and/or workmanship. This warranty shall be for 18 months from equipment delivery to the job site or 12 months from equipment handover, whichever comes first. In the event that it is determined that a defect exists, at the Manufacturer's discretion, the Manufacturer shall repair or replace the defective components, provided that any such defect was not the result of misuse of the component by the Owner or his agents.

The System Manufacturer shall warrant the biotrickling filter, plastic, synthetic media against defects in material and workmanship for ten (10) years from equipment delivery. In addition, the manufacturer shall warrant the media against shrinking, swelling or plugging (such that the design airflow cannot be achieved). In the event that it is determined that a defect exists, at the Manufacturer's discretion, the Manufacturer shall repair or replace the defective components, provided that any such defect was not the result of misuse of the component by the Owner or his agents. The inability of the System

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blower (s) to provide the full design airflow will indicate failure of the media.

All System Warranties are predicated on operation and maintenance of the System being in accordance with the Manufacturers written O&M manual and inlet conditions being in-line with these specifications. Demonstration of the above will be provided through written logs and records provided by the owner.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

The odor control equipment supplied under this section must be provided by a single Manufacturer who will be solely responsible for the design, delivery and performance of the system. The equipment must be new and unused and meet the detailed specifications and warranty requirements stated herein.

#### 2.02 QUALITY ASSURANCE

The Manufacturer shall be an industry recognized process company specializing in the design, manufacture and operation of biological odor and air emissions equipment utilizing a once-through (non-recirculated) irrigation system.

The System Manufacturer shall have the following full-time employees on staff to ensure proper system support: mechanical engineer, environmental engineer, electrical engineer and a dedicated service department.

Any manufacturer whose main business is FRP manufacturing will not be accepted as a supplier for the odor control system specified herein.

The Odor Control Manufacturer is responsible for the coordination of all equipment specified herein. Systems shall be as manufactured by BioAir Solutions, or pre-approved equal only. Proposal of an unnamed Manufacturer after the bid will not be considered. All approved manufacturers are required to meet the project specifications in full. Being named or approved does not imply deviations from the project plans and specifications are permitted.

The basis for the system design and shown on the project plans are the EcoFilter by BioAir Solutions. While competition is encouraged, the contractor shall be responsible for all changes, modifications, costs and approvals associated with other equipment. There shall be no additional costs to the Owner.

##### A. Experience Requirements

The odor control System Manufacturer shall be experienced in the design, manufacture, installation and operation of biotrickling filters designed to remove hydrogen sulfide and organic RSCs from municipal water and wastewater odor

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sources. The System Manufacturer shall have a minimum of ten (10) years of experience producing substantially similar equipment and shall show evidence of at least twenty (20) systems (using the media specified herein) in satisfactory operation for at least ten (10) years in the United States.

### B. Substitution

Any substitutions or deviations in equipment or arrangement from that shown on the drawings or specified herein shall be the responsibility of the Contractor. Any deviation must be accompanied by detailed structural, mechanical and electrical drawings and additional supporting data for review by the Owner and the Owner's Engineer and must be stamped and certified by a registered Professional Engineer (PE) licensed in the State of Alabama.

All costs associated with the review of substitutions or deviations, and costs to the Engineer or Owner associated with project drawing changes as a result of approval of the substitution, shall be borne by the Contractor. There shall be no additional costs to the Owner due to substitutions or deviations.

### C. Acceptable Manufacturers

Where a Manufacturer's standard equipment name is used in these specifications, the intent is to establish a minimum standard in terms of equipment quality, performance, functionality and experience. Substitutions as detailed above must be pre-approved by the engineer prior to bidding. Request for pre-approval must be received in writing 21 days prior to the bid opening date. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence to the specified manufacturer(s). The pre-approval package must include the following supporting documentation and information –

- A detailed list of any and all deviations and/or exceptions from this specification along with an explanation for the deviation/exception.
- Provide project specific drawings showing arrangement of biotrickling filter, blower and electrical and water control panels.
- Performance data from a minimum of five (5) operating systems demonstrating media elimination capacity  $\geq 33\%$  greater than the proposed system loading.
- Provide project specific Process and Instrumentation Diagram (P&IDs)
- Calculations showing cost of operation – power consumption, water consumption, nutrient consumption, expected biotrickling media life, etc.
- A reference list of ten (10) similar installations with contact names and phone numbers, length of time in operation and volume of air being treated. Provide performance data for each reference, showing H<sub>2</sub>S removal % and % of overall odor removed. Each of the installations must use the same biological stage media as proposed for this project and must be operating a once-through irrigation system.
- Installation list detailing equipment capacity, length of time in service,

## BIOTRICKLING FILTER ODOR CONTROL SYSTEM

performance record and performance records for two installations for a minimum 1 week duration for each system.

- Resumes for in-house Mechanical and Electrical Engineering staff, Process Manager and all in-house Service personnel.
- Local service center details.
- Qualifications of key individuals
- Company financial documentation – D&B report, Bonding Capacity, etc.

In addition, the following may be included to aid the evaluation process -

- Cut-sheets, bulletins, company brochures, etc
- Testimonial or recommendation letters from previous customers
- Published Industry technical papers / bulletins

### 2.03 OPERATING CONDITIONS

The System shall be suitable to treat air coming from a continuous supply from the odor source and all equipment must be suited to the operating conditions to which it will be subjected and the various compounds/substances with which they will reasonably be expected to come into contact. The operating conditions, at a minimum, include the following:

Duty	Continuous air supply and odor source
Location	Dauphin Island, Alabama, Outdoors
Inlet air temperature	55 – 100°F
Inlet relative humidity	60 – 100%
Contaminants	Hydrogen sulfide, organic RSC's, ammonia.

### 2.04 DESIGN REQUIREMENTS

At a minimum, the System shall treat the following and meet the following minimum performance criteria:

OPERATING CONDITIONS AND PERFORMANCE	
Parameter	Design Criteria
Design Airflow Capacity (cfm)	950
Inlet H <sub>2</sub> S Concentration (avg/peak)	300 / 900
Methyl Mercaptan Concentration (avg/peak)	N/A
H <sub>2</sub> S Performance (biological, average)	
Inlet 0 – 20 ppmv	Outlet < 0.1 ppmv
Inlet 10 ppmv – 900 ppmv	≥ 99.5% removal

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OPERATING CONDITIONS AND PERFORMANCE	
Parameter	Design Criteria
VESSEL	
Type	Biotrickling Filter
Number of Vessels	1
Vessel Diameter	8'
Maximum Vessel Sidewall Height	11'
MEDIA	
Number of Irrigation Stages	1
Number of Media Beds	1
Maximum Head Loss, inches w.c.	0.3
FOUL AIR FANS	
Number of Fans	1
Fan Design Airflow (cfm)	950
Maximum fan motor size (hp)	3
Maximum head loss (inches w.c.)	4
Maximum motor speed (rpm)	1,800
IRRIGATION SYSTEM	
Maximum instantaneous makeup flow rate (gpm)	19
Average water consumption (gpd)	5,436

### 2.05 SYSTEM COMPONENTS

#### A. Biotrickling Filter Vessel

The System vessel shall be free standing and, with no exceptions, shall operate in a counter-current manner. Each vessel shall consist of one (1) or more modules containing a synthetic media, uniform and structured throughout and one (1) top piece. Each module shall be constructed from Fiberglass Reinforced Plastic (FRP) and be designed with adequate strength to support the number of required modules. The exterior color shall be CCP base white enamel (W005).

The vessel shall be designed using a minimum structural safety factor of 10 to 1 for pressure and 5 to 1 for vacuum. The vessel shall have bottom knuckle reinforcement and be designed for hydrostatic head load 2 feet above the top of the inlet.

Vessel shall be designed for full bottom support and shall be provided with Type 316 stainless steel hold down lugs. All hold down lugs shall be designed to account for all anticipated loads and shall comply with local code requirements. Furnish all anchor bolts, nuts and washers, which shall be constructed of Type 316 stainless steel.

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Lifting Lugs: Lifting lugs shall be capable of withstanding weight of the empty vessel with a minimum safety factor of 5 to 1. A minimum of three lugs shall be furnished per vessel. Lifting lugs shall be Type 316 stainless steel or FRP and attached to the vessel wall with hand lay-up laminate equal to or greater than the vessel wall thickness.

The biotrickling filter vessel shall be designed and constructed from fiberglass reinforced plastic (FRP) materials with ample structural strength and rigidity for the service required. All integrally molded connections shall be manufactured of the same material. All materials of construction shall be corrosion resistant based on the environment in which they will operate.

### Fiberglass Reinforced Plastic (FRP) Vessel Construction:

1. Vessel shall be of flexible chemical barrier construction, and filament-wound in accordance with ASTM D3299-88, Grade 1.
2. Resins:
  - a) Resins used in laminate shall be premium corrosion-resistant, suitable for the intended service, and fire-retardant brominated bisphenol A vinyl ester resins to achieve a 25 or less flame spread rating in accordance with ASTM E84.
    - 1) Resin shall be Hetron FR992 or FR992SB, as manufactured by Ashland Chemical Company, DeraKane 510A or 510C, as manufactured by Dow Chemical Company, Dion 9300 FR, as manufactured by Reichold, Vipel K022- CC or K022-CN, as manufactured by AOC, or approved equal
    - 2) Fire retardant resin to meet Class 1 flame spread rating of 25 or less.
    - 3) Selected resin shall be used for fabrication throughout the entire vessel. Use of more than one resin during fabrication is not acceptable.
    - 4) No dyes, pigments or colorants shall be used except in the exterior coat.
    - 5) The resin shall not contain fillers or thixotropic agents unless otherwise specified.
  - b) Ultraviolet absorbers shall be added to the surfacing resin to improve weather/UV resistance of the vessel. No fillers or thixotropic agents shall be added. Exterior coating shall not be applied until after inspection of the laminate has been completed.
  - c) All cut edges shall be sealed with a resin coating of the same resin as used in the fabrication. The resin shall contain paraffin.
3. Curing System: Vessel shall be cured using a MEKP procedure and in accordance with the recommendations of the resin manufacturer, including post cure temperatures and times. Provide letter from the resin manufacturer, stating that the resin will meet the performance requirements stated herein, that the resin is

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suitable for the service conditions specified herein and fabrication technique proposed and recommended post-cure method.

### 4. Reinforcement:

- a. Synthetic surface veil shall be Veil-Nexus 1012 (apertured) as manufactured by Burlington Industries, Precision Fabrics Group or equal.
- b. Chopped strand mat shall be Type E glass, minimum 1-1/2 ounces per square foot, with silane finish and styrene soluble binder.
- c. Continuous roving used in chopped gun shall be Type E glass.
- d. Woven roving shall be Type E glass, nominal 24 ounces per square yard, with a 4 by 5 weave and a silane-type finish.
- e. Continuous roving used for filament winding shall be Type E glass, nominal 110 strands per pound, with a silane-type finish.

### 5. Laminates:

- a. Laminates shall consist of a corrosion-resistant resin-rich inner surface, an interior corrosion barrier, an exterior structural layer and an exterior layer. Composition specified for inner surface and interior corrosion barrier is intended to achieve optimum chemical resistance.
- b. Laminates shall meet the requirements of the mechanical properties and visual acceptance criteria in ASTM D2563, Level II and RTP 1.
- c. Corrosion-resistant resin-rich inner surface shall be reinforced using a single apertured Nexus synthetic veil. Minimum resin-rich inner surface thickness shall be 10-20 mils. Thixotropic agents shall not be used for this service. Glass content of resin-rich inner surface shall be 10 percent plus or minus 5 percent by weight. Resin content of the inner surface shall be a minimum of 80 percent by weight.
- d. Interior corrosion barrier shall be a minimum of 100 mils of Type E chopped strand mat to a total of 3 ounces/sq. ft. The interior corrosion barrier shall be applied by either the hand lay-up technique, filament winding, or chopper gun. Chopper gun is only permitted if an automated process is used. Manual operation of chopper gun shall not be permitted. Glass content of interior corrosion barrier shall be 27 percent plus or minus 5 percent by weight.
- e. Exterior structural layer shall be fabricated using a filament wound technique with continuous strand roving. Glass content of exterior structural layer shall be between 50 and 80 percent by weight.
- f. Exterior layer shall be reinforced using a single glass veil with a layer of chopped strand mat followed by a clear resin rich 10 mil thick coating similar to the inner surface. Topcoat shall be pigmented parafinized gel-coat with ultraviolet inhibitors. The pigmentation color shall be as directed by the Owner. There shall be no glass fibers exposed.
- g. Vessel wall shall be reinforced around all openings and connections.

### B. Media Support System



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1. The media support system shall be a slotted beam or a vinyl ester FRP grate, suitable for supporting a bed of tower media under all conditions of operation, including a flooded bed condition. Media support system shall be constructed of corrosion-resistant materials.
2. The free area shall be greater than of 95 percent of the cross-sectional area of the tower. The opening size shall not allow the passage of any media.
3. Apply vinyl ester resin, as specified in Part 2.03.4 above, to any field cut edges of FRP media support beams or grating to prevent corrosion and degradation.

### C. Biotrickling Filter Media

The structured media shall be EcoBase®, high porosity, chemically resistant, engineered, plastic, synthetic porous material made from polyvinyl chloride, polyethylene or polyurethane. Organic media, carbon derived lava rock or lava rock media and/or random synthetic or non-synthetic inorganic media materials shall not be allowed.

The media characteristics (available surface area, density, and pressure drop) shall be structured and uniform throughout the media bed with pre-manufactured, engineered flow channels. Random media types (chips, clay balls, foam cubes, etc.) shall not be allowed.

The media shall have a minimum available specific surface area of 230 ft<sup>2</sup>/ft<sup>3</sup> and a void opening of more than 96%. Pressure drop shall not exceed 0.01" w.g. per ft of media depth.

The media shall be guaranteed not to clog or require cleaning, scrubbing, backwashing, acid-washing or replacement for a period of ten (10) years.

Media beds / stages shall be self-supporting, enclosed in a shell or otherwise removal as a single piece. Entry into the vessel shall not be necessary for media removal.

Media shall resist compaction or swelling due to varying moisture levels and shall not degrade when subjected to low pH (i.e. pH < 2) conditions.

The uniform structure of the media shall minimize the potential for short circuiting and encourage a uniform water and air flow pattern over the entire media cross sectional area.

The manufacturer shall provide evidence that the airflow through the media at 24" height from the bottom of the media is homogeneous at the average airflow rate. For purposes of this specification, homogeneous is defined as being when the upflow velocity over the entire media cross sectional area is equal to the average upflow velocity  $\pm 10\%$ . The airflow modeling results with velocity contour plots at 24" media height over the entire cross section shall be provided in graphical format as part of the

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Submittal requirements.

Sufficient media shall be provided to ensure the performance requirements listed in section 2.04 are met.

Media shall be pre-installed in the FRP module (s) by the system manufacturer prior to shipment to the job site. Medias that require a contractor for installation or placement are not permitted.

### D. Irrigation System

Each reactor shall be configured with at least one (1) irrigation point which shall distribute the irrigation water evenly over the entire upper surface of the media layer.

The irrigation system will, without exception, be a once-through system. Recirculated systems will not be considered for this application.

Each spray nozzle shall be tested by the Manufacturer and a certificate of conformity supplied with the shop drawings to show that the nozzle has been tested and meets the specified standards for uniform distribution.

The irrigation system shall be supplied with a nutrient addition system to provide the macro and micronutrients required by the bacteria for optimal metabolism of the odorous compounds being treated.

### E. Control System

#### 1. Electrical Control Panel (ECP)

The ECP enclosure shall be NEMA 4X and constructed of 316SS, and the panel shall come with a 316SS panel stand.

The ECP shall house the necessary electronic components and an Allen Bradley MicroLogix 1400 PLC with PanelView 800 (HMI) for the control and monitoring of the irrigation system. The system shall be controlled on the basis of time for the irrigation cycle and irrigation time and shall be adjustable to sustain conditions appropriate to the activity of the bacteria. Dry contacts shall be provided for external notification of alarm status. Alarms, at a minimum, shall be provided for low irrigation water flow, high irrigation water flow, unexpected and no irrigation water flow, no nutrient flow (if applicable) and blower fail. An Ethernet connection shall be provided to allow for remote monitoring/control of the system. There shall be an allowance to manually open the irrigation spray valve (located in the water control panel) for the purpose of routine maintenance checks but the valve should be normally closed.

The system shall contain a PLC with an Ethernet/IP port, two (2) serial ports, on-line editing capability, and a high-speed counter. The PLC shall be expandable

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with up to seven (7) additional input/output modules.

The ECP shall monitor and log water flow and provide the following summary –  
Daily water consumption  
Weekly water consumption,  
No/Low flow alarms

The ECP shall require a single electrical connection of 480V/3Phase/60Hz. Transformers shall be provided as necessary for power and control voltages. A 120 volt, GFCI convenience outlet shall be provided in the ECP.

### 2. Water Control Panel (WCP)

The Water Control Panel shall be constructed of 316SS and be mounted on the common 316SS panel stand, back-to-back with the ECP.

The WCP shall contain a panel heater, valves, motorized ball valves, strainers, instruments and piping for the control of the irrigation system and shall operate from control signals from the ECP.

The WCP shall contain, without exception, a pulse generating, paddlewheel water flow meter. Irrigation water flow shall be monitored and recorded to ensure proper operation and aid in trouble-shooting. Monitoring irrigation water pressure alone is not acceptable.

The WCP shall allow for a single connection to either a potable water source or suitable final effluent plant water source.

Without exception, the WCP shall house a nutrient addition system.

The WCP shall also contain a flexible spray hose with a hand trigger to allow for convenient rinsing of the strainer, filling of the nutrient barrel, and general convenience. A dedicated ball valve shall be provided in front of the spray hose to allow for the operation of the water panel while simultaneously allowing for isolation in case of a leak in the hose.

### 3. Automatic Flow Control System

- a. Without exception, the ECP and WCP shall contain the necessary programming, circuitry, and hardware for an Automatic Flow Control System, which shall have the following features and shall be capable of meeting the Automatic Flow Control System performance test outlined in Section 3.05.C:
- b. The system will periodically monitor the irrigation water flow rate during the irrigation sequence.
- c. If the irrigation water flow rate is outside of the target flow range the irrigation valve will automatically adjust to correct the irrigation water flow rate.
- d. The following parameters shall be operator-adjustable:

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1. Target irrigation flow rate
2. Allowable flow error
3. Amount of valve adjustment when error is detected
4. Flow evaluation period
- e. The following non-adjustable readings shall be shown on the ECP HMI:
  1. Instantaneous irrigation water flow rate
  2. Actual irrigation valve open %

The following will NOT be considered as meeting the Automatic Flow Control Systems requirements:

- a. Systems using irrigation valves that are only capable of fully-open or fully-closed operation. Solenoid Valves do not meet this requirement and are not allowed.
- b. Systems using mechanical-only means of adjusting the irrigation water flow such as manual diaphragm valves, globe valves, pressure reducing or adjusting valves.
- c. Systems that require operator interaction in order to correct the irrigation water flow.

### 4. Nutrient Addition System

- a. When available, secondary plant effluent meeting OC Supplier's standards shall be used in lieu of a nutrient feed system.
- b. A nutrient addition system shall be provided for each odor control System, utilizing the irrigation system to automatically apply a liquid nutrient mixture to the media based on an operator-adjustable cycle.
- c. Provide a minimum of one (1) nutrient feed pump and all associated piping and equipment necessary to deliver the nutrient solution from the tank to the irrigation system. The nutrient feed pump shall be controlled by the System Control Panel. The amount of nutrient dispensed shall be adjustable and shall be automatically proportional to the flow of irrigation/makeup water. The dispenser shall be pre-piped to the water control assembly.
- d. Nutrient feed pump shall be of the solenoid-operated diaphragm type and shall include factory flow monitors to provide alarm contacts for loss of pump operation. The nutrient feed pump shall be located in the water supply panel, and all piping to the irrigation system shall be factory-installed.
- e. Provide one (1) nutrient storage tank, composed of either HDPE or FRP with cover, insulation. Nutrient storage tanks shall be sized for a 30- day supply, based on the required nutrient usage, as calculated by the OC Supplier.

### F. Dampers

1. Flow Control Dampers shall be constructed of vinyl ester resin, of the single blade type complete with channel type frame, close fitting blade, full circumference blade stop, full length 316 stainless steel axle, and bearings. Dampers shall have the same inside dimensions as the connecting piping.

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2. Isolation Dampers shall be constructed of vinyl ester resin, of the single blade type complete with channel type frame, close fitting blade, neoprene or EPDM blade seat and Viton shaft seals, full length 316 stainless steel axle, and bearings. Each damper shall have the same inside dimensions as the connecting piping.
  3. Backdraft Dampers shall be constructed of vinyl ester resin, of the single blade and counter weight type complete with channel type frame, close fitting blade, neoprene or EPDM blade seat and Viton shaft seals, full length 316 stainless steel axle, and bearings. Each damper shall have the same inside dimensions as the connecting piping.
  4. Dampers shall be Belco, BioAir or Swartwout or equal.
- G. Odor Control Blower
5. The blower(s) shall be single-width wheel, single-inlet as designed and manufactured by Verantis, The New York Blower Company or approved equal.
  6. The blower shall be constructed such that all surfaces in contact with the odorous airstream are to be made of corrosion resistant FRP.
  7. All nuts, bolts and fasteners in contact with the gas stream shall type 316 SS.
  8. Blowers shall be AMCA Arrangement 9 or 10. AMCA Arrangement 4, which places the motor shaft in the odorous airstream, is not allowed.
  9. Blower ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance. Blowers not licensed to bear the AMCA Seal for performance shall be tested, at Contractor's expense, in an AMCA Registered Laboratory.
  10. Blower shall be constructed in accordance with ASTM D-4167 standard specification for FRP blowers and blowers to ensure structural integrity.
  11. Blower housing shall be constructed of polyester resin.
  12. Wheel shall be radial, or backwardly-inclined, non-overloading design. Wheel shall be fabricated of vinyl ester resin.
  13. Wheel hub shall be securely fastened to the shaft and completely encapsulated in FRP to ensure corrosion-resistant integrity. Wheels shall be ground and polished carbon steel, encapsulated in FRP.
  14. The blower motor shall be a premium efficiency, Class 1, Div. 2, 480V/3Phase/60Hz electric motor as manufactured by US Electric Motors, Baldor, Reliance or approved equal.

## BIOTRICKLING FILTER ODOR CONTROL SYSTEM

15. Blower shall be equipped with a Teflon shaft seal.

### H. Recirculation System

Systems requiring a permanent recirculation system shall not be allowed.

### 2.06. EQUIPMENT NAME PLATES

Each separate piece of equipment shall be furnished with a unique name plate identifying the Manufacturer, model & serial number, date of manufacture and, if applicable, capacity and any performance limitations. The nameplates shall be Gravograph Gravoply 2 ply plastic and firmly affixed to the exterior surface of the equipment and in a location that is accessible and easily read.

### 2.08. SPARE PARTS

At a minimum, the following spare parts shall be supplied with the equipment.

One (1) set of fuses, one (1) for each fuse rating.

One (1) set of lamp lenses.

One (1) strainer.

Spare parts shall be stored, by the Contractor, on site and shall be handed over to the Owner at equipment handover.

## PART 3 - EXECUTION

### 3.01 FACTORY ACCEPTANCE TEST

#### A. Reactor Vessels

FRP reactor vessel shall be inspected prior to shipping for conformance to the following:

1. Dimensions match those shown on submittal drawings and are within Manufacturer's specified tolerances.
2. Flanges and connections between reactor parts fit securely without improper bending or stressing of parts.
3. Damage or imperfections to paint or fiberglass work, including cracking/crazing are minimal and in accordance with FRP specifications in Section 2.05A.
4. Manufacturer shall keep a record of the quality control document for each reactor vessel(s) that is available to the Engineer upon request.

#### B. Electrical Control Panel

## BIOTRICKLING FILTER ODOR CONTROL SYSTEM

Electrical control panel shall be inspected prior to shipping for conformance to the following:

1. NEMA rating according to Section 2.05D and bear the UL508 label.
2. PLC program and HMI shall be tested for proper communication and functionality.
3. PLC digital and analog inputs shall be electrically tested to ensure input recognition in the proper area of the PLC program.
4. All wiring between panel components and terminal strips shall be checked for proper labeling and connection.

### C. Water Panel

All water panel piping and/or other pre-installed piping shall be tested prior to shipping for conformance to the following:

1. System shall have no leaks when subjected to a pressure test at 80 psi for a minimum of 1 hour.
2. All installed instruments, sensors, pumps, actuated valves, and other electrical components shall be tested for proper operation.
3. All wiring from terminal strips to all electrical components shall be tested to ensure proper wiring.

### D. Spray nozzle

Spray nozzle shall be factory tested to ensure compliance with Manufacturer standards for uniform distribution.

### E. FAT log

Prior to release for shipment, the Manufacturer shall Submit to the engineer for approval the results of the FAT demonstrating that Testing is complete and that the controls are ready for shipment and installation.

## 3.03 INSTALLATION & EQUIPMENT STARTUP

As far as is reasonably possible, all equipment should be pre-assembled prior to shipment, to minimize the need for on-site assembly. Media should be pre-installed by the Manufacturer and certified to meet the specified performance requirements.

Installation of all equipment will be conducted by the Contractor and must be in accordance with Manufacturer's written installation and startup instructions and by

## **BIOTRICKLING FILTER ODOR CONTROL SYSTEM**

workers experienced in the handling of fiberglass vessels, electrical work, plumbing and instrumentation. The final installation must be certified by the Manufacturer as complete and correct.

The Manufacturer shall provide the Contractor with required clearances, tolerances and limitations, such as smoothness/flatness of concrete pad and shall be available to answer questions prior to and during the installation of the equipment.

Once the installation has been certified by the Manufacturer, the Contractor, with assistance from the Manufacturer, shall start the System to begin the biological acclimation period. This startup period shall take no longer than six (6) weeks but at any point during this startup period, at the discretion and direction of the Manufacturer, the contractor shall switch the system over to normal operation. Any minor re-piping or plumbing required will be clearly detailed in the Manufacturer's installation and startup manual and will be performed by the Contractor.

Any special tools or materials required for this startup/acclimation period shall be provided by the Manufacturer.

After satisfactory startup and the corresponding switch over to normal operation, the Contractor shall, in the presence of the Engineer, conduct the performance test as detailed in section 3.05 below.

### **3.04 FIELD PAINTING & CORROSION PROTECTION**

If painted surfaces are damaged during shipment, off-loading or installation, as long as the damage is surface only and in no way affects the integrity of the equipment or its ability to perform, these blemishes, scratches or other imperfections shall be touched up by the Contractor in accordance with instructions from the Manufacturer. Materials used shall be compatible with the original coating material in quality and color.

### **3.05 PERFORMANCE TESTING**

Performance testing shall not commence until the Manufacturer and Engineer agree that the system has been satisfactorily started-up and sufficient time has been allowed for the acclimation of the bacteria.

After the odor control system has been satisfactorily started-up and switched to normal operation, the Contractor shall, in the presence of the Engineer, demonstrate that the system will perform as specified in section 2.04 of this specification.

The Contractor shall provide the Engineer with a written test protocol and the performance test may not be conducted until the test protocol has been reviewed and approved by the Engineer.

The Manufacturer may be present during the performance test and, at its own discretion, may conduct a parallel performance test as long as they do not interfere with the



## BIOTRICKLING FILTER ODOR CONTROL SYSTEM

performance test being conducted by the Contractor.

The Contractor shall supply, install and operate all equipment, sensors and instrumentation required to complete the performance test.

### A. H<sub>2</sub>S Testing procedure

1. Measure airflow into each unit and, if necessary, adjust to the design airflow +/- 10%. Airflow balancing can be conducted by the odor control manufacturer and witnessed by the Engineer and/or Contractor if desired. Airflow shall be measured at the beginning of the test period. The set position on the damper(s) will be marked or noted. Airflow will not change as long as damper(s) remain in position.
2. Measure pressure drop across each biotrickling filter at beginning of test period.
3. Measure temperature of the inlet, outlet and ambient air.
4. Performance test period to begin at a noted time and last for four (4) hours. H<sub>2</sub>S data from the common inlet location and from the outlet of each odor control system will be measured and logged once every 10 minutes to demonstrate performance during test period.
  - a. The inlet H<sub>2</sub>S data will be logged with a pre-calibrated OdaLog gas data logger with appropriate range and accuracy for the inlet air stream (0-1000 ppmv or 0 - 200 ppmv range, 1 ppm display resolution or 0.0 - 50.0 ppmv range, 0.1 ppmv display resolution).
  - b. The outlet H<sub>2</sub>S data will be logged with a pre-calibrated OdaLog gas data logger with appropriate range and accuracy for the outlet air stream. (0.00 - 2.00 ppmv range, 0.01 ppmv display resolution or 0.0 - 50.0 ppmv range, 0.1 ppmv display resolution).

### B. H<sub>2</sub>S Acceptance criteria:

The System's biological H<sub>2</sub>S removal efficiency shall be determined by calculating the average inlet H<sub>2</sub>S concentration and the average outlet H<sub>2</sub>S concentration and using the following formula:  $\text{H}_2\text{S removal efficiency (\%)} = (1 - (\text{average outlet H}_2\text{S concentration} / \text{average inlet H}_2\text{S concentration})) \times 100$ . The system shall have passed the biological stage H<sub>2</sub>S performance test if the H<sub>2</sub>S removal efficiency is 99.5% or more for inlet air H<sub>2</sub>S concentrations  $\geq 20$  ppmv but  $\leq 900$  ppmv, or the average outlet air H<sub>2</sub>S concentration is  $\leq 0.1$  ppmv, whichever is greater.

In the event that the maximum H<sub>2</sub>S concentration during the four (4) hour test period exceeds the maximum allowable H<sub>2</sub>S concentration as listed in this Specification, the H<sub>2</sub>S acceptance criteria shall not apply and the system shall be considered to have passed the performance test.

## BIOTRICKLING FILTER ODOR CONTROL SYSTEM

### C. Automatic Flow Control System testing procedure

In the presence of the Engineer, the Manufacturer shall demonstrate the operation of the Automatic Flow Control System as given below.

1. Review the requirements list given in Section 2.05.D.3 and prove or demonstrate compliance with each point.
2. The following procedure shall be followed for each irrigation valve in the system. The cycle time shall be minimized to allow the procedure to be completed within 30 minutes.
  - a. Open all manually controlled valves allow for maximum flow through the WCP. Set the target irrigation flow rate to 3x the normal irrigation flow rate (to allow the irrigation valve to fully open). Demonstrate that the valve will reach 100% open status within 20 s during irrigation.
  - b. In between irrigation cycles, while the irrigation valve is CLOSED, set the target irrigation flow rate to the proper design irrigation flow rate. Demonstrate that the irrigation valve will automatically close in order to reach the design flow rate within 30 s during its next irrigation cycle.
  - c. Repeat steps a. and b. above for a minimum of 3 additional set points both above and below the normal target irrigation flow rate.
  - d. Set the target irrigation flow rate to the normal target irrigation flow rate. Partially close at least one valve upstream of the modulating ball valve and demonstrate that the irrigation valve will automatically adjust to a more open position in order to reach the design flow rate within 30 s during its next irrigation cycle.
  - e. Return all Automatic Flow Control settings to their normal positions and fully open all upstream and downstream valves. Demonstrate that the system will return to normal flow control operation.

### 3.06 MANUFACTURER'S SERVICES

In addition to being available by phone to assist the Contractor during the offloading, installation, and startup of the equipment, the following Manufacturer's services shall be provided with the number of trips and days on site as a minimum.

Startup assistance	One (1) trip, two (2) days on site
Performance testing assistance/training	One (1) trip, one (1) day on site

Notwithstanding the above, the Manufacturer shall continue to assist the Contractor with questions, issues and remote assistance until the system is properly installed, running satisfactorily and handed over to the Owner.

**END OF SECTION**

**SECTION 11670**  
**TERTIARY PACKAGE FILTER**

**PART 1 GENERAL**

**1.01 EQUIPMENT INCLUDED**

**A. TERTIARY FILTER**

There shall be one Model ADFSP-54-x-6e-pc AquaDisk filter as manufactured by Aqua-Aerobic Systems, Inc., of Loves Park, Illinois. Factory tested and ready for operation. Contractor shall furnish all labor, materials, equipment and incidentals required for installation of the AquaDisk as shown on the drawings and as specified herein.

Each unit will include:

Tank Assembly  
Centertube Assembly with Cloth Media Disks  
Drive Assembly  
Backwash System  
Backwash/Sludge Discharge Assembly  
Valves  
Electrical Controls with Internal Components as specified.  
Vacuum Transmitter  
Pressure Transmitter  
Float Switch

All motors, pumps, and bearings shall be designed for continuous duty and long operating life in a high humidity atmosphere. All motors and pumps shall be 460 volt, 60 hertz, 3 phase.

**B. SPECIFICATION PRECEDENCE**

The valves, equipment, materials of construction and controls specified under this section supersede valves, equipment, materials of construction and controls specified elsewhere in the contract documents. Purchased components such as gear reducers, pumps, motors, valves, and actuators shall be provided with standard recommended manufacturers paint, unless otherwise specified within this section.

**1.02 SERVICE**

The equipment manufacturer shall furnish the services of a factory trained representative for a minimum of 1 trip and 3 eight-hour days at the jobsite to inspect the installing contractor's equipment installation, supervise the initial operation of the

equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance.

If additional service is required due to the mechanisms not being fully operational, at the time of service requested by the contractor, the additional service days will be at the contractor's expense.

1.03 WARRANTY

The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or part which has been altered, applied, operated or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence or accident.

1.04 MANUFACTURING QUALIFICATIONS

The filter supplier shall have experience in the design and manufacture of cloth media filters for a minimum of ten (10) years and shall be able to demonstrate a minimum of fifty (50) installations within the United States in municipal wastewater applications with cloth media.

**PART 2 PRODUCT**

2.01 PERFORMANCE AND DESIGN PARAMETERS

- A. The AquaDisk filter shall be capable of filtering effluent from an SBR process. Design shall be for:
  - 1.5 MGD Average Daily Flow
  - 2.0 MGD Peak Daily Flow
- B. Filter influent total suspended solids (TSS) concentration shall be 10 mg/l daily average and 15 mg/l peak at average daily flow rate.
- C. Filter effluent suspended solids concentration shall not be greater than 5 mg/l based on a monthly average.
- D. Filter influent total phosphorus concentration shall be 2 mg/l daily average.
- E. Filter effluent total phosphorus shall not be greater than 1 mg/l based on a monthly average.

2.02 FILTER DISK TANK

- A. Each tank assembly shall be 316 stainless steel. Entire tank construction shall have a minimum thickness of 10 gauge. Each tank shall be provided with an integral solids waste collection manifold. Each tank drain shall be provided with a threaded manually operated stainless ball valve, manufactured by TCI. Valve shall be provided loose for installation by the installing contractor. Interior: Citric passivated and steam cleaned. Exterior: Commercial sandblast (SSPC-SP6), painted with PPG PSX 805T3/01 (color "satin clear-tinted") 2 coats 3-5 mils total DFT over the entire exterior..

2.03 DRIVE ASSEMBLY

- A. Each filter shall include an adjustable drive assembly with a gearbox, nylon drive sprocket, acetal drive chain with 316 stainless steel link pins, and a 316 stainless steel chain guard. The gearbox shall be parallel in-line helical type, with a 1/2 HP drive motor rated for 460 volt, 3 phase, 60 Hz. Gear reducer shall be Nord or approved equal. Drive motor shall be Nord, Weg, Baldor, or approved equal.
- B. To reduce energy demand, the drive assembly shall rotate the disks only during backwash. Systems requiring constantly rotating disks during filtration will not be acceptable. Belt drive systems or systems with multiple drive units per filter will not be acceptable.
- C. If motors and gearboxes require routine maintenance, and are not accessible from the outside tank side walls, the equipment manufacturer shall provide an internal access platform between the tank side walls and motors and gearboxes

2.04 CENTER TUBE ASSEMBLY

- A. Each centertube assembly shall include a minimum 3/16", 316 stainless steel centertube weldment, driven sprocket, wheel assemblies, 316 stainless steel disk segment rods, and frame and cloth assemblies. Each centertube assembly shall also include a Viton v-ring effluent port seal which provides superior chlorine resistance. Materials other than Viton are not acceptable for seal materials. Systems with swivel joints requiring routine lubrication are not acceptable. The driven sprocket shall be multi segment made of UHMW polyethylene. All fasteners shall be stainless steel.

2.05 FILTER CLOTH ASSEMBLY AND MEDIA

- A. Each cloth disk assembly shall have a minimum of 53.8 square feet of effective submerged filtration area. Each disk shall be divided into no more than six (6) segments and shall be easily removable for service.  
If the wet weight of the filter disk segment is greater than 50 pounds, a lifting mechanism shall be provided.

- B. Each basin shall include six cloth disk assemblies.
- C. Each filter unit shall have a total of: 322.8 square feet of minimum effective submerged filtration area.
- D. Cloths shall be of microfiber pile construction having a nominal filtration rating of 5 microns. Granular media and screens having structured identical openings shall not be allowed. The pile cloth shall be free chlorine resistant cloth.
- E. Cloth filter media must have obtained conditional acceptance under California Title 22 regulations. The approval letter associated with this acceptance must be included with submittals.
- F. The cloth media shall have an active filter depth of 3 to 5 mm to provide additional collisions between solids particles and the media within the media depth, resulting in capture of solids across a broader particle range. The cloth depth shall also provide storage of captured solids, reducing backwash volumes while maintaining an operational headloss. Woven mesh or microscreen type media with no filtration depth are not acceptable.
- G. Individual pile fibers shall be held in place by a support backing integral to the media. To facilitate proper flow of backwash water through the cloth, the medium's back side shall be of open construction consisting of 10% open area at least 50 times larger than the nominal filtration media in any direction. Media that uses sewn in support structures, which have the potential to prevent free flow through the media, shall not be allowed.
- H. Cloth strength is critical to ensure long term performance of the media. Cloth media breaking strength and elongation shall be tested in accordance with ASTM Standard D5035 2R-E method by an ISO certified laboratory specializing in textile testing. Breaking strength shall be in excess of 200 lbf (890 N) in the warp and the weft direction. Elongation shall be less than 10% at 60 lbf (270 N) in the warp and the weft direction. Test reports shall be provided with submittals to demonstrate compliance with this requirement.
- I. To avoid excessive media movement, deformation and folding during backwash, the maximum distance between cloth restraints must not exceed 36 inches.

## 2.06 BACKWASH SYSTEM

The backwash function shall incorporate a pump that draws filter effluent through the cloth as the media rotates past the fixed backwash shoe, thereby removing accumulated solids from the cloth surface. Each disk shall be cleaned by a minimum of two backwash shoes, one on each side. The backwash shoes shall remain in a fixed position. Springs shall be used to maintain the proper tensioning of the backwash shoe against the media surface.

The backwash shoe shall be in direct contact with the cloth to ensure effective media cleaning. Systems utilizing media cleaning mechanisms that do not contact the filter media will not be acceptable. Neither the cloth / support assemblies nor the backwash shoes shall include any gridwork overlays or other interferences that would prevent direct contact of the backwash shoes with the cloth fibers.

The backwash system shall include 316 stainless steel backwash shoe supports with UHMW backwash shoes, 316 stainless steel springs reinforced PVC flexible hose with stainless steel hose clamps, 316 stainless steel backwash manifolds.

2.07 BACKWASH/SLUDGE DISCHARGE ASSEMBLY

- A. Each backwash/waste pump assembly shall include one backwash/waste pump(s), valves and gauges. In the external piping shall be backwash and solids waste valves, recirculation ball valve(s), 3" manually operated flow control gate valve for each pump (this valve can be removed as it is not required for filter operation), vacuum gauge(s), and pressure gauge(s).
- B. The backwash/waste pump(s) shall be shipped loose for field installation by the installing contractor. Backwash piping between the filter tank and pump(s) as well as piping following the pump(s) shall be supplied by the installing contractor. Installing contractor shall supply unions or flanges for service, wiring, and factory installed conduit shall be provided within 3 feet of the pump(s).
- C. The backwash/waste pump(s) shall be a Gorman Rupp model 12B20, externally mounted centrifugal pump. Pump shall be provided with a 3 HP, 460 volt, 3 phase, 60 Hz motor and operate at variable RPM. Pump shall be rated for a maximum flow of 130 gpm at 42.5 ft TDH with 18.5 ft allowable discharge head after losses in internal filter piping have been accounted for. Motor shall be Baldor, Teco, Weg or approved equal. Backwashing shall be initiated by tank water level, timer, or manually through the operator interface. Operator shall have the ability to specify backwash time interval elapses through the operator interface. The backwash water shall be pressurized by the filter's backwash/waste pump for discharging from the filter system. Systems utilizing non-pressurized backwash flow will not be accepted. Backwash pumps using a belt drive shall not be acceptable due to routine tensioning and other maintenance requirements.
- D. One flow meter shall be provided per filter. Flow meter shall be 3" Krohne Enviromag 2100 C series with IFC100 C signal converter integral to flow meter. Output shall be 4-20 mA. The flow meter shall be provided loose to be installed and wired by the installing contractor.

## TERITIARY PACKAGE FILTER

- E. The 2 inch 3-way ball valve shall be threaded with a stainless steel body, stainless ball, and Teflon seats. Valve shall be TCI or approved equal.
- F. The vacuum gauge(s) shall have a minimum 2.5" dial with all stainless steel welded construction, 0-30" Hg vacuum range, liquid filled, 1/4" NPT process connection, 316 stainless steel bourdon tube and tip material, and bronze socket material, Ashcroft or approved equal.
- G. The pressure gauge(s) shall have a 2.5" dial with a black painted steel case, 0-15 psi, heat resistant polycarbonate window, 1/4" NPT process connection, "C" shaped bronze bourdon tube, and brass socket material, Ashcroft or approved equal.
- H. Filtering shall not be interrupted during normal backwashing and solids waste discharge.
- I. Valves

Each filter shall include three 2" backwash valve(s). Valve(s) shall be 3 piece, grooved end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, fullport, installed with painted cast iron Victaulic couplings, with a 115 volt, single phase, 60 Hz, open / close service electric actuator. Valve / actuator combination shall be TCI / RCI (RCI, a division of Rotork), Nibco, or equal. Valve actuator shall include a compartment heater and limit switch feedback to the microprocessor in both the open and closed positions.

Because of fouling that can be caused by stringy material, non full port valves such as butterfly valves or plastic valves shall not be acceptable.

Each filter shall include one 2" solids waste valve. Valve shall be 3 piece, grooved end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, fullport, "installed with" painted cast iron Victaulic couplings, with a 115 volt, single phase, 60 Hz, open / close service electric actuator. Valve / actuator combination shall be TCI / RCI (RCI, a division of Rotork), Nibco, or equal. Valve actuator shall include a compartment heater and limit switch feedback to the microprocessor in both the open and closed positions.

Each filter shall include a solids waste removal system in the floor of the filter tank. The manifold shall be designed to siphon settled solids waste for discharge through the backwash/waste pump. The operation of the solids waste removal system shall be automatic with user adjustable intervals and duration through the operator interface. Filters that are designed without a solids waste removal system will not be acceptable.



2.08 INDIVIDUAL FILTER ISOLATION

- A. Each filter shall include isolation upstream provided by the installing contractor.

2.09 PRESSURE TRANSMITTER

- A. The pressure transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of 0 psi to 5 psi. Unit shall monitor the water level of each filter tank. Transmitter shall be flush mounted to the tank wall. Transmitter shall be an IFM Effector PX series or approved equal.

2.10 FLOAT SWITCH

- A. A float switch shall be furnished to indicate emerging overflow level. The float switch shall be Anchor Scientific Model S40N0-NC. The float shall contain a mercury switch, chemical resistant polypropylene casing hermetically sealed and a PVC #18 AWG three conductor cable. Switch rating shall be 4.5 amps non-inductive at 120 Vac.

2.11 VACUUM TRANSMITTER

The vacuum transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of -30 to 0 inHg. Transmitter shall be an IFM Effector PX series or approved equal.

2.12 MISC/SPARE PARTS

- (2) Frame and cloth assemblies.
- (1) Backwash/Sludge waste valve and actuator.
- (1) Viton V-ring effluent port\centertube seal.
- (1) of each PLC I/O module(s) (if applicable)
- At least 1 of each fuse(s), control relay(s), and indicating light replacement bulb(s).

2.13 CONTROL SYSTEM

- A. The automatic and manual controls for operation of the Disk Filter system shall be furnished fully assembled, wired and pre-programmed in a NEMA rated and UL certified control enclosure. Controls shall be provided to control or monitor equipment as described in the contract drawings. The control system shall include the following control components and practices:

2.14 CONTROL PANEL WIRING AND ASSEMBLY

- A. All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor.

- B. All control panel wire shall be 16 AWG multi-strand machine tool wire minimum, with MTW insulation.

Wire colors are as follows:

230 VAC or higher	-	Black
120 VAC control power	-	Red
Neutral	-	White
Ground	-	Green
Power from remote source	-	Yellow
24 VDC (+)	-	Blue
24 VDC (-)	-	White with Blue Stripe

- C. All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing.
- D. Wiring inside the control panel shall be run in PVC wiring duct rated for continuous temperatures up to 122° Fahrenheit. Devices mounted in the enclosure door shall have wires run in spiral wrap to avoid pinch points when opening and closing the door.
- E. Control components mounted internal and external to the enclosure shall be mounted with stainless steel hardware and clearly labeled with a plastic identification nametag. The tag shall be white with black lettering.

## 2.15 CONDUIT

- A. All wiring of pre-assembled and mounted external electrical components to control panels or junction boxes on the tank shall be aluminum metallic construction. Conduit shall be sized for adequate spare capacity. The aluminum conduit system shall be manufactured in accordance with UL6A and ANSIC80.5. All conduits shall be supported at maximum 3 foot intervals with support straps designed especially for installation of conduit. The clamp system shall allow the conduit to expand and contract freely, eliminating bowing caused by varying temperature changes. The aluminum conduit bodies shall be manufactured in accordance with UL514A, and Federal Military Specification WWC-586B. They shall be suitable for classified location use in Class I, Division 2 areas, if installed in compliance with NEC 501.10(B)-2008. Conduit body hubs shall be threaded. Materials shall be copper free aluminum (max. 4/10 of 1% copper content), lightweight, shall be high corrosion resistance, be self-oxidizing, and self-renewing. Blank covers shall be domed for extra wiring space and shall be supplied complete with a neoprene or composition fiber gasket.

2.16 CONTROL PANEL QUALITY ASSURANCE

- A. All Control panels shall be UL certified. Testing by manufacturer's electrical engineering prior to releasing for shipment shall be completed. Testing shall consist of the following:
  - 1. Point to point testing of all wiring prior to application of power
  - 2. Intended supply voltage shall be applied to the enclosure
  - 3. All components shall be tested for proper operation and calibration
  - 4. The PLC and operator interface program shall be loaded and functionally checked
  - 5. All components shall be checked to confirm proper mounting specifications have been followed
  - 6. Enclosure shall be inspected for defects and repaired if necessary
  - 7. All labeling of wires and devices are correct, properly installed and clean
- B. The manufacturer shall finalize the factory panel checkout by completing a controls checklist to document all testing completed above. This document must be signed by Engineering, prior to release for shipment.
- C. Upon the successful completion of the control testing of the enclosure assembly, all applicable documentation (i.e. finalized drawing set, signed control checklist cover page, device data sheets, etc.) shall be placed in the drawing pocket of the enclosure.

2.17 CONTROL ENCLOSURE

- A. The automatic controls shall be provided in a UL listed, NEMA Type 4X 316 stainless steel (14 gauge) wall mounted enclosure that provides insulation and protection for electrical controls and components from highly corrosive environments indoors and outdoors. Enclosure shall include a seamless foam-in-place gasket to assure watertight and dust-tight seal. An internal 3-point latch and 316SS padlocking POWERGLIDE® handle shall be provided. Enclosures shall be unpainted, with a smooth #4 brushed finish. Enclosure shall include a painted white mild steel (12 gauge) sub-panel mounted with collar studs. Enclosure shall be manufactured by Hoffman or approved equal.
- B. The control panel will be factory installed, wired, tested then removed for shipping. The installing contractor shall mount the control panel and re-connect the wiring.

2.18 CORROSION INHIBITOR

- A. Each control enclosure assembly shall be provided with corrosion inhibitors to protect interior electrical components from damage caused by high humidity. The corrosion inhibitors shall be installed prior to shipment to provide protection

during shipment and storage of the enclosure. The corrosion inhibitor shall be Hoffman AHCI5E or approved equal.

**2.19 AIR CONDITIONER**

- A. A thermostat controlled air conditioner with noise suppression shall be supplied to protect control components mounted inside the enclosure from high temperatures, humidity and ambient air contaminants. The air conditioner shall be constructed of brushed finish stainless steel 304 material and provide NEMA 4X Type protection from outdoor and hose-down applications. The air conditioner unit shall use CFC-free or environmentally safe refrigerant that is universally accepted. The air conditioner shall be manufactured by Hoffman or approved equal.

**2.20 MAIN DISCONNECT CIRCUIT BREAKER**

- A. A UL listed, automatic molded case 3-pole disconnect breaker shall be provided in the control enclosure(s). The primary function of the disconnect switch shall be to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. The disconnect breaker shall have a door mounted operating mechanism with trip indication. Power distribution connectors shall be mounted integrally to the circuit breaker for multiple load connections. Integral connectors shall be provided. The disconnect circuit breaker shall be a Square D/HDL, JDL, LDL, MDL, PDL or approved equal.

**2.21 MOTOR STARTER**

- A. A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and monitoring functions for the motor. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and phase imbalance trip.
- B. A full voltage non-reversing IEC Style motor starter shall be provided for motor applications over 15 kW. Each starter shall consist of a circuit breaker, contactor and overload relay. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a minimum 18 kA @ 480VAC and 25 kA @ 240 VAC interrupt rating on short circuit when used in combination with a PowerPact circuit breaker. The starter shall have a mechanical durability of 15 million operations. The solid state

overload relay shall have class 10 tripping characteristics with trip current adjustment, phase loss and unbalance protection.

2.22 VARIABLE FREQUENCY DRIVE

- A. UL Listed Variable Frequency Drive(s) (VFD) shall be provided to control the backwash pump(s) of the filter. The VFD's shall control motor speed via a manual setting. It functions only as a manual adjustment to the motor rpm so that the appropriate backwash rate is provided. The VFD output frequency shall be programmable. The VFD shall be provided in a NEMA Type 20 panel mount package and rated for an operating temperature of -4° to 122°F (-20° to 50°C). The VFD shall have a 65 kA maximum short circuit rating when protected with an Allen Bradley 140M motor circuit protector or Class CC/J fuse. The VFD shall be Allen-Bradley PowerFlex or approved equal.

2.23 TRANSFORMER

- A. A step-down multi-tap transformer shall be supplied when there is a necessity to reduce incoming 3-phase power to 120 VAC single-phase. The transformer power wire connections (incoming and outgoing) shall be protected with a finger-safe cover to protect against accidental contact. Primary and secondary fuse protection shall be provided. Transformer shall be UL listed and of continuous wound construction with vacuum impregnated with non-hygroscopic thermosetting varnish. Transformer shall be Square D 9070T or approved equal.
- B. Properly rated fuses and fuse blocks shall be provided for primary and secondary protection of the transformer. Each fuse shall be equipped with a thermoplastic cover to protect against accidental contact. Clip style fuse block shall be rated up to 600 VAC and 100 amps, dual element, time delay fuses shall be rated up to 600 VAC. Fuse blocks and fuses shall be UL listed. Fuses shall be Littelfuse Class CC or approved equal. Fuse blocks and fuse covers shall be manufactured by Marathon or approved equal.

C. CIRCUIT BREAKERS

All single phase branch or supplementary circuits shall be protected with a single-pole, C-Curve rated circuit breaker. Circuit breakers shall be rated for 240 VAC maximum, 50/60 Hz and UL 489 listed. Supplementary and branch protection circuit breakers shall be Merlin Gerin Multi 9 or approved equal.

D. FUSES

Properly rated fuses and fuse holders shall be provided for protection of individual control devices (discrete and analog signals) mounted outside of the enclosure. Each fuse shall be housed in a hinged type fuse block to protect against contact with the fuse. Fuses shall be rated up to 250 VAC and be

Littelfuse or approved equal. Fuse holders shall be rated to 600 VAC and 30 Amps and be Allen-Bradley 1492 or approved equal.

**2.24 OPERATOR DEVICE**

- A. Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for manual operation of the filter. Transformer type push-to-test pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:

Amber – Alarm active, caution

Green – Valve open, motor running

Red – Valve closed

White - Information

- B. All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Square D 9001 or approved equal.

**2.25 ELAPSED TIME METER**

- A. An elapsed time meter shall be mounted on the front of the control panel for each motor. The meter shall measure motor operation time in hours and tenths. The meter shall be non-resettable, electromechanical wheel type. The meter shall contain solid state electronic circuitry, a quartz crystal for accurate timing, shall be tamperproof and sealed against dirt and moisture, and includes gasket and mounting hardware for NEMA 4X and 12 rating. The meter shall be an ENM model T50B212 or approved equal.

**2.26 HIGH FREQUENCY NOISE FILTER**

- A. A UL listed active tracking filter shall be provided to protect the PLC and HMI power feeds from high-frequency noise and low-energy transients. It shall be designed for a single phase input voltage of 120VAC operating at 50/60 Hz. The unit shall provide surge capacity of 25,000 amps and provide transient protection in all modes (Line to neutral, line to ground and neutral to ground). The noise filter shall be a SolaHD STFV or approved equal.

**2.27 UNINTERRUPTIBLE POWER SUPPLY**

- A. A UL listed uninterruptible power supply suitable for location in a UL 508 panel shall be provided to protect the HMI and PLC from short power outages by switching to an emergency battery backup without data loss or downtime. Nominal input voltage and output voltage shall be 120VAC with an autosensing

input frequency of 47 to 63 Hz. The output power capacity shall be 650W / 1000VA. The UPS shall be provided with an audible alarm and LED status indicators and operate from 32° to 122°F (0° to 50°C). The UPS shall be an Allen Bradley 1609-B1000N.

2.28 GROUND FAULT DUPLEX RECEPTACLE

- A. A UL listed ground fault circuit interrupter (GFCI) duplex receptacle shall be provided within the panel for instrument (e.g. programming terminal, modem, etc.) use only. The receptacle shall be protected with a 5 Amp circuit breaker. The receptacle shall carry a 20A / 120VAC rating. The electro-mechanical circuit interrupter shall be double-pole and trip free (GFCI protection and shall not be overridden by holding reset button). Built-in transient suppression shall protect GFCI's internal circuitry from voltage transients. Receptacle shall be Hubbell DRUBGFI20 or approved equal.

2.29 POWER SUPPLY

- A. A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with 100 or 240 VAC (single and three phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is "OK". The unit shall provide for internally fused input connections, a nominal output current of 2.1A and operate in a temperature range between 14°F and 158°F. The power supply shall be an Allen-Bradley 1606 or approved equal.

2.30 CONTROL RELAY

- A. UL listed control relays for general control purposes shall be supplied with a pilot light to indicate when the coil is in an energized state. The relay socket shall be panel or DIN rail mounted inside the enclosure. The relays shall provide the following ratings: 120VAC coil, 10A contact rating (thermal), 250 VAC insulation rating and 5 million mechanical life cycles. Relays shall be Allen Bradley 700-HK, Square D, or approved equal.

2.31 TERMINAL BLOCK

- A. Standard feed-through screw terminal blocks, DIN rail mounted, shall be supplied for all point to point wiring connections. All terminals shall be numbered per the wiring schematic with printed markers. Terminals shall carry a 600V AC/DC voltage rating. Terminal blocks shall be Allen-Bradley 1492-J4 (35A max) and 1492-J16 (85A max) or approved equal.

2.32 PROGRAMMABLE LOGIC COMPUTER

- A. Automatic operation of the Filter shall be controlled through a programmable logic controller (PLC) mounted inside the main control panel. The PLC components shall consist of a power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include built-in USB and two (2) Ethernet IP communication ports. All input and output points supplied (including unused) shall be wired to terminal blocks. Processor design characteristics shall include: 1.0MB user memory size, real-time clock and calendar, battery backed RAM and an operating temperature range between 32 °F and 140°F. The PLC processor shall be an Allen-Bradley CompactLogix 1769-L30ER or approved equal.

Modular equipment shall be provided to complete the PLC system. These Allen-Bradley components include: 1769-PA4 - Power Supply, 1769-IA16 - Discrete input (16 point) modules, 1769-OW16 - Discrete output (16 point) modules and 1769-IF8 - Analog input (8 point) modules, 1769-OF4CI - Analog output (4 point) modules.

- B. **PLC POWER SUPPLY**  
Input voltage range of 85-265 / 170-265 VAC, 47-63 Hz, maximum inrush current of 30 amps, backplane output current of 4 amps @ 5V or 2 amps @ 24V, internal fuse protection, ambient operating temperature of 32°F to 140°F, Class I, Division 2 hazardous location certified, UL Listed.
- C. **DISCRETE INPUT MODULE**  
Operating voltage of 79 to 132 VAC at 47 to 63 Hz, backplane current draw at 5VDC = 115mA, off-state current 2.5mA maximum, maximum inrush current 250mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
- D. **DISCRETE OUTPUT MODULE**  
Operating voltage of 5 to 265 VAC at 47 to 63 Hz / 5 to 125 VDC, backplane current draw at 5 VDC = 205mA, at 24VDC = 180mA, off-state current leakage is 1.0mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
- E. **ANALOG INPUT MODULE**  
Backplane current draw at 5 VDC = 120mA, at 24VDC = 70mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.
- F. **ETHERNET SWITCH**  
An unmanaged Ethernet switch shall be provided inside the control enclosure to provide connectivity between the PLC, operator interface and plant networking. The switch shall support both 10 and 100 Mbit/s operation. The switch shall



have at a minimum five (5) total ports, four (4) of which shall be copper RJ-45 10/100 and one (1) shall be a multimode fiber optic 100 meg port.

The unit shall be DIN rail mounted and require 24VDC power. Diagnostic LEDs for power and connection status shall be included. The Ethernet switch shall be UL listed and manufactured by Allen-Bradley Stratix 2000 1783-US4T1F, or approved equal.

## 2.33 HUMAN MACHINE INTERFACE OVERVIEW

- A. The control system shall be equipped with a UL listed operator interface that provides control display screens. These screens shall be used by the operator to monitor and control filter status, setpoint and alarm information.
- B. The Interface shall allow the Operator access to adjust the following operating parameters:
  - i. Backwash Interval
  - ii. Backwash Duration
  - iii. Solids Waste Interval
  - iv. Solids Waste Duration
  - v. Number of Backwashes between Solids Waste Interval
- C. The operator interface shall provide information to assist the Operator in assessing the status of the filter system. The interface screen shall display, at minimum, the following parameters:
  - i. Water Level in the Filter
  - ii. Time since last Backwash
  - iii. Time since last Solids Waste Withdrawal
  - iv. Elapsed Time on the Drive Motor
  - v. Elapsed Time on the Backwash/Waste Pumps
  - vi. Total Backwash Time and Cycles
  - vii. Total Solids Waste Time and Cycles
- D. The operator interface shall allow the Operator to:
  - i. Initiate Backwash
  - ii. Control all electric actuated valves.
- E. The interface shall display the alarm history. The alarm history shall include the time and date of the most recent 25 alarms along with the description of the alarm.
- F. The interface shall also display current alarms, including the date, time and a description of the alarm.

- G. As a diagnostic aid to the Operator, the interface shall display the time between Backwashes for the most recent 40 Backwashes.

2.34 HUMAN MACHINE INTERFACE

- A. the operator interface shall be a NEMA Type 12, 13, 4X rated, 6.5" diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 640 x 480 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 7".

2.35 OPERATOR INTERFACE SUNSHIELD

- A. A sunshield constructed of stainless steel 316 shall be mounted over the operator interface to provide protection and visibility of operator screens in outdoor applications.

**END OF SECTION**

**SECTION 11750**  
**ULTRAVIOLET DISINFECTION SYSTEM**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Furnish and install a complete closed vessel, medium pressure, high intensity, ultraviolet disinfection (UV) system as described in this specification and as shown on the Drawings. The Contractor shall be responsible for equipment installation per directions of the Manufacturer. The Manufacturer will be responsible for verification of system installation, start-up, testing, and operation and maintenance training of the Owner's personnel.
- B. The manufacturer shall guarantee that the system shall be capable of disinfecting secondary effluent flow of 2.0 MGD as described in the operating parameters specified herein.
- C. These specifications are intended to give a general description of what is required, but do not cover all details that will vary in accordance with the requirements of the equipment application. It is, however, intended to cover the furnishing, shop testing, delivery, complete installation and field testing of all materials, equipment and all appurtenances required to complete the Work of this Section, whether specifically mentioned in these Specifications or not.

**1.02 SUBMITTALS**

- A. Complete descriptive information for the UV System to be furnished including design criteria, sizing information, type of equipment, number of lamps, modules and trains, and materials of constructions for all components of the UV system.
- B. Shop drawings showing all details of UV System construction including UV reactors, power supply cabinets, on-line mechanical cleaning system, UV intensity sensors, UV transmittance monitors (if required), and related equipment. Minimum clearances for inspection and maintenance of major equipment components shall be shown on the shop drawings.
- C. Detailed wiring and control schematics and layout drawings, including wires, and a description of the operation of all panels.

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- D. All interconnections and interface requirements, dimensions and locations of all major elements of the UV Disinfection System. The maximum separation distances of electrical ballast panels from the UV reactors shall be provided in the submittal.
- E. Complete specifications and parts list for the UV System including materials of construction, painting systems and standards certifications.
- F. List of spare parts, special tools, and supplies furnished with the UV System. The list of special tools shall include those required for checking, testing, parts replacement, and maintenance of UV System components that have been specially design and not routinely carried by maintenance mechanics.
- G. List of tools furnished with the UV System.
- H. Requirements for protection of the equipment during storage prior to installation and after installation prior to startup.
- I. Requirements for routine maintenance prior to startup, and for initial startup and operation prior to acceptance by the Owner.

### 1.03 SUBSTITUTIONS

- A. Shop Drawings shall be provided to demonstrate compliance with the material and process requirements. If any manufacturer desires review as an “or equal”, or in any way takes exception to, or requests a waiver of certain aspects of this specification, the requirements listed here shall be strictly adhered to.
- B. All manufacturers, other than Named Manufacturers shall be required to submit a complete and detailed EXCEPTION-QUALIFICATION PACKAGE to the owner and engineer 21 days in advance of the initial bid date so that approval can be granted by addendum prior to bid at the time of the bid. This package must, at minimum, contain the following:
  - 1. Detailed layout drawings showing the proposed system fitting within dimensions indicated on the drawings with no modifications.
  - 2. Detailed component specifications and catalog cut sheets.
  - 3. Process P&ID Drawing.
  - 4. Detailed list of variations required from original design, referencing appropriate sections of the specifications and locations on the drawings.

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5. History of the closed vessel units for municipal wastewater applications offered, including performance data and experience. History must include a list of all installations in the last 10 years which have received state approval by including contact information for each location for confirmation of successful operational experience. Experience must include a minimum of 5 successful operating sites with same proposed unit.
  6. A detailed plan for Guarantee of System Performance, including a plan for remedies for non-performance and/or non-compliance.
- C. The Owner reserves the right to reject a bid that, in their sole opinion, fails to meet the design intent of the project and/or proposes a substitution that is deemed to be not equal to the specified system.

### PART 2 - MATERIALS

#### 2.01 GENERAL

The Contractor shall furnish and install a complete high intensity, medium pressure disinfection system as described herein. The system shall include, but is not limited to, a stainless steel disinfection reactor, medium pressure, high intensity UV lamps, power, and control equipment. The Contractor shall provide the power source, electrical conduit, electrical conductors, and equipment base supports. The Contractor shall physically install the disinfection reactor, power modules, and control modules according to the Manufacturer's directions and the drawings. The Manufacturer shall be responsible for verification of installation including conductors, electrical hookup of equipment, start-up, testing, and operation and maintenance instruction of the Owner's personnel.

#### 2.02 ACCEPTABLE MANUFACTURERS

- A. Only companies with a minimum of 10 years experience and history with over 50 successful Municipal Wastewater installations of closed vessel medium pressure, high intensity UV systems in North America will be considered. Pre-approved companies are as follows:

Aquionics Inc.  
4215 Stuart Andrew Blvd  
Suite E  
Charlotte, NC 28217

ETS (Evoqua)  
334 Knight Street, Suite 3100  
Warwick, RI 02886-1286

- B. Aquionics is the basis of design, other units may vary with respect to size,

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orientation and electrical requirements. Any UV system selected other than the design basis may require modifications to the layout or electrical systems. Any changes shall be the sole responsibility of the general contractor to incorporate and provide a complete working system, at no additional cost to the Owner. Major modifications to the design will require acceptance by the Engineer.

### 2.03 OPERATING PARAMETERS

- A. System Operating Conditions: UV disinfection system shall meet the performance requirements under the following water quality conditions:

Fluid Evaluation: > 65% transmittance in a 1 cm quartz cell @ 254 nm

Total Suspended Solids: < 10 mg/l

Maximum Particle Size < 30 microns

Iron Concentration: < 0.1 mg/l

Influent Enterococci: < 35,000 mpn/100 ml

Effluent Enterococci: < 35 mpn/100 ml

Minimum Validated RED (MS2) UV Dose at design Flow: 35 mJ/cm<sup>2</sup>

Maximum Flow Rate: 2.0 MGD

Minimum Water Temperature: 32 deg F

Maximum Water Temperature: 113 deg F

- B. UV Disinfection System Design Conditions: UV Disinfection System shall have the following characteristics:

1. Design dose a maximum flow: 35 mJ/cm<sup>2</sup> through one reactor train, assuming lamps at the end of lamp life, and an effluent with a UVT of 65 percent or better.

2. Maximum headloss across the train at maximum flow is less than 5 inches

3. Lamp Life Factor: 0.92

4. Fouling Factor: 0.8

- C. Performance Requirements:

1. Basis for evaluating the dose delivered by the UV system shall be the Manufacturer's 3<sup>rd</sup> party CFD model substantiated by a bioassay of reactor series from NWRI validation testing.

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### 2.04 ULTRAVIOLET DISINFECTION CHAMBER

#### A. UV Reactor

1. The UV system shall consist of one (1) UV reactors. The reactors shall be capable of disinfecting up to 2.0 MGD of wastewater of characteristics described in section 2.03. Open channel systems shall not be considered.
2. The reactors shall have a maximum laying length of 31.5 inches and width of 35.3 inches. Each reactor shall have isolation valves installed upstream and downstream of the UV system.
3. The UV reactor shall be designed to handle a maximum operating pressure of 150 psig, and shall be factory hydrostatically tested to 1.5 times the rated operational pressure prior to shipment.
4. The disinfection reactor shall be the following model: ProLine PQ WW IL 5000

Model	# lamps	lamp type	I/O flange
5000	8	B4035E+	14" ANSI 150 lb

5. The reactors shall be constructed of 316 SS. All wetted parts shall be stainless steel, high purity quartz, Teflon, EPDM and/or Viton. The reactors shall be provided pre-wired and only require field connections from the power/control module(s) to the reactor.
6. UV lamp orientation shall be horizontal and perpendicular to the flow. Lamps shall be protected from contact with the water by high purity quartz sleeves. Lamps shall be removable from either end of the reactor without draining the unit.
7. The reactors shall be designed in such a way that when properly installed and operated there is no possibility of direct operator exposure to UV light from the UV lamps.
8. Piping shall be designed so that the reactor will be full of water at all times during operation.

#### B. UV Lamps

1. Only medium pressure high intensity ultraviolet lamps shall be provided for disinfection. Maximum power consumption per lamp, including the ballast, shall be:

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a. 4.3 kW for B4035E+ lamps

2. The lamps shall be operated by variable output electronic ballasts.
3. Germicidal UV output from the lamps shall not be affected by temperature.

### C. UV Quartz Sleeves

1. The UV quartz sleeve shall be manufactured from Type 200 quartz, the same type used during the 3<sup>rd</sup> party testing of unit.
2. Quartz sleeves shall be open at both ends and sealed by means of an o-ring and Type 316 stainless steel compression fitting.

### D. UV Intensity Sensor

1. One lamp in each reactor shall be equipped with a UV sensor, which measures the UV intensity of that lamp, providing continuous performance verification over the above specified water transmission range.
2. The sensors shall measure only the germicidal portion of the light emitted by the UV lamps as measured from 220 nm and 290 nm. The sensor shall be designed with an accuracy of +/- 8 percent.
3. The wet portion of the sensor port shall have a SS housing, EPDM "O" ring, and a high purity quartz window over the monitor site hole.
4. The sensor shall be unaffected by static, electromagnetic fields, or short-wave radio emissions that comply with current FCC regulations.
5. The sensors shall produce a 4-20 ma signal, which shall be sent to the control module.

### E. Cleaning Mechanism

1. For periodic cleaning of the quartz sleeves and UV monitor probe, the reactor shall be fitted with an automatic/mechanical cleaning mechanism, which shall consist of a SS yoke and Teflon bosses. Each boss shall hold one EPDM molded wiper ring, which fits over the quartz sleeve. Wiper rings shall be replaceable.
2. The cleaning mechanism is electrical/mechanical and shall be operated by



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means of a two-pole bi-directional capacitor driven motor and an acme lead screw. Limit switches shall be provided at the ends of the reactor to signal the control system to stop the motor when it reaches the end of the reactor. No pneumatic cleaning mechanisms shall be acceptable.

3. The cleaning system shall be fully operational while still providing disinfection.
4. The cleaning cycle shall be field adjustable. The cleaning cycle shall be activated from the control system or manually at the operator interface.
5. The cleaning system shall allow for a field upgrade to an online chemical assisted system for future water quality changes with minimal changes.

### F. Temperature Sensor

1. A temperature sensor shall be fitted to the reactor for protection against heat buildup under no or low flow conditions. UV system will shut down and alarm in event of heat buildup in the reactor.

### G. Access Hatch

1. A circular access hatch shall be provided on top of the reactor to allow easy, simple access for visual lamp/sleeve inspection and/or removal of foreign debris from the reactor without removing the lamps or quartz sleeves.

## 2.05 ELECTRICAL/INSTRUMENTATION AND CONTROLS

### A. General

1. For each IL 5000, one power/control cabinet shall be provided. Cabinets shall conform to NEMA 4X (IP56), suitable for outdoor installation in an area protected from direct sunlight with ambient temperature range of 41 to 122°F and an ambient humidity to <95% non-condensing.
2. Cabinets shall be air conditioned and shall be constructed of 304 brushed stainless steel. The cabinets shall be free standing. The cabinet shall be 78.8" H x 59.1" W x 31.9" D.
3. The door of each cabinet shall be electrically interlocked so that the module is de-energized when the door is opened.
4. All wiring within the cabinets shall be harnessed or enclosed in wire

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channel.

5. Incoming circuits shall be protected by circuit breakers. Recommended customer breaker size is >80A.
6. Ballasts shall be of the electronic type designed for operation of medium pressure high intensity lamps. Ballast power shall be variable down to at least 35% of lamp full power.
7. The cabinets shall be located a maximum of 100 ft from UV chamber.

### B. Power Requirements

- 480 3L 60 Hz

Maximum Connected Load: 35 kW @ 100% output.

- 4.3 kW per lamp

### C. Power/Control Cabinet

1. Each UV reactor shall be provided with an Allen Bradley Micro 870 PLC and monitoring system mounted in a single power/control cabinet.
2. Each UV reactor shall be controlled independently. Control of multiple units shall be accomplished through SCADA by others.
3. The power/control cabinet shall contain an HMI mounted at eye level. This HMI shall be an Allen Bradley 7inch touch screen color display. All information, warnings, and alarms shall be presented on the screen for ease of operation. The following information for each reactor will be available on the screen at a minimum:
  - a. Lamp Power Level
  - b. Mode
  - c. Intensity (%)
  - d. UV Dose (mJ/cm<sup>2</sup>)
  - e. Water temperature
  - f. Flow Rate
  - g. Operation hours
  - h. Lamp hours

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- i. Number of Wiper Cycles
- 4. The controller shall have the ability to flow pace and adjust the power level of the lamps automatically based on programmed data and external inputs.
- D. Monitoring and SCADA Interfacing
  - 1. All status and alarm information available on the control HMI shall be available for remote monitoring.
  - 2. The PLC shall be provided with an Ethernet and fiber optic switch to facilitate interfacing and monitoring. The following parameters shall be available (but not limited to) via Ethernet or hardwired signals:
    - a. Remote UV On/Off
    - b. System Ready
    - c. UV Failure (UV Dose or Intensity)
    - d. Lamp Failure
    - e. Wiper Failure
    - f. Water/Cabinet Temperature Overheating
    - g. Any Warning
    - h. Any Alarm
    - i. Remote Wipe
    - j. Remote set power level
    - k. UV Dose – 4-20 mA output (representing dose or UV intensity)
    - l. Flow Rate – 4-20 mA input (from SCADA or others)
    - m. Water Temperature – 4-20 mA input (from UV supplied temp sensor)

### 2.06 SPARE PARTS

- A. The following spare parts shall be supplied with the equipment (no less than enough spares for one chamber). For a ProLine PQ IL 5000 this is:
  - 8 Lamps
  - 8 Quartz sleeves
  - 16 O-ring seals
  - 8 Wiper rings
  - 1 Operator Kit (includes: lamp tester, sleeve removal tool)

**PART 3 - EXECUTION**

**3.01 FABRICATION**

The UV disinfection system specified herein should be factory assembled, to the largest extent possible, complete with all components specified.

**3.02 INSTALLATION**

- A. The Contractor shall install the UV equipment and any instrumentation and accessories including but not limited to online UVT monitors, chemical tanks and pumps for Ultrawipe system.
- B. The Manufacturer shall provide written installation instructions to the Contractor and answer any related questions that the Contractor may have.

**3.03 MANUFACTURER ON-SITE SERVICES**

A Manufacturer's representative shall as a minimum perform the following tasks:

- A. Installation, Start-up, and Testing Services
  - 1. One (1) day for installation assistance, inspection to verify mechanical, structural, and electrical integrity of equipment.
  - 2. Two (2) days for functional and performance testing
- B. Training Services
  - 1. One (1) day for classroom or hand-on equipment training of Owner's personnel.
  - 2. One (1) day of separate trip for operator refresher training (4 to 6 months after start-up).
- C. Provide additional services at no cost to the owner to correct any operational problems due to the design and/or fabrication of the ultraviolet disinfection equipment.

3.04 TESTING

- A. Prior to startup, the Manufacturer shall inspect the installed UV disinfection system for proper alignment, correct operation, proper connection, and satisfactory function of all components.
- B. After startup and as part of the equipment certification process, the Owner shall submit to the Manufacturer one month of collected data as indicated below.
  - 1. Monthly operator's reports for 30 days following start-up.
  - 2. Daily values for:
    - a. Plant flow (at time sample was collected)
    - b. Number of units in operation
    - c. Power level
    - d. Time sample was collected
    - e. Transmittance
    - f. Influent Fecal Coliforms
    - g. Effluent Fecal Coliforms
    - h. Total Suspended Solids
    - i. Dose
    - j. Sample collected by

C. Laboratory Tests

All laboratory tests necessary to confirm the Guaranteed Performance Requirements testing for the UV Disinfection System shall be performed in accordance with the applicable portions of the most recent edition of Standard Methods.

3.05 WARRANTIES

The Manufacturer shall provide a written warranty that provides for:

- A. Full replacement of all defective lamps within the first 2000 hours of operation provided that the system is operated continuously.
- B. Full replacement of components against defects in materials and workmanship for a period of one year from date of start-up not to exceed 18 months from date of shipment.

## ULTRAVIOLET DISINFECTION SYSTEM

- D. Performance warranty as outlined in Section 1.01.

**END OF SECTION**

**SECTION 11811**  
**REFRIDGERATED VACUUM SAMPLER**

**PART 1 GENERAL**

Furnish and install two (2) Wave electronically controlled refrigerated vacuum samplers, as manufactured by Emerald Coast MFG and represented by Aqua Products, Pensacola FL.

**1.01 SUBMITTALS**

A. Submittals:

1. Manufacturer's descriptive literature.
2. Manufacturer's detailed installation instructions.
3. Manufacturer's O&M instructions.

**PART 2 PRODUCTS**

**2.01 SAMPLER DESIGN REQUIREMENTS**

Sampler Body: High impact ABS Plastic

HMI: Integrated 7" color touch screen

Size:	51.5" H x 28.25" W x 27 ' D
Weight (Dry):	220 lbs. approximate
Refrigeration Body:	Fully insulated cabinet
Intake Tubing:	PVC 3/8" ID x 5/8' OD Length: 3 - 200
Containers:	5.0 gal
Operational Temperatures:	-20°F to 125°F
Power Required:	11 5 VAC, 60 H z
Maximum Lift	Vertical lift 29', Horizontal 200'
Sample Transport Velocity:	Greater than 3.75 FPS @ 20' with 3/8' tubing
Repeatability:	+/- 1%
Accuracy:	+/-3%

## REFRIDGERATED VACUUM SAMPLER

Programmable Functions:	Pre/Post-purge, Sample size, Auto shut-off, Delay start, Flow inputs, Sampling interval, Weekly programming
Sampling Modes:	Constant Time/Constant Volume; Random Time/ Constant Volume; Flow/Constant Volume
Controller:	Microprocessor control
Controller Protection:	Nema4X, IP65
Warranty:	Two years from shipment

### PART 3 INSTALLATION

- A. Installation of the sampler shall be in strict accordance with the manufacturer's installation instructions.
- B. Provide manufacturer start-up and training services.
- C. Tubing/piping sleeve from the sampling location shall be buried Schedule 80 PVC sized according to the manufacturer's requirements.
- D. Tubing shall be sleeved in Sch. 80 PVC. Long radius bends shall be installed as to allow easy installation and removal of the tubing.

END SECTION



**SECTION 12350**  
**MECHANICAL GENERAL PROVISIONS**

**PART 1      GENERAL**

**1.01    DESCRIPTION**

- A.      The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

**1.02    SCOPE OF WORK**

- A.      The Work shall include the furnishings of systems, equipment, and materials specified in this Division and as required by Contract Documents to include: supervision, operation, methods, and labor for the fabrication, installation, start-up, and tests for the complete mechanical installation.
- B.      Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as pipe fittings, access panels, and sleeves may not be shown. This Contractor shall be responsible for selecting the equipment to fit the space provided. The location and sizes for ductwork, pipe fittings, sleeves, inserts, and other basic items required by code and other sections shall be coordinated and included for the proper installation of the work.
- C.      Equipment Specification may not deal individually with minute items required such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether specifically called for in the Contract Documents.
- D.      Where the words "provide", "furnish", "include", or "install" are used in the Specification or on the Drawings, it shall mean to furnish, install, and test complete and ready for operation, the items mentioned. If an item is indicated in the Contract Documents, it shall be considered sufficient for including same in the work.
- E.      Where noted on the Drawings or where called for in other Sections of the Project Manual, the Contractor for this Division shall install equipment furnished by Others and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.
- F.      Coordinate with all trades in submittal of shop drawings. Shop drawings shall be prepared clearly indicating all applicable components. Space conditions shall be detailed to the satisfaction of all concerned trades, subject to review and final acceptance by the Engineer. In the event that the Contractor installs his work before coordinating with other trades or so as to cause any interference with work of other trades, the necessary changes shall be made in the work to correct the condition, at no additional cost to the Owner.

## MECHANICAL GENERAL PROVISIONS

### 1.03 CODES AND STANDARDS

- A. Conform to latest edition of governing codes, ordinances, or regulations of city, county, state, or utility company having jurisdiction. Where local codes are not applicable, conform to Standard Plumbing Code; Standard Mechanical Code; Standard Fire Prevention Code and National Electrical Code.

### 1.04 CONTRACTOR'S QUALIFICATIONS

- A. The qualifications of the Mechanical Contractor for this project shall be as follows:
  - 1. The Contractor shall have been in the mechanical contracting business for the last five (5) consecutive years and under their current corporation name with essentially the same corporate officers.
  - 2. The Contractor shall have successfully completed at least two projects of comparable size and scope.
  - 3. The Contractor's main office shall be located within 100 miles driving distance of the project. If the Contractor's office is located more than 100 miles from job site, the Contractor shall submit for approval, 10 working days prior to bidding the job, the name of the service company within a 100 mile radius of the job site, who will be responsible for any/all service required during the warranty period. In either case, the Contractor shall be responsible for having a qualified technician on the job site within 4 hours after receiving a service call.
  - 4. When requested, the contractor shall provide substantiating proof of these requirements.

### 1.05 FEES, PERMITS, AND INSPECTIONS

- A. Secure all permits and pay all fees required in connection with the Work.
- B. Coordinate and provide such inspections as are required by the Authorities with jurisdiction over the site.
- C. Where applications are required for procuring of services to the building, prepare and file such application with the Utility Company. Furnish all information required in connection with the application in the form required by the Utility Company.

### 1.06 ACTIVE SERVICES

- A. Existing active services: water, gas, sewer, electric, are to be located and shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities with jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

## MECHANICAL GENERAL PROVISIONS

### 1.07 SITE INSPECTION

- A. Contractor shall inspect the site to familiarize himself with conditions of the site which will affect his work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the Work required because of Contractor's failure to make this inspection.

### 1.08 OPENINGS, CUTTING, AND PATCHING

- A. Coordinate the placing of openings in the new structure as required for the installation of the Mechanical Work.
- B. When additional patching is required due to failure to inspect work; then provide the patching required to properly close the openings, to include patch painting.
- C. When cutting and patching of the structure is made necessary due to failure to install piping, ducts, sleeves, or equipment on schedule, or due to failure to furnish, on schedule, the information required for the leaving of openings, then provide the cutting and patching as required.

### 1.09 WIRING FOR MECHANICAL EQUIPMENT

- A. Division 26 shall provide power services for motors and equipment furnished by this Contractor to include safety disconnect switches, starters and final connections.
- B. Division 23 shall provide all motors and contactors for equipment furnished under this Division, except where they are an integral part of a motor control center which is provided under another Division.
- C. Provide internal wiring, alarm wiring including for fire protection and/or security, control wiring, and interlock wiring for equipment furnished, to include temperature control wiring.
- D. Coordinate with Division 26 all motors and other mechanical equipment which require electrical services. Provide schedule which shall include the exact location for rough-in, electrical load, size, and electrical characteristics for all services required.
- E. Where motors or equipment furnished require larger services or services of different electrical characteristics than those called for on the Electrical Drawings, this contractor shall coordinate with the electrical contractor and the Electrical Engineer to provide a larger service as required, the cost of which shall be the responsibility of this contractor.
- F. Electrical work provided under Division 23 shall conform to the requirements of Division 26.

## MECHANICAL GENERAL PROVISIONS

### 1.10 SUBSTITUTIONS

- A. Any equipment submitted as "equal" to the basis of design shall be accompanied with a comparison letter from the vendor stating any differences from the equipment being submitted and the basis of design. A letter is also to be submitted from the vendor, on the vendor's letterhead, stating that the vendor has received a copy of the job specifications, all addendums and any necessary drawings.
- B. Substitutions for the scheduled and specified equipment shall only be done with the prior approval of the engineer and shall be obtained in writing. Prior approvals shall be obtained no less than ten working days prior to the bid date. Prior approval shall not relieve the contractor of supplying equipment that meets the specifications, capacities, efficiencies, physical dimensions, etc.

### 1.11 PROTECTION

- A. Special care shall be taken for the protection of equipment furnished. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
- B. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled, or otherwise damaged during the course of such work. Contractor shall arrange with the other Contractors for repairing and refinishing of such areas which may be damaged.
- C. When welding is required inside building, provide one man for a fire watch. Fire watch shall require adequate protection of existing surfaces and observance of lower floors where penetrations exist.

### 1.12 SUBMITTALS

- A. General
  - 1. Submit to Engineer shop drawings and product data required by the drawings and specifications.
  - 2. Contractor shall compile all data including but not limited to ductwork materials and construction details, ductwork layout, manufacturers catalog and product data, controls wiring diagrams and material data, piping, insulation, water treatment, and test and balance.
  - 3. Submit a minimum of 7 copies of data, more if required by the Architect.
- B. Submittal Requirements
  - 1. Prepare submittals compiled in a 3 ring, hard bound, loose leaf binder. The face of the binder shall be clearly marked with the project title and number, the name of the Owner, Architect, Engineer, General Contractor, and this contractor.
  - 2. The first page inside the binder shall provide an index, numerically indicating all sections applicable to this submittal.

## MECHANICAL GENERAL PROVISIONS

3. Separate binders shall be provided for HVAC, plumbing and fire protection trades.
4. Provide tab dividers for each section submitted. In the event an item appears on the drawings not specifically covered by the specifications, provide an additional numeric tab at the end of the index detailing the item and include the submittal data in the binder.
5. All equipment included on the submittal sheets shall be marked to indicate the "Tag" name or number of the equipment as shown on the drawings. The equipment shall be high-lighted, where necessary, to clarify which items are being submitted.
6. For the ductwork submittals, the contractor will be provided with an electronic copy of the mechanical floor plans. Ductwork layout submittals shall consist of one copy on a reproducible medium such as mylar. The drawings shall be on standard size sheets of 24" x 36" or 30" x 42". The reproducible copy shall be returned to the contractor with the engineer's approval stamp and comments.
7. Submit only complete project submittals. Partial submittals or submittals not complying with the above requirements shall be returned to the contractor un-marked and rejected.
8. In the interest of project expediency, the contractor may pre-submit long lead items for pre-approval. However, the contractor shall not be relieved of including the same data as required by submittal binder and shall be included therein.
9. The Contractor may turn in submittals without control drawings if they require a longer production time. All other items shall be included.
10. Provide a tab for items not included and include an explanation of why item is not included in the submittal and the expected submittal date.
11. Review shop drawings and product data prior to submission to Engineer.
12. Verify field measurements, field construction criteria, catalog numbers, and similar data.
13. Coordinate each submittal with work of the project and Contract Documents.
14. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Engineer's review of submittals unless Engineer gives written acceptance of specific deviations.
15. Notify Engineer in writing of deviations from requirements of Contract Documents at time submittals are made. A "deviation" shall be construed to mean a minor change to the sequence indicated on drawings or

## MECHANICAL GENERAL PROVISIONS

specification. A "deviation" is not intended to allow substitutions or product options.

16. Do not begin work which requires submittals until submittals have been returned with Engineer's stamp and initials or signature indicating review and approval. Materials and equipment that were installed prior to being not approved shall be removed and replaced with approved items at no additional cost to other parties.
17. Shop Drawings and/or submittals requiring resubmission to the Engineer due to non-compliance with the Contract Documents and/or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Engineer for review. The Contractor shall ensure the completeness and compliance of the submittal materials and shall reimburse the Engineer at their standard hourly billing rates for review of submittals/shop drawings beyond the second submission.
18. Attention is directed to the fact that Engineer's review is only to check for general conformance with the design concept of the project and general compliance with Contract Documents. No responsibility is assumed by Engineer for correctness of dimensions, details, quantities, procedures shown on shop drawings or submittals.
19. Omission in shop drawings of any materials indicated in Contract Drawings, mentioned in Specifications, or required for proper execution and completion of Work, does not relieve the Contractor from responsibility for providing such materials.
20. Approval of a separate or specified item does not necessarily constitute approval of an assembly in which item functions.

### 1.13 OPERATING AND MAINTENANCE MANUALS

#### A. General

1. Provide three up-to-date copies of shop drawings, product data, and other information described in this Section for use in compiling operating and maintenance manuals.
2. Provide legible submittals made by permanent reproduction copy equipment from typewritten or typeset originals.
3. Pre-punch 8-1/2-inch x 11-inch sheets for standard three ring binders.
4. Submit larger sheets in rolled and protected packages.

#### B. Compilation

1. The Contractor will receive shop drawings, brochures, materials list, technical data of all types, warranties, guarantees, and other pertinent information and will assemble, catalog, and file information in loose-leaf, hardback three-ring binders.

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2. Submittal Format: (Provide each of the following items, as applicable, for each required item or system. Requirements will vary, depending on the equipment. Refer to specific Specification section requirements.)
- a. Item: (Use appropriate Section title.)
  - b. System Description: (Provide a detailed narrative description of each system, describing function, components, capacities, controls, and other data specified, and including the following:
    - (1.) Number of.
    - (2.) Sizes.
    - (3.) Type of operation.
    - (4.) Detailed operating instructions, including start-up and shut-down of each system, with indications for position of all controls, as applicable.
    - (5.) Wiring Diagrams: (Complete wiring diagrams for internally wired components including controls.)
    - (6.) Operating Sequence: (Describe in detail.)
    - (7.) Manufacturers Data: (Provide catalog data sheets, specifications, nameplate data and parts list.)
    - (8.) Preventative Maintenance: (Provide manufacturer's detailed maintenance recommendations.)
    - (9.) Troubleshooting: (Provide manufacturer's sequence for trouble-shooting procedures for operational problems.)
    - (10.) Extra Parts: (Provide a listing of extra stock parts furnished as part of the Contract.)
    - (11.) Warranties: (Provide specific manufacturer's warranty. List each component and control covered, with day and date warranty begins, date of expiration, and name, address, and telephone number of persons to contact regarding problems during warranty period.)
    - (12.) Directory: (Provide names, addresses and telephone numbers of Contractor, its subcontractors, suppliers, installers and authorized service and parts suppliers. Format as follows:)
      - Contractor:
      - Address:
      - Telephone No.:
      - Person to Contact:
      - Subcontractor:
      - Address:

## MECHANICAL GENERAL PROVISIONS

Telephone No.:

Person to Contact:

Installer:

Address:

Telephone No.:

Person to Contact:

Manufacturer:

Address:

Telephone No.:

Person to Contact:

Local Service Representative:

Address:

Telephone No.:

Person to Contact:

### 1.14 RECORD DRAWINGS

#### A. Detailed Requirements for Record Drawings

1. During the progress of the work, the Contractor shall require the job superintendent for the plumbing, air conditioning, heating, ventilating, and fire protection subcontractors to record on their field sets of drawings the exact locations, as installed, of all conduits, pipes, and ducts whether concealed or exposed which were not installed exactly as shown on the contract drawings.
2. The Contractor shall submit redline as-built drawings to the Engineer for review.
3. The Engineer shall authorize the Contractor to produce and distribute the redline as-built drawings in PDF format as follows:
  - a. One (1) Computer Disc (CD) to the Engineer.
  - b. One (1) CD to the Architect.
  - c. Three (3) hard copies full size
  - d. Two (2) CD to the Owner.

### 1.15 SUBSTITUTIONS AND PRODUCT OPTIONS

- #### A.
- For products specified only by reference standard, select product meeting that standard, by any manufacturer.



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- B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with specifications.
- C. For products specified by naming several products or manufacturers and stating "or equivalent", "or equal", or "or Engineer approved equivalent", or similar wording, submit a request for proposed substitutions for any product or manufacturer which is not specifically named; for review and approval by the Engineer.
- D. For products specified by naming only one product and manufacturer, there may be an option of an Engineer approval of a product of equal or greater quality or size.

### 1.16 SUBSTITUTION SUBMISSIONS

- A. Contractor's Base Bid shall be per contract documents.
- B. Submit separate request for each substitution. Support each request with:
  - 1. Complete data substantiating compliance of proposed substitution with requirements stated in contract documents:
    - a. Product identification, including manufacturer's name and address.
    - b. Manufacturer's literature; identify:
      - (1.) Product description.
      - (2.) Reference standards.
      - (3.) Performance and test data.
    - c. Name and address of at least two similar projects on which product has been used, and date of each installation.
    - d. Itemized comparison of the proposed substitution with product specified list significant variations.
    - e. Data relating to changes in construction schedule.
    - f. Any effect of substitution on separate contracts.
    - g. List of changes required in other work or products.
    - h. Designation of availability of maintenance services, sources of replacement materials.
    - i. Provide certification of product compatibility with adjacent materials.
- C. Substitutions will not be considered for acceptance when:
  - 1. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor or his supplier prior to bid.

## MECHANICAL GENERAL PROVISIONS

2. Acceptance will require substantial revision of contract documents.
3. In judgement of Engineer, do not include adequate information necessary for a complete evaluation.
4. Substitute products shall not be ordered or installed without written acceptance of Engineer.
5. Engineer will determine acceptability of proposed substitutions.

### 1.17 CONTRACTOR'S SUBSTITUTION RESPONSIBILITIES

- A. In making formal request for substitution, Contractor represents that:
  1. He has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.
  2. He will provide same warranties or bonds for substitution as for product specified.
  3. He will coordinate installation of accepted substitution into the work and will make such changes as may be required for the work to be complete in all respects. This includes revisions due to changes in electrical characteristics, physical size and weight, service requirements, service clearances, etc.
  4. He waives claims for additional costs caused by substitution which may subsequently become apparent.
- B. The contractor shall have included all costs associated with the substitution for the specified products or materials, and that no additional cost will be incurred by any other party in order to fully incorporate the substituted item(s).
- C. The contractor agrees to reimburse the Architect/Engineer for any architectural or engineering re-design that is required by the substitution to be fully incorporated. The reimbursement shall be at the Architect/Engineer's standard billing rate.

### 1.18 ENGINEER DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

### 1.19 FINISHING

- A. General: Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.
- B. Cleaning: At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the mechanical construction. All closed off spaces shall be cleaned of all packing boxes, wood frame members, and other waste materials used in the mechanical construction.

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- C. The entire system of piping and equipment shall be cleaned internally. The Contractor shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris.
- D. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.
- E. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.). All HVAC equipment shall have affixed adjacent to the permanent nameplate, the unit identification on an engraved label with permanent adhesive.
- F. Heating and air conditioning equipment, tanks, pumps, etc., shall be thoroughly cleaned and new filters or filter media installed.

### 1.20 TEST AND DEMONSTRATIONS

- A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.
- B. Prior to acceptance of the mechanical installation, demonstrate to the Owner or his designated representatives all essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The contract shall allow for five (5) working days to perform the demonstrations.
- C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.
- D. Dates and times for performing the demonstrations shall be coordinated with the Owner.
- E. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall bear signatures of contractor and owner.
- F. Training shall include audio/video recording in DVD format turned over to the owner as part of closeout documents.

### 1.21 PAINTING AND IDENTIFICATION

- A. Touch-up paint where damaged on equipment furnished with factory applied finish, to match original finish.
- B. Provide engraved, laminated plastic tags for all equipment. Tags shall be attached with permanent adhesive.

### 1.22 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Provide excavation necessary for underground water piping, etc., and backfill such trenches and excavations after work has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are

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not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe and utility laying, than that which is authorized.

- B. Trenches for piping and utilities located inside foundation walls and to point five (5) feet outside of the wall shall be not less than sixteen (16) inches or more than twenty-four (24) inches wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five (5) feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.
- C. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the barrel will be supported on compacted fill. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell but shall be no larger than necessary for proper jointing. All sewers and piping required for the structure shall be excavated to at least (6) inches below pipe invert.
- D. Immediately after testing and/or inspection, the trench shall be carefully backfilled with earth free from clods, brick, etc., to a depth one-half the pipe diameter and then firmly puddled and tamped in such a manner as not to disturb the alignment or joints of the pipe. Thereafter, the backfill shall be puddled and tamped every vertical foot.

### 1.23 CONCRETE WORK

- A. Provide concrete bases and housekeeping pads for mechanical equipment unless indicated otherwise. Concrete work shall be as specified in the applicable Civil/Site and Structural Sections. Vibration pads, equipment bases, pipe supports and thrust blocks shall be provided by this Contractor.
- B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

### 1.24 ACCESS PANELS

- A. Provide access panels where required and not shown on the drawings for installation by the drywall Contractor. Access panels shall be as specified in the applicable architectural section. All access panel locations which allow access to mechanical equipment shall be approved by the Architect/Engineer.

### 1.25 SLEEVES

- A. Sleeves passing through non-fire rated walls and partitions shall be Schedule 10 black steel.
- B. Sleeves passing through load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 galvanized steel pipe or cast iron pipe.

## MECHANICAL GENERAL PROVISIONS

- C. Sleeves passing through non-load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 PVC or cast iron.
- D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.
- E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.
- F. Pipe to wall penetration closures for underground pipe penetrations of walls shall be "Link-Seal" as manufactured by Thunderline Corporation, or equal.

### 1.26 ESCUTCHEONS

- A. Provide chrome plated escutcheons at each sleeved opening into finished and stainless steel to exposed exterior spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve but not to insulation with set screws or other approved devices.

### 1.27 INSULATION PROTECTION

- A. Where exposed insulated piping extends to floor, provide sheet metal guard around insulation.

### 1.28 ANCHORING OF EQUIPMENT

- A. All equipment located on floor slab, that is not mounted on wheels and is capable of being moved shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficient size to prevent equipment from overturning.

### 1.29 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Water piping shall not be installed in electrical rooms or directly above electrical equipment.

### 1.30 CONNECTIONS FOR FIXTURES AND EQUIPMENT UNDER ANOTHER SECTION OR BY OWNER

- A. Rough all equipment requiring connection to systems provided under this Division. Verify requirements and current locations before proceeding with work.
- B. Make all connections to equipment furnished under another Section or by owner as required to obtain complete and working systems.

### 1.31 SYSTEM GUARANTEE

- A. Work required under this Division shall include one-year guarantee. Guarantee by Contractor to Owner to replace for Owner any defective workmanship or material which has been furnished under contract at no cost to the Owner for a

## MECHANICAL GENERAL PROVISIONS

period of one year from date of substantial completion. Guarantee shall also include all reasonable adjustments of system required for proper operation during guarantee period. Guarantee shall not include normal preventative maintenance services or filters.

- B. At "Demonstration", one-year guarantee provision by Contractor shall be explained to Owner.
- C. All sealed hermetic refrigeration systems shall be provided with five-year factory warranty from date of substantial completion

**END OF SECTION**

**SECTION 12352**  
**MOTOR STARTERS**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    Provide motor starters for all mechanical motor driven equipment not provided with a starter or contactor.

1.02    SUBMITTALS

- A.    Provide catalog cuts for all motor starters. Cut sheets shall be identified as to the equipment it serves, the horsepower rating and accessories provided.

**PART 2      PRODUCTS**

2.01    GENERAL

- A.    Supply motor starters when required for any equipment provided. Starters shall be adequately sized for the motor.
- B.    Provide labels for each starter.
- C.    Provide starters with enclosures suitable for the associated environment, or as specified elsewhere in the documents.

2.02    MANUAL MOTOR STARTER

- A.    Fractional Horsepower  
Provide manually operated toggle switches equipped with melting alloy-type thermal overload protection. Utilize replaceable thermal units of one-piece construction which inhibit starter operation when removed or melted.
- B.    Integral Horsepower
  - 1.    Provide starters equipped with bimetallic or melting alloy-type thermal overload protection, as required.
  - 2.    Provide with operating and indicating equipment as required.
  - 3.    Provide with under-voltage protection if required.

2.03    MAGNETIC MOTOR STARTERS

- A.    Provide starters for full voltage starting, sized in accordance with NEMA standard horsepower ratings.
- B.    Provide starters allowing for a maximum of four external auxiliary normally open or closed contacts.
- C.    Provide starters with coils of molded construction, through NEMA size five. All coils shall be replaceable without removing the starter.

- D. Provide starters with bimetallic or melting alloy-type thermal overload protection. Utilize replaceable thermal units of one-piece construction which inhibit starter operation when removed or melted. Three phase starters shall use three thermal units.
- E. Provide starters with replaceable contacts. Contact replacement shall occur without starter or wire removal.
- F. Provide Hand/Off/Auto switches.
- G. Starters shall be manufactured by Culter-Hammer, or approved equals by Square D, ITE-Siemens, or General Electric.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Provide types of starters as required or specified elsewhere.
- B. Provide with control schemes as specified elsewhere.
- C. Provide overload protection elements sized to the full load current rating of the motor per the motor nameplate.
- D. Install floor mounted units on concrete housekeeping pads in rooms with concrete floors susceptible to flooding.

**END OF SECTION**



## SECTION 12360 - LABORATORY CASEWORK

### 1. GENERAL

#### 1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 2. SUMMARY

##### A. Section Includes:

1. Wood laboratory casework.
2. Filler and closure panels.
3. Laboratory countertops.
4. Tables.
5. Shelves.
6. Laboratory sinks and troughs.
7. Laboratory accessories.
8. Water, laboratory gas, and electrical service fittings.

##### B. Related Sections:

1. Division 6 Section "Rough Carpentry Miscellaneous Carpentry" for wood blocking for anchoring laboratory casework.
2. Division 9 Section "Non-Load-Bearing Steel Framing" for reinforcements in metal-framed partitions for anchoring laboratory casework.
3. Division 9 Section "Resilient Wall Base and Accessories" for resilient base applied to metal laboratory casework.
4. Division 11 Section "Laboratory Fume Hoods" for fume hoods, including base cabinets and countertops under fume hoods.
5. Divisions 15 and 16 Sections for installing service fittings specified in this Section, including connecting service utilities.

#### 3. DEFINITIONS

- A. MDF: Medium-density fiberboard.

- B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches (1200 mm) above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets, including those installed directly against walls or other cabinets, are defined as "exposed."
2. Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets are defined as "concealed."

- C. Semiexposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cabinets 78 inches (1980 mm) or more above floor are defined as "semiexposed."
- D. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.
- E. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive and faced both front and back with hardwood veneers.

#### 4. PERFORMANCE REQUIREMENTS

- A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
  - 1. Support Framing System: 600 lb/ft. (900 kg/m) <Insert load>.
  - 2. Suspended Base Cabinets (Internal Load): 160 lb/ft. (240 kg/m) <Insert load>.
  - 3. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft. (240 kg/m) <Insert load>.
  - 4. Wall Cabinets (Upper Cabinets): 160 lb/ft. (240 kg/m) <Insert load>.
  - 5. Shelves: 40 lb/sq. ft. (200 kg/sq. m) <Insert load>.
- B. Delegated Design: Design laboratory casework, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.

#### 5. SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For laboratory casework. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Indicate locations of hardware.
  - 2. Indicate locations and types of service fittings.
  - 3. Indicate locations of blocking and reinforcements required for installing laboratory casework.
  - 4. Include details of utility spaces showing supports for conduits and piping.
  - 5. Include details of support framing system.
  - 6. Include details of exposed conduits, if required, for service fittings.
  - 7. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
  - 8. Include coordinated dimensions for laboratory equipment specified in other Sections.
- C. Samples for Initial Selection: For factory-applied finishes and other materials requiring color selection.

- D. Samples for Verification: For each type of cabinet finish and each type of countertop material indicated, in manufacturer's standard sizes.
- E. Delegated-Design Submittal: For laboratory casework indicated to comply with seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Qualification Data: For qualified manufacturer.
- G. Product Test Reports for Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard and system structural performance specified in "Performance Requirements" Article.
- H. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

## 6. QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8.
- B. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.
  - 1. Obtain countertops sinks accessories and service fittings from casework manufacturer.
- C. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes and similar door and drawer configurations and complying with the Specifications may be considered. Refer to Division 1 Section "Product Requirements."
- D. Casework Product Standard: Comply with SEFA 8, "Laboratory Furniture - Casework, Shelving and Tables - Recommended Practices."
- E. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Preinstallation Conference: Conduct conference at Project site.

## 7. DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

8. PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

9. COORDINATION

- A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.
- B. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.

10. EXTRA MATERIALS

- A. Furnish complete touchup kit for each type and color of wood laboratory casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

2.PRODUCTS

1. WOOD CABINET AND TABLE MATERIALS

- A. General:
  - 1. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
  - 2. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core, unless otherwise indicated, made without urea formaldehyde.
  - 3. MDF: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
  - 4. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde or straw-based particleboard complying with ANSI A208.1, Grade M-2, except for density, made with binder containing no urea formaldehyde.
  - 5. Hardboard: AHA A135.4, Class 1 Tempered.
  - 6. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch- (3-mm-) thick, solid wood of same species as face veneer.
    - a. Colors: Match Architect's samples As selected by Architect from manufacturer's full range.
- B. Exposed Materials:
  - 1. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
  - 2. Wood Species: White oak.

3. Plywood: Hardwood plywood with face veneer of species indicated, selected for compatible color and grain. Grade A exposed faces at least 1/50 inch (0.5 mm) thick, and Grade J crossbands. Provide backs of same species as faces.

- a. Face Veneer Cut: Plain sliced.

4. Solid Wood: Clear hardwood lumber of species indicated and selected for grain and color compatible with exposed hardwood plywood.

C. Semiexposed Materials:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of same species as exposed solid wood.
2. Plywood: Hardwood plywood of same species as exposed plywood. Grade B faces and Grade J crossbands. Provide backs of same species as faces.
3. Provide solid wood or hardwood plywood for semiexposed surfaces unless otherwise indicated.
4. Metal for Steel Drawer Pans: Cold-rolled, carbon-steel sheet complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.

D. Concealed Materials:

1. Solid Wood: Any species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood. Provide backs of same species as faces.
3. Particleboard.
4. MDF.
5. Hardboard.

2. AUXILIARY CABINET MATERIALS

- A. Acid Storage-Cabinet Lining: 1/4-inch- (6-mm-) thick, glass-fiber cement board complying with ASTM C 1186 polyethylene or polypropylene polyethylene, polypropylene, epoxy, or phenolic-composite lining material.
- B. Glass for Glazed Doors: Clear laminated tempered glass complying with ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with 2 lites not less than 3.0 mm thick and with clear, polyvinyl butyral interlayer.

3. COUNTERTOP TABLE TOP SHELF TROUGH AND SINK MATERIALS

- A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Durcon Company (The).
    - b. Epoxyn Products.
    - c. Laboratory Tops, Inc.

- d. Prime industries, inc.
  2. Physical Properties:
    - a. Flexural Strength: Not less than 10,000 psi (70 MPa).
    - b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
    - c. Hardness (Rockwell M): Not less than 100.
    - d. Water Absorption (24 Hours): Not more than 0.02 percent.
    - e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
  3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
    - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
    - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
  4. Color: Black.
4. WOOD CABINETS AND TABLES
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - B. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard Peterson & Company, Inc. or comparable product by one of the following:
    1. Advanced Lab Concepts, Inc.
    2. CampbellRhea.
    3. CiF Furniture Ltd.
    4. Collegedale Casework, LLC.
    5. Diversified Woodcrafts, Inc.
    6. Fisher Hamilton L.L.C.
    7. Keur Industries, Inc.
    8. Kewaunee Scientific Corporation; Laboratory Products Group.
    9. Laboratory Design & Supply.
    10. Leonard Peterson & Company, Inc.
    11. Sheldon Laboratory Systems.
    12. South Texas Woodmill, Inc.
    13. Terrill Manufacturing Company.
  - C. Design: Reveal overlay with square edges.
    1. Provide 1/8-inch (3.2-mm) <Insert dimension> reveals between doors and drawers that are adjacent.
  - D. Grain Direction:

1. Vertical on doors, horizontal on drawer fronts.
2. Lengthwise on face frame members.
3. Vertical on end panels.
4. Side to side on bottoms and tops of units.
5. Vertical on knee-space panels.
6. Horizontal on aprons and table frames.

E. Veneer Matching:

1. None required; select and arrange veneers for compatible grain and color.
2. Provide veneers for each cabinet from a single flitch, book or slip and running matched.
  - a. Provide continuous matching of adjacent drawer fronts within each cabinet.
3. Provide veneers for each elevation from a single flitch, book or slip and running matched.
  - a. Provide continuous matching of adjacent drawer fronts within each cabinet and end matching between drawer fronts of adjacent cabinets.

F. Construction: Provide wood-faced laboratory casework of the following minimum construction:

1. Bottoms of Base Cabinets and Tall Cabinets: 3/4-inch- (19-mm-) thick veneer-core hardwood plywood.
2. Tops and Bottoms of Wall Cabinets and Tops of Tall Cabinets: 1-inch- (25-mm-) thick veneer-core hardwood plywood.
3. Ends of Cabinets: 3/4-inch- (19-mm-) thick hardwood plywood.
4. Shelves: 1-inch- (25-mm-) thick veneer-core hardwood plywood.
5. Base Cabinet Top Frames: 3/4-by-2-inch (19-by-50-mm) solid wood with mortise and tenon, glued and pinned or screwed.
6. Base Cabinet Stretchers: 3/4-by-4-1/2-inch (19-by-114-mm) solid wood boards at front and back of cabinet, glued and pinned or screwed.
7. Base Cabinet Subtops: 3/4-inch- (19-mm-) thick panel product glued and pinned or screwed.
8. Backs of Cabinets: 3/4-inch- (19-mm-) thick, hardwood plywood where exposed, 1/4-inch- (6.4-mm-) thick, hardwood plywood dadoed into sides, bottoms, and tops where not exposed.
9. Drawer Fronts: 3/4-inch- (19-mm-) thick, hardwood plywood or solid hardwood.
10. Drawer Sides and Backs: 1/2-inch- (12.7-mm-) thick, solid hardwood or hardwood plywood, with glued dovetail joints.
11. Drawer Bottoms: 1/4-inch- (6.4-mm-) thick, veneer-core hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch- (12.7-mm-) thick material for drawers more than 24 inches (600 mm) wide.
12. Doors 48 Inches (1200 mm) High or Less: 3/4 inch (19 mm) thick, with particleboard or MDF cores, solid hardwood stiles and rails, and hardwood face veneers and crossbands.
13. Stiles and Rails of Glazed Doors 48 Inches (1200 mm) High or Less: 3/4-inch- (19-mm-) thick, solid hardwood.

G. Tables: Solid hardwood legs, not less than 2 inches (50 mm) square with solid hardwood stretchers as needed to comply with product standard. Bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device at bottom of each leg.

1. Leg Shoes: Black vinyl or rubber, open-bottom, slip-on type.
- H. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.
1. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
  2. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
  3. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed indicated. Fabricate from same material and with same finish as exposed cabinet backs.
5. WOOD FINISH
- A. Preparation: Sand lumber and plywood before assembling. Sand edges of doors, drawer fronts, and molded shapes with profile-edge sander. Sand after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.
- B. Staining: Remove fibers and dust and apply stain to exposed and semiexposed surfaces as necessary to match approved Samples. Apply stain in a manner that will produce a consistent appearance. Apply wash-coat sealer before applying stain to closed-grain wood species.
1. Stain Color: As selected by Architect from manufacturer's full range.
- C. Chemical-Resistant Finish: Apply laboratory casework manufacturer's standard three-coat, chemical-resistant, transparent finish. Sand and wipe clean between coats. Topcoat(s) may be omitted on concealed surfaces.
1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
6. HARDWARE
- A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
- B. Hinges: Stainless-steel, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches (1200 mm) high or less and 3 for doors more than 48 inches (1200 mm) high.
- C. Hinged Door and Drawer Pulls: Solid aluminum, stainless steel, or chrome-plated brass back-mounted pulls. Provide 2 pulls for drawers more than 24 inches (600 mm) wide.
1. Design: As selected from manufacturer's full range.
  2. Overall Size: As selected from manufacturer's full range.



- D. Sliding Door Pulls: Stainless-steel or chrome-plated recessed flush pulls.
    - 1. Design and Size: As selected from manufacturer's full range.
  - E. Door Catches: Nylon-roller spring Dual, self-aligning, permanent magnet catches. Provide 2 catches on doors more than 48 inches (1200 mm) high.
  - F. Drawer Slides for Wood Cabinets: Hardwood runners under centers of drawers with polymer guides fastened to backs of drawers.
  - G. Locks for Wood Cabinets: Cam type with 5-pin tumbler, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281 or E07261.
    - 1. Provide a minimum of two keys per lock and two master keys.
    - 2. Provide at instructor's tables.
    - 3. Keying: Key locks within each room alike, key each room separately each lock separately locks as directed.
    - 4. Master Key System: Key all locks to be operable by master key.
  - H. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.
  - I. Adjustable Shelf Supports for Wood Cabinets: Powder-coated steel shelf rests complying with BHMA A156.9, Type B04013.
  - J. Adjustable Shelf Supports for Wood Cabinets: Mortise-type, powder-coated steel standards and shelf rests complying with BHMA A156.9, Types B04071 and B04091.
  - K. Adjustable Wall Shelf Supports: Surface-type steel standards and steel shelf brackets, with epoxy powder-coated finish, complying with BHMA A156.9, Types B04102 and B04112.
7. COUNTERTOPS, TABLE TOPS , SHELVES , TROUGHS, AND SINKS
- A. Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch (25 mm), with continuous drip groove on underside 1/2 inch (13 mm) from edge.
  - B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.
    - 1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2 (DN 40), unless otherwise indicated.
    - 2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches (50 mm) less than sink depth. Provide in same material as strainer.
  - C. Epoxy Countertops Table Tops and Sinks:
    - 1. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.

- a. Countertop Configuration: Flat, 1 inch (25 mm) thick, with beveled or rounded edge and corners, and with drip groove and integral coved or applied backsplash.
  - b. Countertop Construction: Uniform throughout full thickness Retain first subparagraph below for maximum competition if phenolic-composite countertops are acceptable.
- 2. Table-Top Fabrication:
  - a. Table-Top Configuration: Flat, 1 inch (25 mm) thick, with beveled or rounded edge and corners, and with drip groove at perimeter.
  - b. Table-Top Construction: Uniform throughout full thickness
- 3. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch (13-mm) minimum thickness.
  - a. Provide with polypropylene strainers and tailpieces.
  - b. Provide sinks for drop-in installation with 1/4-inch- (6-mm-) thick lip around perimeter of sink.
  - c. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
  - d. Provide manufacturer's recommended adjustable support system for table- and cabinet-type installations.
- 8. LABORATORY ACCESSORIES
  - A. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop, unless otherwise indicated.
  - B. Burette Rods: Aluminum or stainless-steel rods, 1/2 inch (13 mm) in diameter and 18 inches (450 mm) long, threaded on 1 end to fit tapered plug adapter for flush socket receptacle. Provide with tapered plug adapter and receptacle.
  - C. Upright Rod Assembly and Metal Crossbar: Aluminum or stainless steel. Two vertical rods and 1 horizontal crossbar, 3/4 inch (19 mm) in diameter and 36 inches (900 mm) long, unless otherwise indicated; 2 flush socket receptacles and 2 crossbar clamps. Ends of vertical rods are tapered to fit receptacles; all other rod ends are rounded.
  - D. Greenlaw Arm Assembly: Aluminum or stainless-steel vertical rod, tapered on one end to fit flush socket receptacle. Adjustable crossbar of hardwood with black, acid-resistant finish, secured to upright with adjustable clamp. Provide with receptacle.
  - E. Lattice Assembly: Aluminum or stainless-steel, vertical and horizontal rod lattice assembly with 3/4-inch- (19-mm-) diameter rods at approximately 12 inches (300 mm) o.c. with 2 flush socket receptacles for mounting.
    - 1. Size: 36 inches (900 mm) 48 inches (1200 mm) wide by 24 inches (600 mm) 36 inches (900 mm) high.

- F. Pegboards: Polypropylene, epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless-steel drip troughs with drain outlet.

9. WATER AND LABORATORY GAS SERVICE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Broen A/S.
  - 2. Chicago Faucet Company (The); a Geberit company.
  - 3. WaterSaver Faucet Co.
- B. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures - Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.
  - 1. Provide units that comply with "Vandal-Resistant Faucets and Fixtures" recommendations in SEFA 7.
- C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.
  - 1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.
- D. Finish: Chromium plated.
  - 1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard metallic brown, aluminum, white, or other color as approved by Architect.
- E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig (550 kPa).
  - 1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
  - 2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
  - 3. Self-Closing Valves: Provide self-closing valves where indicated.
- F. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig (280 kPa), with serrated outlets.
- G. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf (22 N) to operate. Provide units designed for working pressure up to 75 psig (520 kPa), with serrated outlets.
  - 1. Where ball valves are indicated for fuel-gas use, provide locking safety handles that must be pushed in or pulled up before being turned on unless otherwise indicated.

- H. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig (140 kPa), with serrated outlets.
  - I. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.
    - 1. Provide units designed for working pressure up to 60 psig (410 kPa) 100 psig (690 kPa) 125 psig (860 kPa).
  - J. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."
  - K. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.
  - L. Handles: Provide three- or four-arm, forged-brass or three- or four-wing, molded plastic or powder-coated metal handles for valves unless otherwise indicated.
    - 1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
    - 2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
    - 3. Provide heat-resistant plastic handles for steam valves.
    - 4. Provide knurled, molded plastic handles for needle valves.
  - M. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.
10. ELECTRICAL SERVICE FITTINGS
- A. Service Fittings, General: Provide units complete with metal housings, receptacles, terminals, switches, pilot lights, device plates, accessories, and gaskets required for mounting on laboratory casework.
  - B. Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498. Duplex type, Configuration 5 20R.
    - 1. Receptacle Grade: Hospital General grade unless otherwise indicated.
    - 2. Color of Receptacles: As selected by Architect unless otherwise indicated or required by NFPA 70.
    - 3. GFCI Receptacles: Straight blade, feed-through or non-feed-through type. Comply with UL 943, Class A, Hospital General grade, and include indicator light that is lighted when device is tripped.
    - 4. TVSS (Transient Voltage Surge Suppressor) Receptacles: Comply with UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
      - a. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and a minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.

- b. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
  - c. Receptacle Type: Hospital General grade, with isolated-ground terminal.
  - d. Identification: Distinctive marking on face of device to denote TVSS-type unit.
  - e. Color of TVSS Receptacles: Blue.
- C. Switches: Comply with NEMA WD 1 and UL 20. Provide single-pole, double-pole, or 3-way switches as required; rated 120 to 277-V ac; and in amperage capacities to suit units served.
  - 1. Color of Switches: Brown Ivory As selected by Architect <Insert color> unless otherwise indicated or required by NFPA 70.
  - 2. Provide pilot light adjacent to switch or neon-lighted handle, illuminated when switch is "ON," where noted as "PL" next to switch identification.
  - 3. Provide key-operated switch where noted as "KEY" next to switch identification.
  - 4. Provide thermal-overload switches, single or double pole, as required, with maximum overcurrent trip setting to suit particular motor controlled.
- D. Service Fittings, General: Provide units with metal housings and gaskets required for mounting on laboratory casework. Receptacles, terminals, switches, pilot lights, device plates, and accessories are specified in Division 16 Section "Wiring Devices."
- E. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.
- F. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates same size as boxes.
- G. Recessed-Type Fittings: Provide with galvanized-steel boxes.
- H. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Architect from manufacturer's full range.
- I. Cover Plates: Provide satin finish, chrome-plated Type 304, stainless-steel cover plates with formed, beveled edges.
- J. Cover-Plate Identification: Use 1/4-inch- (6-mm-) high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.
  - 1. Provide on all cover plates. at the following locations:
    - a. Receptacles other than standard 125-V duplex, grounding type.
    - b. Switches and thermal-overload switches.
    - c. Pilot lights when located remotely from associated equipment or switch, where function is not obvious.
    - d. Receptacles, switches, and other locations indicated.
  - 2. Provide the following information:
    - a. Voltage and phase for receptacles other than standard 125-V duplex, grounding type.

- b. Indicate equipment being controlled by switches and thermal-overload switches.
- c. Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
- d. Number of breaker in panelboard that controls device.

### 3.EXECUTION

#### 1. EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of laboratory casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 2. INSTALLATION OF CABINETS

- A. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
  - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).
  - 2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet (3 mm in 3 m).
  - 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet (3 mm in 3 m).
  - 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
  - 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5 mm).
- B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.
- C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches (600 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
  - 1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches (600 mm) o.c. and at sides of cabinets with not less than 2 fasteners per side.
- D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches (600 mm) o.c.
- E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- F. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

### 3. INSTALLATION OF COUNTERTOPS

- A. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.
- B. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.
  - 1. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.
- C. Fastening:
  - 1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
  - 2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches (1200 mm) o.c.
  - 3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch (3 mm) and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
- D. Provide required holes and cutouts for service fittings.
- E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
- F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
- G. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

### 4. INSTALLATION OF SINKS

- A. Comply with installation requirements in SEFA 2.3.
- B. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

### 5. INSTALLATION OF LABORATORY ACCESSORIES

- A. Install accessories according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions.

- B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.
- C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.
- D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

6. INSTALLATION OF SERVICE FITTINGS

- A. Comply with requirements in Divisions 15 and 16 Sections for installing water and laboratory gas service fittings and electrical devices.
- B. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

7. CLEANING AND PROTECTING

- A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- B. Protect countertop surfaces during construction with 6-mil (0.15-mm) plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches (1200 mm) o.c.

8. LAB CASEWORK AND SERVICE-FITTING SCHEDULE

- A. LCW1 - Typical Lab Sink in Casework:
  - 1. Epoxy drop-in-sink, 18" x 15" x 8" – Leonard Peterson L-2025
  - 2. Faucet – Watersaver L412VBBH
- B. LCW1EW – Same as LCW1 but added eye wash, deck mounted swing down, "Auto Flow" Watersaver EW849.

END OF SECTION 12360



**SECTION 13121**  
**PRE-ENGINEERED METAL BUILDINGS**

**PART 1 - GENERAL**

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
  - 1. Structural-steel framing.
  - 2. Accessories.
- B. Related Requirements:

1.03 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.04 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03300 "Cast-in-Place Concrete."
- B. Coordinate panel assemblies with rain drainage work, flashing, trim, and construction of supports, mono-rails and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
  - 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
  - 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
  - 3. Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners,

anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
  - a. Flashing and trim.
  - b. Gutters.
  - c. Downspouts.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Delegated-Design Submittal: For metal building systems.

1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Provide calculations indicating proper design wind pressures shall be provided.
3. Provide drawings showing elevations, dimensions, sections, and structural details.
4. All drawings and calculations shall be provided, reviewed and certified by a Licensed Professional Engineer (PE stamped). The entire building design shall be signed and sealed by a Florida Licensed Professional Engineer.
5. Provide sealed certified final building reaction loads.

#### 1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration.
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

- 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
  - D. Erector Certificates: For qualified erector, from manufacturer.
  - E. Material Test Reports: For each of the following products:
    - 1. Structural steel including chemical and physical properties.
    - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
    - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
    - 4. Shop primers.
    - 5. Nonshrink grout.
  - F. Source quality-control reports.
  - G. Field quality-control reports.
  - H. Sample Warranties: For special warranties.
  - I. Final, Detailed design drawing package shall be required prior to the contractor submitting for a building permit. See section 2.04 for delegated design.
- 1.07 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer, specializing in prefabricated metal building systems with a minimum documented experience of five (5) years.
    - 1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
    - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
  - B. Pre-installation Meetings: Conduct meetings to verify project requirements, substrate conditions, utility connections, manufacturer's installation instructions, and warranty requirements.
  - C. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
  - D. Welding Qualifications: Qualify procedures and personnel according to the following:
    - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
    - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- 1.08 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

**1.09 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

**1.10 WARRANTY**

The manufacturer shall warrant the entire building as well as its ancillary appurtenances being supplied, against defects in workmanship and materials for a minimum period of eighteen (18) months under normal use, operation and service from the date of system acceptance by the Owner.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A&S Building Systems, Inc.; a division of NCI.
  - 2. All American Systems; a division of NCI Building Systems, Inc.
  - 3. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
  - 4. Kirby Building Systems; a Nucor Company.
  - 5. Mesco Building Solutions; a division of NCI Building Systems, Inc.
  - 6. Nucor Corporation, Nucor Buildings Group.
  - 7. Steel Systems; a division of NCI Building Systems, Inc.
  - 8. Varco-Pruden Buildings; a division of BlueScope Buildings North America, Inc.
- B. Source Limitations: Obtain metal building system components, including primary and secondary framing, from single source from single manufacturer.

**2.02 GENERAL**

- A. The Contractor shall prepare for and pour the concrete foundations for the pre-engineered metal building, based on the Drawings, which will be adjusted, based on the pre-engineered metal canopy manufacturer's certified design base reactions.
  - 1. Cost changes between the as-bid and the final foundation design shall be adjusted, based on the Unit Prices.

## PRE-ENGINEERED METAL BUILDINGS

- B. The pre-engineered metal building manufacturer shall provide the certified design base reactions to the Engineer for finalizing the required support foundations.
- C. The building sizes shall be as shown on the Drawings. The Contractor shall verify location and elevation of footings relative to finished grade, columns, and other construction contiguous with pre-engineered metal building by field measurements before fabrication and indicate measurements on shop drawings. Slight adjustments to suit manufacturer's requirements will be allowed.
- D. The buildings shall be equipped with UL rated lighting fixtures for outdoor use. On/off switches shall be provided at both ends of the canopy at a height of 4 feet above ground.
  - 1. All electrical components, devices, and accessories shall be UL listed and labeled as defined in NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Electrical Items: See contract documents.

### 2.03 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
  - 1. Rigid Clear Span: Solid-member, structural-framing system without interior columns, located at center and end-walls.
- C. Secondary-Frame Type: Manufacturer's standard roof purlins and partially inset-framed wall girts.
- D. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.
- E. Bay Spacing: As indicated on Drawings.
- F. Roof Slope: As indicated on Drawings.
- G. Crane Loading as indicated on the drawings.

### 2.04 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual." No part of the new metal building shall be attached to an existing wall or structure for support.
  - 1. Live Load: The vertical live load of the canopy shall not be less than 20 pounds per square foot applied on the horizontal projection of the roof. Reduction of loads due to tributary loaded areas will not be permitted

## PRE-ENGINEERED METAL BUILDINGS

2. Wind Load: The wind load shall be calculated to conform with the requirements set forth using the following parameters:

- a. Basic Wind Speed - 133 mph
- b. Exposure C
- c. Importance Factor - 1.15

3. Deflection and Drift Limits: No greater than the following:
  - a. Purlins and Rafters: Vertical deflection of  $1/240$  of the span.
  - b. Main Building Frames: Horizontal Deflection  $1/240$
  - c. Girts: Horizontal deflection of  $1/120$  of the span.
  - d. Roof Panels: Vertical deflection of  $1/120$  of the span.
  - e. Wall Panels: Horizontal deflection of  $1/120$  of the span.
  - f. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- D. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

### 2.05 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
  1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
    - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Engineer.

## PRE-ENGINEERED METAL BUILDINGS

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior wind column shall be provided on end frames as required.
  - a. Minimum flange and web thickness: 5/16-inch.
  - b. Maximum frame flange width: 4-inches.
  - c. Interior and End-Wall Rigid Frames.
3. Frame Configuration: As indicated on the drawings
4. Column: Tapered or Uniform depth.
5. Rafter: Tapered or uniform Depth.
- E. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
  1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch-wide flanges.
    - a. Depth: As needed to comply with system performance requirements.
  2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch-wide flanges.
    - a. Depth: 6-inch.
  3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
  4. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
  5. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- F. Bracing: Provide adjustable wind bracing as follows:
  1. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- G. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to the foundation.
- H. Materials:
  1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.

## PRE-ENGINEERED METAL BUILDINGS

2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
  3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
  4. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
  5. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
    - a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
  6. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
    - a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
  7. Headed Anchor Rods: ASTM F1554, Grade 36.
    - a. Configuration: Straight.
    - b. Nuts: ASTM A563 heavy-hex carbon steel.
    - c. Plate Washers: ASTM A36/A36M carbon steel.
    - d. Washers: ASTM F436 hardened carbon steel.
    - e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.
  - I. Finish: All structural members shall be factory applied hot dip galvanized (zinc coated).
- 2.06 ACCESSORIES
- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
    1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - B. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
    1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.



- C. Gutters: Zinc-coated (galvanized) steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
  - 1. Gutter Supports: Fabricated from same material and finish as gutters.
- D. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
  - 1. Mounting Straps: Fabricated from same material and finish as gutters.
- E. Materials:
  - 1. Fasteners: Self-tapping screws, bolts, nuts, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
    - a. Fasteners for Roof Panels: Self-drilling/tapping, Type 304 stainless steel, with EPDM washer under heads of fasteners bearing on weather side of panels.
    - b. Fasteners for Metal Wall Panels: Self-drilling, Type 304 stainless steel self-tapping, hex washer head, with EPDM sealing washers bearing on weather side of panels.
    - c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
  - 2. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- F. Flood Vents:
  - 1. 316 Stainless Steel vents required for automatic flood venting protection with no natural air ventilation. Vents shall be Smart Vent model 1540-570 or equal.
  - 2. Insulation: 2" insulation core with R-value of 8.34
  - 3. Dimensions: 16" square clear opening
  - 4. Install vents 1 ft above finish floor elevation.
  - 5. Provide framing, flashing and fasteners required for PEMB wall installation.

## 2.07 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
  - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

## PRE-ENGINEERED METAL BUILDINGS

- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
  - 1. Make shop connections by welding or by using high-strength bolts.
  - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
  - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
  - 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
  - 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
  - 1. Make shop connections by welding or by using non-high-strength bolts.
  - 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

### 2.08 INTERIOR LINER PANELS

- A. The building interior (dewatering building only) shall be lined with corrugated PVC liner panels for the full length of the building sidewalls.
- B. Liner panel shall be high gloss white finish, non flammable, chemical and impact resistant.
- C. Manufacturer: Amerilux Agrilite or equal
- D. Profile: Agrilite 9"
- E. Thickness: 0.039"
- F. Warranty: 10 years

## EXECUTION

### 2.09 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.
- D. Check installed anchor bolts for accuracy. Verify that bearing surfaces are ready to receive the work.
- E. Verify the rough-in of required mechanical and electrical services prior to placement of the structure.

### 2.10 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

### 2.11 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

## PRE-ENGINEERED METAL BUILDINGS

- E. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
  - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- F. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
  - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  - 2. Locate and space wall girts to suit openings.
  - 3. Provide supplemental framing at entire perimeter of openings.
- G. Bracing: Install solid rod bracing in roof where indicated on erection drawings.
  - 1. Tighten rod bracing to avoid sag.
- H. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.
- I. ACCESSORY INSTALLATION
- J. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 2. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- K. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
- L. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

## PRE-ENGINEERED METAL BUILDINGS

- M. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

- 1. Provide elbows at base of downspouts to direct water away from building.

### 2.12 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/ A780M and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories.
  - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
  - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

**END OF SECTION**

**SECTION 13220**  
**PRESTRESSED CONCRETE TANK**  
**(Open Top)**

**PART 1      GENERAL**

1.01    SECTION INCLUDES

- A.     Prestressed concrete tank.
- B.     Accessories for prestressed concrete tank.

1.02    RELATED SECTIONS

- A.     Section 03300 – Concrete.
- B.     Section 03200 – Steel Reinforcement.
- C.     Section 09972 – Special Concrete Coatings
- D.     Section 05500 – Metal Fabrications
- E.     Section 05530 – Aluminum Grating & Stair Treads

1.03    REFERENCES

- A.     ACI 372R-03 – Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures.
- B.     AWWA D110-04 – Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks.
- C.     ACI 506R – Guide to Shotcrete.
- D.     ASTM A 821/A 821M – Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks.
- E.     ASTM A 1008/A 1008M – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy With Improved Formability.
- F.     ASCE Standard 7-05 – Minimum Design Loads for Buildings and Other Structures.
- G.     ASTM C 881/C 881M – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

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(Open Top)**

**1.04 SUBMITTALS**

- A. Shop Drawings: Provide complete plan, elevation, and sectional views showing critical dimensions including:
  - 1. Size, location and number of all reinforcing bars.
  - 2. Thickness of all parts of the tank structure including floor, core wall, and covercoat.
  - 3. Prestressing schedule including number and placement of prestressing wires on the tank wall and total applied force per foot of wall height.
  - 4. Location and details of all accessories required.
  - 5. Minimum size of shop drawings shall be 18" by 24".
- B. Product Data: Submit concrete design mixes including ingredient proportions, minimum cementitious content, and water/cementitious ratio in accordance with these specifications.
- C. Design Data: Submit structural calculations for the tank, signed and sealed by a registered Alabama professional engineer in accordance with Section 1.5 A.3 of these specifications.
- D. Test Reports: Submit concrete strength reports for 7-day and 28-day breaks.
- E. Warranty Document: Submit warranty document in Owner's name in accordance with Section 1.6A of these specifications.
- F. Project Record Documents: Record actual location layout and final configuration of tank and accessories on shop drawings and submit to engineer after construction of the tank is complete.

**1.05 QUALITY ASSURANCE**

- A. Qualifications and Experience:
  - 1. Tank Construction Company: Shall be a firm with ten years of experience in the design and construction of wire-wound, circular prestressed composite tanks with satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tank in accordance with the quality required by these specifications. The company constructing the tank shall have built completely in its own name in the past five years, and be presently responsible for, a minimum of ten (10) prestressed composite tanks of equal or greater size than that required for this project which meet these specifications and are now providing satisfactory service.

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2. Construction: The entire tank, including all portions of the floor and wall shall be built by the tank construction company, using its own trained personnel and equipment.
3. Design: All design work for the tank shall be performed by an Alabama registered professional engineer with no less than five years of experience in the design and construction of circular prestressed composite tanks. The professional engineer shall be a full-time staff member of the tank construction company and shall be licensed to work in the state where the project is located.
4. Walkway Design: All design work for the tank walkways shall be performed by a Alabama registered professional engineer with no less than five years of experience in the design and construction of elevated walkways attached to prestressed concrete tanks. The professional engineer shall be a full-time staff member of the tank construction company and shall be licensed to work in the state where the project is located.
5. The steel shell design and epoxy injection procedure (covered by U.S. Patent 5,150,551) shall have been used in the ten tanks required in the tank construction company's experience record.

**B. Prequalification:**

1. The CROM Corporation and PRECON are the prequalified tank construction companies for the prestressed concrete tanks.
2. Additional tank construction companies wanting to be prequalified and meeting the criteria as stated in Section 1.5 Qualifications and Experience shall make a complete submittal to the Engineer for review fourteen (14) days prior to the date set for receipt of the bids.
3. Prequalification submittal by tank construction companies who are not previously prequalified shall include the following items:
  - a. Preliminary design drawings and calculations showing the dimensions of the tank, details of the type of construction, wire wound prestressing methods and principal sizes and thicknesses of structural members.
  - b. Complete experience record for the tanks that have been designed and built in the tank construction company's own name. The record should also include the size of the tank, name and address of the Owner, the year of construction and the name of the Engineer for the project.



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- c. The name of the tank designer and his/her experience as the designer of record for prestressed concrete tanks.

**1.06 WARRANTY**

- A. Provide warranty for workmanship and materials on the complete structural portion of the tank for a five-year period from date of acceptance of the work. In case leakage or other defects appear within the five-year period, the tank construction company shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined as a stream flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank. The tank construction company shall not be responsible for, nor liable for, any subsurface condition. This warranty shall not apply to any accessory, equipment or product that is not a structural part of the tank and is manufactured by a company other than the tank construction company.
- B. Tanks shall be designed for a max one (1) foot storm water surge depth (elevation 7.0). The OWNER agrees to sign an agreement with the tank supplier that during a severe storm event where the storm surge rises higher than elevation 7.0 the liquid level inside the tanks will match or exceed the storm water elevation on site.

**PART 2 PRODUCTS**

**2.02 PERFORMANCE**

- A. The design shall be in conformance with applicable portions of American Concrete Institute (ACI) 372R-03 Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures, AWWA D110-04 Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks, and currently accepted engineering principles and practices for the design of such structures.
- B. Two (2) Process Basins:
  - Inside Diameter: 91'
  - Wall Height 21'
- C. Two (2) Clarifiers
  - Inside Diameter: 55'
  - Wall Height: 21'
- D. One (1) Digester Basin (with bi-seating hydrostatic wall)
  - Inside Diameter: 70'
  - Wall Height: 21'

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- E. Earthquake Design: Fixed percentage method as specified in AWWA D110, Section 4.1.
- F. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.
- G. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.
- H. Concrete:
  - 1. Use Type I / II cement.
  - 2. A maximum of 20% of cementitious material may be fly ash for all concrete mixes.
  - 3. Floor Concrete: Minimum 4000 psi compressive strength at 28 days, maximum  $\frac{3}{4}$ " aggregate, 5%  $\pm$  1% air content, 4"  $\pm$  1" slump.
- I. Shotcrete:
  - 1. Use Type I / II cement.
  - 2. A maximum of 20% of cementitious material may be fly ash for all concrete mixes.
  - 3. Core Wall Shotcrete: Minimum 4000 psi compressive strength at 28 days, 4"  $\pm$  1" slump.
  - 4. Covercoat Shotcrete: Minimum 3500 psi compressive strength at 28 days, 4"  $\pm$  1" slump.
  - 5. Allowable compressive stress due to final prestressing force,  $f_g$ :
    - a. 1250 psi + 75t psi/in. with 0.45  $f'_g$  maximum (where  $f'_g$  is defined as compressive strength required for final prestressing force and t is the thickness of the core wall in inches).
    - b. Maximum of 2000 psi.
  - 6. Allowable compressive stress due to initial prestressing force,  $f_{gi}$ :
    - a. 1250 psi + 75t psi/in. with 0.5  $f'_{gi}$  maximum or less (where  $f'_{gi}$  is defined as compressive strength at time initial prestressing force is applied and t is the thickness of the core wall in inches).
    - b. Maximum of 2250 psi.
- J. Prestressing Wire:

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1. The prestressing wire shall conform to the requirements of ASTM A821, Type B.
2. Wire size shall be 0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250".
3. Working stress for the tank wall,  $f_s$  shall be a maximum of 115,000 psi.
4. Allowable design tensile stress before losses,  $f_{si}$  shall be 145,600 psi or no greater than  $0.63 f_u$ .
5. Ultimate tensile strength,  $f_u$  shall be, 231,000 psi or greater for 8 gauge wire, 222,000 psi or greater for 6 gauge.

K. Non-prestressed Mild Reinforcing Steel:

1. Allowable design tensile stress,  $f_s$  shall be a maximum of 18,000 psi.
2. Yield strength of reinforcing steel,  $f_y$  shall be 60,000 psi.

2.02 FLOOR

- A. Concrete membrane floors shall be a minimum of 4" thick and have a minimum thickness of 8" of concrete over all pipe encasements and around sumps.
- B. A minimum percentage of 0.60% reinforcing steel shall be used in the membrane floor. The minimum percentage shall apply to all thickened sections and shall extend a minimum of 2' into the adjacent membrane floor.

2.03 CORE WALL

- A. The core wall shall be constructed of shotcrete, encasing a steel diaphragm continuous the full wall height without horizontal splices.
- B. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, backfill, and other applicable loads, but in no case be less than 3½" thick.
- C. Horizontal sections of the wall shall form true circles without flat areas, excessive bumps or hollows.
- D. Interior and exterior surfaces of the core wall shall be water cured for a minimum of 7 days or until prestressing begins.
- E. To compensate for bending moments, shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall.

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1. The top 2' of core wall shall have not less than 1% circumferential reinforcing.
2. The bottom 3' of core wall shall have not less than 1% circumferential reinforcing.
3. Inside Face:
  - a. 26 gauge steel shell diaphragm continuous the full wall height without horizontal splices.
  - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.
4. Outside Face:
  - a. Vertical reinforcing steel: Minimum of #4 bars at 12" center to center.
  - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.

**2.04 STEEL SHELL DIAPHRAGM**

- A. A 26 gauge steel tank shell, complying with ASTM A 1008, shall be used throughout the core wall, providing a waterstop. The steel shell diaphragm shall be encased and protected with shotcrete no less than 1" thick at all places.
- B. The steel shell is to be formed and erected so that a mechanical key is created between the shotcrete and diaphragm.
- C. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices will not be permitted.
- D. All vertical joints in the diaphragm shall be sealed watertight by epoxy injection in accordance with U.S. Patent No. 5,150,551.
- E. Epoxy injection shall be carried out from bottom to top of wall, using a pressure pumping procedure, after the steel shell has been fully encased, inside and outside, with shotcrete.
- F. The sealant shall conform to the requirements of ASTM C881, Type III, Grade 1, and shall be 100% solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.
- G. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel.
- H. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to this waterstop.

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**2.05 SHOTCRETE**

- A. All shotcrete shall be applied by or under direct supervision of experienced nozzlemen certified by the American Concrete Institute (ACI) as outlined in ACI certification publication CP-60.
- B. Shotcrete mixes shall have a minimum of 1 part cementitious material to 3 parts of sand.
- C. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer.
- D. No shotcrete shall be applied to reinforcing steel or diaphragm that is encrusted with overspray.
- E. No less than 1/8" thick shotcrete shall separate reinforcing steel and prestressing wire.

**2.06 HORIZONTAL PRESTRESSING**

- A. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM 821 Type B, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.
- B. Placement of the prestressing steel wire shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive stress equal to that shown on the design drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire or when removing a defective section of wire.
- C. Areas to be prestressed will contain not less than 10 wires per foot of wall for 8 gauge and 8 wires per foot of wall for 6 gauge. A maximum of 24 wires per layer per foot for 8 gauge and 20 wires per layer per foot for 6 gauge will be allowed. Shotcrete shall be used to completely encase each individual wire and to protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one wire diameter.
- D. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the drawings.

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- E. The tank construction company shall supply equipment at the construction site to measure tension in the wire after it is positioned on the tank wall. The stress measuring equipment shall include: electronic direct reading stressometer accurate to within 2%, calibrated dynamometers and a test stand to verify the accuracy of the equipment.
- F. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This encasement shall completely encapsulate each wire and permanently bond the wire to the tank wall.
- G. When multiple layers of wire are required, shotcrete cover between layers shall be no less than  $\frac{1}{8}$ " thick.
- H. After all circumferential prestressing wires have been placed, a shotcrete cover having a thickness of no less than 1" shall be placed over the prestressing wires.

**2.07 WALL OPENINGS**

- A. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe or sleeve shall be no less than 18" above the floor slab, and the prestressing wires required at the pipe elevation shall be distributed above and below the opening leaving an unbanded strip around the entire tank.
- B. Unbanded strips shall have a vertical dimension of no more than 36" unless an axi-symmetric shell analysis is performed to account for shear and moments caused by displacement of the prestressing wires into adjacent bands.
- C. All wall pipes and sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

**2.08 TANK ACCESSORIES**

- A. The tank construction company shall furnish and install the tank accessories.
- B. The tank shall have a minimum of one, 1' 3" x 4' 4" rectangular Type 316 stainless steel wall manhole for access to the interior of the tank. The cover and the bolts shall be of Type 316 stainless steel.
- C. Through-wall pipe sleeves shall be Type 316 stainless steel sleeves with neoprene modular-seal units using stainless steel tightening bolts.
- D. Through-wall pipe sleeves for below grade application will be Type 316 stainless steel flanged wall pipes.
- E. Design and provide thickened tank for attachments of baffle walls, pipe supports, and walkways. Coordinate required locations with walkway, aeration

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system and baffle wall suppliers prior to submittals. Confirm pipe support, and pipe penetration locations with the General Contractor prior to submittals.

- F. Design walkway air main supports to carry the full weight of the dropleg. Dropleg must be supported to maintain a plumb position so that lateral loads are not imposed on the air manifold. Air main and supports to be furnished, as specified, by Contractor.
- G. Coordinate walkway design and installation with the clarifier bridge supplier. The contractor shall coordinate all attachments for supports, handrails and grating between the clarifier bridge, crosswalk and headworks connections with the walkway suppliers.
- H. Aluminum stairs and walkways attached to the clarifier shall be the responsibility of the tank supplier to design, furnish and install. Stairs and walkways shall meet all the requirements of Section 05500 and 05530.

**2.09 PAINTING**

- A. Exterior paint system shall consist of the following system:
  - 1. See Section 09963 – Special Tank Concrete Coatings.
  - 2. Coat exterior of the process/clarifier tanks completely and interior to 2' below the normal water line
  - 3. Coat interior of clarifier launders and exterior launders to 2' below the water line.
  - 4. Coat Digester exterior completely and interior walls to the floor/wall interface.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify elevations, placement and grading for tank prior to starting tank construction.

**3.02 INSTALLATION**

- A. Tank Floor:
  - 1. The floor shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.
  - 2. The floor shall be continuously water cured until tank construction is completed.
- B. Tank Wall:

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1. The wall shall be constructed in a predesigned manner utilizing steel shell diaphragm, layers of shotcrete and prestressing wire.
  2. The diaphragm shall be protected against damage before, during, and after erection. Nail or other holes shall not be made in the steel shell for erection or other purposes except for inserting wall pipes or sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.
  3. Interior and exterior portions of the shotcrete wall shall be water cured for a minimum of 7 days or until prestressing is started.
- C. Prestressing: The initial tension in each wire shall be read and recorded to verify that the total aggregate force is no less than that required by the design. Averaging or estimating the force of the wire on the wall shall not be considered satisfactory evidence of correct placement of prestressing wires.

**3.03 FIELD QUALITY CONTROL**

- A. Inspection and Testing:
1. Hydrostatic Testing: Test completed tank for liquid tightness by filling tank to its overflow elevation with water provided by Owner.
  2. Concrete and Shotcrete Testing: Test all concrete and shotcrete used in the tank structure in accordance with Section 03300.

**3.04 CLEANING AND DISINFECTION**

- A. Clean interior and exterior of tank to remove debris, construction items, and equipment.

**END OF SECTION**



## SECTION 14210 ELECTRIC TRACTION ELEVATORS

### PART 1 GENERAL

#### 1. SUMMARY

A. Section Includes: Electric Traction Elevators.

B. Products Supplied But Not Installed Under this Section:

1. Hoist Beam
2. Pit Ladder
3. Inserts mounted in block walls for rail attachments

C. Work Supplied Under Other Sections:

1. Temporary lighting, including temporary lighting in hoistway for machine space with switch located in hoistway on the strike jamb side of top landing door.
2. Main line disconnects for each elevator.
  - a. One fused three phase permanent power in building electrical distribution room
  - b. One non fused three phase permanent power in hoist way at top landing
3. Hoistway ventilation shall be in accordance with local and national building code requirements.
4. Guide Rail Support shall be structurally adequate to extend from pit floor to top of hoistway, with spans in accordance with requirements of authority having jurisdiction and final layouts.
5. Removable barricades at all hoistway openings, in compliance with OSHA 29 CFR 1926.502 in addition to any local code requirements.
6. Lifeline attachments capable of withstanding 5000 lb load in accordance with OSHA 29 CFR 1926.502. Provide a minimum of 2 at the top, front of each hoistway.
7. Pit lighting: Fixture with switch and guards. Provide illumination level equal to or greater than that required by ASME A17.1/CSA B44 2000, or applicable version.
8. Control space lighting with switch. Coordinate switch with lighting for machine space as allowable by code.

A. Related sections:

1. Section 015000 - Temporary Facilities and Controls
2. Section 033000 - Cast-in-Place Concrete:
3. Section 042000 - Unit Masonry

4. Section 055000 - Metal Fabrications
5. Section 071600 - Cementitious Waterproofing
6. Section 230000 - Heating, Ventilating, and Air Conditioning
7. Section 260000 - Electrical
8. Section 263000 - Electric Power Generating and Storing Equipment
9. Section 273000 - Voice Communications
10. Section 283100 - Fire Detection and Alarm
11. Section 310000 - Earthwork

**B. Industry and government standards:**

1. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
2. ADAAG - Accessibility Guidelines for Buildings and Facilities
3. ANSI/NFPA 70, National Electrical Code
4. ANSI/NFPA 80, Standard for Fire Doors and Fire Windows
5. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.

**2. DESCRIPTION OF ELEVATOR**

- A. Elevator Equipment: KONE EcoSpace™ gearless traction elevator
- B. Equipment Control: KCM831
- C. Drive: Non Regenerative
- D. Quantity of Elevators: 1
- E. Landings: 2
- F. Openings: 2 Front Openings, 0 Back Openings
- G. Travel: 15'-0"
- H. Rated Capacity: 2500 lbs
- I. Rated Speed: 150fpm
- J. Cab Height: 8' 0"
- K. Clear height under suspended ceiling: 7'-4"
- L. Entrance Width and Type: Single speed center opening
- M. Entrance Height: 7' 0"

- N. Main Power Supply: 208 Volts + 5%, three-phase
- O. Operation: Simplex
- P. Machine Location: Inside the hoistway mounted on car guide rail
- Q. Control Space Location: within the front wall of the shaft at the 2<sup>nd</sup> landing
- R. Elevator Equipment shall conform to the requirements of seismic zone: non-seismic
- S. Maintenance Service Period: 12 months

## **2. PERFORMANCE REQUIREMENTS**

### **A. Car Performance**

- 1. Car Speed  $\pm 5\%$  of contract speed under any loading condition or direction of travel.
- 2. Car Capacity: Safely lower, stop and hold (per code) up to 125% of rated load.

### **B. System Performance**

- 1. Vertical Vibration (maximum): 25 mg
- 2. Horizontal Vibration (maximum): 25 mg
- 3. Jerk Rate (maximum): 3.3 ft/sec<sup>3</sup>
- 4. Acceleration (maximum) 1.3 ft/sec<sup>2</sup>
- 5. In Car Noise: = 55 dB(A)
- 6. Leveling Accuracy:  $\pm 0.2$  inches
- 7. Starts per hour (maximum): 120

## **3. SUBMITTALS**

### **A. Comply with Section 01 33 00 - Submittal Procedures.**

### **B. Product Data: Submit manufacturer's product literature for each proposed system.**

- 1. Cab design, dimensions and layout.
- 2. Layout, finishes, and accessories and available options.
- 3. Controls, signals and operating system.
- 4. Color selection charts for cab and entrances.

### **C. Shop Drawings:**

- 1. Clearances and travel of car.

2. Clear inside hoistway and pit dimensions.
3. Location and layout of equipment and signals.
4. Car, guide rails, buffers and other components in hoistway.
5. Maximum rail bracket spacing.
6. Maximum loads imposed on building structure.
7. Hoist beam requirements.
8. Location and sizes of access doors.
9. Location and details of hoistway door and frames.
10. Electrical characteristics and connection requirements.

D. Operation and maintenance data:

1. Provide manufacturer's standard maintenance and operation manual.

E. Diagnostic Tools

1. Prior to seeking final acceptance for the completed project as specified by the Contract Documents, the Elevator Contractor shall deliver to the Owner any specialized tool(s) that may be required to perform diagnostic evaluations, adjustments, and/or parametric software changes and/or test and inspections on any piece of control or monitoring equipment installed. This shall include any specialized tool(s) required for monitoring, inspection and/or maintenance where the means of suspension other than conventional wire ropes are furnished and installed by the Elevator Contractor. Any and all such tool(s) shall become property of the Owner. Any diagnostic tool provided to the Owner by the Elevator Contractor shall be configured to perform all levels of diagnostics, systems adjustment and parametric software changes which are available to the Elevator Contractor. In those cases where diagnostic tools provided to the Owner require periodic recalibration/or re-initiation, the Elevator Contractor shall perform such tasks at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the completed project. During those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation, or repair, the Elevator Contractor shall provide a temporary replacement for the tool at no additional cost to the Owner. The Elevator Contractor shall deliver to the Owner, printed instructions for the proper use of any tool that may be necessary to perform diagnostic evaluations, system adjustment, and/or parametric software changes on any unit of microprocessor-based elevator control equipment and means of suspension other than standard elevator steel cables furnished and install by the Elevator Contractor. Accompanying the printed instructions shall be any and all access codes, password, or other proprietary information that is necessary to interface with the microprocessor-control equipment.

**4. QUALITY ASSURANCE**

- A. Manufacturer: Minimum of fifteen years experience in the fabrication, installation and service of elevators of the type and performance of the specified. The manufacturer shall have a documented quality assurance program.
- B. Installer: The equipment manufacturer shall install the elevator.
- C. Inspection and Testing: In accordance with requirements of local jurisdiction, obtain required permits, inspections and tests.

**5. DELIVERY, STORAGE AND HANDLING**

- A. Comply with manufacturer's recommendations for delivery, storage and handling.
- B. If the construction site is not prepared to receive the elevator equipment at the agreed ship date, the General Contractor shall be responsible to provide a safe, dry, and easily accessible storage area on or off the premises. Additional labor costs for double handling will be the responsibility of the general contractor.
- C. Delivered elevator materials shall be stored in a protected environment in accordance with manufacturer recommendations. A minimum storage area of 10 feet by 20 feet is required adjacent to the hoistway.

**6. WARRANTY**

- A. Provide manufacturer warranty for a period of one year. The warranty period is to begin upon Substantial Completion of the Contract. Warranty covers defects in materials and workmanship. Damage due to ordinary use, vandalism, improper or insufficient maintenance, misuse, or neglect do not constitute defective material or workmanship.

**7. MAINTENANCE SERVICE**

- A. The elevator manufacturer shall provide maintenance service consisting of regular examinations and adjustments of the elevator equipment for a period of 12 months after date of substantial completion. Replacement parts shall be produced by the original equipment manufacturer.
- B. Maintenance service be performed during regular working hours of regular working days and shall include regular time call back service.
- C. Maintenance service shall not include adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents.

**PART 2 PRODUCTS**

**1. MANUFACTURER**

- A. Provide AC gearless machine room-less elevator systems subject to compliance with the design and performance requirements of this specification. Elevator manufacturers may include but are not limited to one of the following:
  - 1. Basis of Design: EcoSpace™ traction elevators by KONE, Inc. ([www.kone.com](http://www.kone.com)).

2. Other acceptable machine room-less products: manufacturer with minimum 15 years experience in manufacturing, installing, and servicing elevators of the type required for the project.

## 1. EQUIPMENT: CONTROL COMPONENTS AND CONTROL SPACE

- A. Controller: Provide microcomputer based control system to perform all of the functions.
  1. All high voltage (110V or above) contact points inside the controller cabinet shall be protected from accidental contact in a situation where the controller doors are open.
  2. Controller shall be separated into two distinct halves; Motor Drive side and Control side. High voltage motor power conductors shall be routed and physically segregated from the rest of the controller.
  3. Provide a serial cardrack and main CPU board containing a non-erasable EPROM and operating system firmware.
  4. Variable field parameters and adjustments shall be contained in a non-volatile memory module.
- B. Drive: Provide Variable Voltage Variable Frequency AC drive system to develop high starting torque with low starting current.
- C. Controller Location: Locate controller{s} in the front wall integrated with the top landing entrance frame, machine side of the elevator. A separate control space should not be required.

## 1. EQUIPMENT: HOISTWAY COMPONENTS

- A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave, mounted to the car guide rail at the top of the hoistway.
- B. Governor: Friction type over-speed governor rated for the duty of the elevator specified.
- C. Buffers, Car and Counterweight: Polyurethane buffer.
- D. Hoistway Operating Devices:
  1. Emergency stop switch in the pit
  2. Terminal stopping switches.
  3. Emergency stop switch on the machine
- E. Positioning System: System consisting of magnets and proximity switches.
- F. Guide Rails and Attachments: Steel rails with brackets and fasteners.

## 2. EQUIPMENT: HOISTWAY ENTRANCES

- A. Hoistway Entrances

1. Sills: extruded.
2. Doors: Hollow metal construction with vertical internal channel reinforcements.
3. Fire Rating: Entrance and doors shall be UL fire-rated for 1-1/2 hour.
4. Entrance Finish: Brushed Stainless Steel.
5. Entrance Markings Jamb Plates: Provide standard entrance jamb tactile markings on both jambs, at all floors. Plate Mounting: Refer to manufacturer drawings.

### 3. EQUIPMENT: CAR COMPONENTS

- A. Car Frame: Provide car frame with adequate bracing to support the platform and car enclosure.
- B. Platform: Platform shall be all steel construction.
- C. Car Guides: Provide guide-shoes mounted to top and bottom of both car and counterweight frame. Each guide-shoe assembly shall be arranged to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.
- D. Steel Cab Finish:

1. Car Wall Finish: Brushed Stainless Steel
2. Car Wall Panels: Non-removable vertical panels special metallic laminate selected from standard manufacturer's catalog of choices.
3. Car Front Finish: Brushed stainless steel.
4. Car Door Finish: Brushed stainless steel.
5. Ceiling:
  - a. Square LED Down Light Drop Ceiling - LF-97: Satin Finished Stainless Steel three panel suspended ceiling with three holes per panel for Square LED lights.

1. Handrail:
  - a. Rails to be located on back of car enclosure.
2. Flooring: See finish schedule. Adjust depth of elevator floor system to coordinate with floor depth.
3. Threshold: Aluminum

#### E. Emergency Car Signals

1. Emergency Siren: Siren mounted on top of cab that is activated when the alarm button in the car operating panel is engaged. Siren shall have rated sound pressure level of 80 dB(A) at a distance of three feet from device. Siren shall respond with a delay of not more than one second after activation of alarm button.

2. Emergency Car Lighting: Provide emergency power unit employing a 12-volt sealed rechargeable battery and totally static circuits shall illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
3. Emergency Exit Contact: An electrical contact shall be provided on the car-top exit.
4. Ventilation: Fan

# **1. EQUIPMENT: SIGNAL DEVICES AND FIXTURES**

- A. Car Operating Panel: Provide car operating panel with all push buttons, key switches, and message indicators for elevator operation. Fixture finish to be: Brushed Stainless Steel.
  1. Flush mounted car operating panel shall contain a bank of round, mechanical, illuminated buttons marked to correspond to landings served, emergency call button, door open button, door close button, and key switches for lights, inspection, and exhaust fan. Buttons have white illumination (halo). All buttons to have raised text and Braille marking on left hand side. The car operating display panel shall be white DOT-matrix. All texts, when illuminated, shall be white. The car operating panel shall have a brushed stainless steel finish.
  1. Additional features of car operating panel shall include:
    - a. Car Position Indicator within operating panel white.
    - b. Elevator Data Plate marked with elevator capacity and car number on car top.
    - c. Help buttons with raised markings.
    - d. In car stop switch per local code.
    - e. Firefighter's hat.
    - f. Firefighter's Phase II Key-switch.
    - g. Call Cancel Button.
    - h. Pre-programmed integrated ADA phone (complete description of krms features included as standard)
    - i. Help Button/Communicator. Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
    - j. Firefighter's Phase II emergency in-car operating instructions.
    - k. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.
- B. Hall Fixtures: Wall mounted hall fixtures shall be provided with necessary push buttons and key switches for elevator operation. Wall mounted hall fixtures shall have a brushed stainless steel finish.



1. Hall fixtures shall feature round, mechanical, buttons in applied mount face frame. Hall fixtures shall correspond to options available from that landing. Buttons shall be in a vertically mounted fixture. Hall fixtures shall not be jamb-mounted. Hall lanterns shall feature white illumination.
- A. Hall Lanterns and Chime: A directional lantern visible from the corridor shall be provided at each hall entrance. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound. The chime will sound once for up and twice for down.
  - A. Combination Hall Position Indicator and Hall Lantern located at Lobby and First Floor. Hall lanterns and hall indicators shall feature white illumination; all numbers will be white display.
7. EQUIPMENT: ELEVATOR OPERATION AND CONTROLLER
- A. Elevator Operation
    1. Simplex Collective Operation: Using a microprocessor-based controller, operation shall be automatic by means of the car and hall buttons. If all calls in the system have been answered, the car shall park at the last landing served.
    2. Zoned Car Parking.
    3. Relative System Response Dispatching.
  - B. Standard Operating Features to include:
    1. Full Collective Operation
    2. Fan and Light Control.
    3. Load Weighing Bypass.
    4. Ascending Car Uncontrolled Movement Protection
    5. Top of Car Inspection Station.
  - C. Additional Operating Features to include:
    1. Independent Service
    2. Hoistway Access Bottom Landing
    3. Hoistway Access Top Landing
    4. Car Secure Access.
    5. Provision for Card Reader in Car (Card Reader provided and Installed by others)
    6. Emergency Hospital Service.
    7. Provide provisions for coaxial cable for CCTV. CCTV by others.
    8. Intercom Provisions

### 9. Emergency Battery Power Supply

- a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. The elevator will rise or lower to the first available landing, open the doors, and shut down. The elevator will return to service upon the return of normal main line power. An auxiliary contact on the main line disconnect and shunt trip breaker ( if used ) will be provided by others.
- b. Not required if elevator is on hospital emergency power system.

### D. Elevator Control System for Inspections and Emergency

1. Provide devices within controller to run the elevator in inspection operation.
2. Provide devices on car top to run the elevator in inspection operation.
3. Provide within controller an emergency stop switch to disconnect power from the brake and prevents motor from running.
4. Provide the means from the controller to mechanically lift and control the elevator brake to safely bring car to nearest available landing when power is interrupted.
5. Provide the means from the controller to reset the governor over speed switch and also trip the governor.
6. Provide the means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
7. Provide the means for the control to reset elevator earthquake operation.

## 2. EQUIPMENT: DOOR OPERATOR AND CONTROL

- A. Door Operator: A closed loop permanent magnet VVVF high-performance door operator shall be provided to open and close the car and hoistway doors simultaneously. Door movement shall be cushioned at both limits of travel. Electro-mechanical interlock shall be provided at each hoistway entrance to prevent operation of the elevator unless all doors are closed and locked. An electric contact shall be provided on the car at each car entrance to prevent the operation of the elevator unless the car door is closed.
- B. The door operator shall be arranged so that, in case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Emergency devices and keys for opening doors from the landing shall be provided as required by local code.
- C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. A door open button shall be provided in the car. Momentary pressing of this button shall reopen the doors and reset the time interval.
- D. Door hangers and tracks shall be provided for each car and hoistway door. Tracks shall be contoured to match the hanger sheaves. The hangers shall be designed for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed-for-life bearings.

- E. Electronic Door Safety Device. The elevator car shall be equipped with an electronic protective device extending the full height of the car. When activated, this sensor shall prevent the doors from closing or cause them to stop and reopen if they are in the process of closing. The doors shall remain open as long as the flow of traffic continues and shall close shortly after the last person passes through the door opening.

### PART 3 EXECUTION

#### 1. EXAMINATION

- A. Field measure and examine substrates, supports, and other conditions under which elevator work is to be performed.
- B. Do not proceed with work until unsatisfactory conditions are corrected.
- C. Prior to start of Work, verify hoistway is in accordance with shop drawings. Dimensional tolerance of hoistway from shop drawings: -0 inches +2 inches. Do not begin work of this section until dimensions are within tolerances.
- D. Prior to start of Work, verify projections greater than 2 inches (4 inches if ASME A17.1/CSA B44 2000 applies) must be beveled not less than 75 degrees from horizontal.
- E. Prior to start of Work, verify landings have been prepared for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.
- F. Prior to start of Work, verify elevator pit has been constructed in accordance with requirements, is dry and reinforced to sustain vertical forces, as indicated in approved submittal. Verify that sumps or sump pumps located within pit will not interfere with installed elevator equipment.
- G. Prior to start of Work, verify control space has been constructed in accordance with requirements, with access coordinated with elevator shop drawings, including Sleeves and penetrations.
- H. Verify installation of GFCI protected 20-amp in pit and adjacent to each signal control cabinet in control space.

#### 2. PREPARATION

- A. Coordinate installation of anchors, bearing plates, brackets and other related accessories.

#### 3. INSTALLATION

- A. Install equipment, guides, controls, car and accessories in accordance with manufacturer installation methods and recommended practices.
- B. Properly locate guide rails and related supports at locations in accordance with manufacturer's recommendations and approved shop drawings. Anchor to building structure using isolation system to minimize transmission of vibration to structure.
- C. All hoistway frames shall be securely fastened to fixing angles mounted in the hoistway. Coordinate installation of sills and frames with other trades.
- D. Lubricate operating system components in accordance with manufacturer recommendations.

- E. Perform final adjustments, and necessary service prior to substantial completion.

**4. CONSTRUCTION**

**A. Interface with Other Work:**

1. Guide rail brackets attached to steel shall be installed prior to application of fireproofing.
2. Coordinate construction of entrance walls with installation of door frames and sills. Maintain front wall opening until elevator equipment has been installed.
  - a. Ensure adequate support for entrance attachment points at all landings.
  - b. Coordinate wall openings for hall push buttons, signal fixtures and sleeves. Each elevator requires sleeves within the hoistway wall.
  - c. Coordinate emergency power transfer switch and power change pending signals as required for termination at the primary elevator signal control cabinet in each group.
  - d. Coordinate interface of elevators and fire alarm system.
  - e. Coordinate interface of dedicated telephone line.
  - f. Coordinate the installation of the non fused three phase permanent power disconnect in hoist way at top landing

**5. TESTING AND INSPECTIONS**

- A. Perform recommended and required testing in accordance with authority having jurisdiction.
- B. Obtain required permits and provide originals to Owner's Representative.

**6. DEMONSTRATION**

- A. Prior to substantial completion, instruct Owner's Representative on the proper function and required daily maintenance of elevators. Instruct personnel on emergency procedures.

END OF SECTION 14210

**SECTION 14555**  
**SHAFTLESS SCREW CONVEYORS**

**PART 1      GENERAL**

**1.01    SCOPE OF WORK**

- A.    The Contractor shall furnish, install, and place in satisfactory operation shaftless screw conveyors complete with all supports, spare parts, accessories, and appurtenances as specified herein, show on the Drawings, and as required for a complete and operable system.
- B.    Biosolids conveyors shall be supplied by the screw press manufacturer. Conveyors shall be seamlessly integrated into the screw press mechanical and PLC control systems
- C.    Screenings conveyors shall be supplied by the screen supplier. Screw conveyors shall integrate seamlessly into the screens control system.

**1.02    RELATED WORK**

- A.    Screw Press            Section 11542

**1.03    REFERENCES**

- A.    ASTM            American Society for Testing and Materials
- B.    NEMA            National Electrical Manufacturers Association
- C.    AGMA            American Gear Manufacturers Association
- D.    AWS            American Welding Society
- E.    CEMA            Conveyor Equipment Manufacturers Association

**1.04    SUBMITTALS**

- A.    Submit for approval the following
  - 1.    Provide (4) complete approval submittal manuals. Manuals shall be in a white 3-ring binder, and include tabbed sections defining scope, process calculations, mechanical and structural calculations, catalog cuts, and drawings.
  - 2.    Drive details, including calculations and procedures used for selection of drive components, service factor of gear reducer based on absorbed horsepower and installed motor horsepower.
  - 3.    Manufacturer's literature, illustrations, specifications, and engineering data including total weight of each unit, structural loads at supports, connection details, and performance data.
  - 4.    Drawings shall show dimensions, overall arrangement of equipment and materials of construction.

**1.05 QUALITY ASSURANCE**

**A. Acceptable Manufacturers**

1. Referenced manufacturer is Jim Myers & Sons, Inc., Charlotte, NC (JMS), Custom Conveyor, Spirac and KWS.
2. The system shall be capable of distributing dewatered sludge to multiple locations of either a dump truck or dumpster.

**1.06 WARRANTY**

- A.** The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.

**PART 2 PRODUCTS**

**2.01 GENERAL**

- A.** All parts furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, transportation, erection, and continuous operation. All materials for the conveyors shall be new and shall be of the very best quality, entirely suitable for the service to which the units are to be subjected and shall conform to all applicable sections of these specifications.
- B.** The screw conveyor equipment shall be factory pre-assembled, factory pre-wired, and factory tested to the greatest extent practical.

**2.02 PERFORMANCE AND DESIGN REQUIREMENTS**

**A. Biosolids Shaftless Screw Conveyor**

1. Number of units: 2
2. Designation: Transfer Screw Conveyor (TSC), Distribution Screw Conveyor (DSC)
3. Operating schedule: Continuous duty
4. Design handling capacity: 144 cu ft/hr
5. Maximum incline: 15 degrees
6. Length of trough/screw: TSC=23', DSC=19'
7. Minimum screw diameter: 12 inches
8. Material density: 65 lb/ cu ft
9. Percent solids: 16 percent - 25 percent solids by dry weight
10. Maximum screw rotation speed: 20 rpm
11. Minimum drive horsepower: 5.0 hp
12. Trough bottom drain size: 6 inch
13. Spray washwater connection: 3/4 inch

## SHAFTLESS SCREW CONVEYORS

14. Conveyor system designed to provide a minimum clear height of 11'-6" at discharge elevation of DSC.
15. DSC discharge points: Four (4)

### B. Screenings Shaftless Screw Conveyor

1. Number of units: 1
2. Designation: Screenings Screw Conveyor (SSC)
3. Operating schedule: Continuous duty
4. Design handling capacity: 15 cu ft/hr
5. Maximum incline: 5 degrees
6. Length of trough/screw: TSC=23', DSC=19'
7. Minimum screw diameter: 12 inches
8. Material density: 65 lb/ cu ft
9. Maximum screw rotation speed: 20 rpm
10. Minimum drive horsepower: 5.0 hp
11. Trough bottom drain size: 6 inch
12. Spray washwater connection: 3/4 inch

## 2.03 EQUIPMENT

### A. Spiral Flighting

1. Spiral shall be manufactured from chromium nickel alloy steel with a brinell hardness of 250, and maximum yield strength of 80,000 psi.
2. Spiral flighting shall be designed to convey material without a center shaft.
3. The spiral flights shall be designed with the stability to prevent distortion and jumping in the trough. The torsional rating of the spiral shall be such that, at 150% of the motor nameplate horsepower, the drive unit cannot produce more torque than the torsional rating of the flighting. Spiral flights shall be 1" thick x 3" wide. Sectional flighting, formed from plate, shall not be permitted. Dual ribbon spirals may be provided when recommended by the manufacturer.
4. Connect spiral flighting to drive shaft by welding spirals to minimum 3/4 inch circular torque plate reinforced with curved gusset plate for 180 degrees. Drive shaft shall have a mating flange for bolting to the spiral flighting.

## SHAFTLESS SCREW CONVEYORS

5. A gland packing ring consisting of two Teflon fiber packing rings shall seal the drive shaft at its penetration through the end plate, along with a greased labyrinth sealing system.
6. Compression and/or elongation: Less than 0.08 inch per 1 foot at maximum loading
7. Edges: Smooth in the as-rolled condition
8. Spirals shall be manufactured in a two-stage process. Single stage forming of diameter and pitch is not acceptable. Manufacturer shall certify the two-stage forming process, and this certification shall be included in the submittal information. Such two stages shall first consist of tightly cold rolling at zero pitch on a mandrel which uses a device to control the plastic flow of the spiral during forming and maintain a uniform outside and inside diameter thickness with no neck-down. The second stage of spiral forming shall consist of pulling the closely wound spiral in tension to the specified pitch in a device permitting free spiral rotation.

### B. Troughs

1. Trough shall conform to CEMA Standards and be manufactured from T-304 stainless steel.
2. Minimum trough thickness (inch): 3/16 in.
3. A neoprene or rubber gasket shall be provided at each trough flange and between trough top and covers
4. CEMA standard trough end plates shall be provided with a split gland packing ring consisting of two Teflon coated packing rings shall seal the drive shaft at its penetration through the end plate.
5. UHMW-PE Liner: 1/2" thick, in four (4) foot sections, held in place without penetrations or fasteners through trough, and replaceable
6. Stiffeners shall be placed across the top of the trough and fastened to both sides of the trough to maintain trough shape.
7. Drain: 3 inches from driven-end trough flange, bottom mounted, and welded perpendicular to the trough
8. Each trough shall be equipped with filling and/or discharge spouts at the location shown on the drawings. If required, each filling and discharge spout shall be flanged suitable for interconnection to other devices.

### C. Conveyor Trough Covers

1. Trough covers should be 1/8 inch thickness, hinged and clamped. Each cover shall be less than 48 inches in length and shall have two hinges along one edge.
2. Hinges are located on the top of the conveyor trough U-flange and connect to the down-turned lip of the covers. Provide release to permit



## SHAFTLESS SCREW CONVEYORS

covers to be easily removable. Hinges shall incorporate an integral back support for the cover to support the cover in an open position at an over-center position.

3. The covers shall be gasketed on all four sides. Each cover shall have a 1-inch turned-down edge on the two long sides of the covers with a bubble gasket fixed to the edges of the covers. The gaps between the covers shall have gaskets. Cover at chutes or bolted cover will have turned-down edges on two sides only. Each cover shall have a lifting handle, 3/8 inch diameter rod, approximately (plus 1/8 inch) 6 inches wide by 2 inches deep. The handle rod shall be fully welded to the cover.

### D. Supports

1. Provide supports suitable for mounting as shown on the drawings and as required by supplier's design. The supports shall be capable of supporting the equipment weight when fully loaded. The supports shall be fabricated from standard shapes and plates. Supports shall be match marked and shipped to the job site for installation in the field.
2. At a minimum, each conveyor shall be provided with supports at the inlet and discharge end, with intermediate supports at 10 feet-0 inches on center.
3. Provide base plates at each support leg for anchor bolting
4. Height of support legs as indicated on Drawings
5. The supports shall be designed to avoid interference with other equipment or equipment supports.
6. Supports shall be manufactured from carbon steel.
7. All structural supporting members shall be designed such that the ratio of the unbraced length to least radius of gyration (slenderness ratio) shall not exceed 120 for any compression member and shall not exceed 240 for any tension member. In addition, all structural members and connections shall be designed so that the unit stresses will not exceed the American Institute of Steel Construction allowable stresses by more than 1/3 when subject to loading of twice the maximum design operating torque of the spiral conveyor drive motors.

### E. Drive System

1. Drive assembly shall consist of an integral gearmotor, mounted directly to the screw shaft. Gearmotor housing shall be cast iron, furnishing complete protection under all conditions of service. Gears shall be manufactured and rated for continuous duty in accordance with AGMA Standards, of heat-treated alloy steel. Provide splash type gear lubrication. Gear reducer shall be Class II speed reducer as manufactured by Eurodrive.
2. The gear reducer and drive shall be designed to provide an applied torque adequate to start a full loaded conveyor.

## SHAFTLESS SCREW CONVEYORS

3. Drive shall have a minimum AGMA service factor of 1.4 and shall operate on 460V/3 phase/60 Hz power.
4. The drive system shall be provided with an instantaneous trip current relay for torque overload protection. The relay shall be provided with a time delay (adjustable) to short the relay on start-up and initial motor amp draw.
5. In the event of a prolonged power failure or emergency system shutdown, the drive system shall be designed, at a minimum, to start the conveyor from a dead stop with the trough filled at 2 times the design load.
6. Gearboxes and motors shall be factory-assembled on the conveyor, factory-tested and shipped fully assembled with the conveyors.

### F. Motor Operated Slide Gates

1. The slide gate shall be designed so that in the full, open position at least one rotation of the spiral is exposed to the opening in the direction of transport. The slide gates shall have an opening at least the full width of the conveyor. Minimum opening size shall be 14" X 13". The slide gates shall be fabricated with A36 steel frame, galvanized after fabrication and gate blade and wetted parts 304 stainless steel. The conveyor manufacturer shall provide electric motor operated actuator with internal limit switches to indicate open and closed status.
2. The electric actuators shall be NEMA 4 rated, have internal adjustable limit switches, and a manual hand wheel override. The actuator shall be supported underneath the conveyor trough by supports designed and supplied by the conveyor manufacturer. Actuator BUS cards (if applicable) shall be furnished by the controls supplier. Electric actuators shall be as manufactured by Limitorque or Rotork.
3. Provide two (2) motor operated slide gates on the DSC as shown on the drawings.

### G. Safety Devices

1. Each conveyor shall be furnished with a pull cord emergency stop switch. The cord shall run the full length of each conveyor. The trip switch shall immediately stop all conveyors when the switch is actuated. This device shall be in NEMA 4 enclosure.
2. A zero speed switch shall be provided. The switch shall be housed in a NEMA 4 enclosure, mounted on the side of the conveyor U-trough with a stainless steel bracket. The switch shall be a Milltronics ZSS or equal.

### H. Hardware

1. All fasteners shall be 316 stainless steel.
2. All stainless steel bolts shall be assembled using an anti-seize compound.
3. All structural bolts shall be A-325, hot-dip galvanized.

## SHAFTLESS SCREW CONVEYORS

### I. Fabrication

1. All parts and components shall be factory-assembled in sections convenient for field handling and installation but requiring the minimum amount of work for field assembly. Field welds at the jobsite by the Contractor for installation may be necessary when any overall conveyor length presents shipping or handling constraints.
2. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.
3. All assembled parts and components ready for shipment shall be securely bundled, coiled, or crated and adequately protected from damage and corrosion during shipment and storage.

### J. Surface Preparation

1. SSPC-SP 6 blast cleaning with one (1) coat shop primer, 3-4 mil dry film thickness.
2. Fabricated carbon steel components shall be shop blasted & hot dipped galvanized.
3. Drive unit shall include manufacturer's standard wash down duty paint system.

### K. Control Panel

1. No control panel is required. The conveyors will be controlled from the starters furnished by the contractor.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The screw conveyor shall be installed in accordance with the manufacturer's written recommendations.
- B. Lubricants and Lubricating Equipment
  1. Provide and install necessary grade quality oils, greases and anti-seize compounds for initial operation of all equipment provided that requires oil, grease or anti-seize.
  2. Anti-seize shall be applied to the threads of all stainless steel bolts before assembly at the factory and field assembly.

### 3.02 MANUFACTURERS SERVICES

- A. Manufacturer's Field Services: The CONTRACTOR shall provide the following services in addition to any other services specified herein and required by these Specifications.
  1. A factory trained manufacturer's representative shall be provided for a minimum of two (2) trips and a minimum of three (3) eight-hour days to provide installation supervision, start-up and field testing services, and O&M training services. The installation services shall be coordinated

## SHAFTLESS SCREW CONVEYORS

between the CONTRACTOR and the manufacturer. The start-up and field testing services, and the O&M services shall be coordinated with the ENGINEER.

2. After installation supervision and field testing services by the manufacturer, the CONTRACTOR shall submit to the ENGINEER, a certification letter on the manufacturer's letterhead and signed by the manufacturer certifying that the equipment was installed per the manufacturer's recommendations.
  3. The manufacturer shall provide operator training to all required plant personnel.
- B. All costs, including travel, lodging, meals, and incidentals for manufacturer service shall be included in the CONTRACTOR'S bid.

### 3.03 OPERATIONS AND MAINTENANCE

- A. Submit (4) complete operation and maintenance manuals. Manuals shall be in a white 3-ring binder with tabbed sections to include reinforced 8.5" x 11" paper, 11" x 17" B-size drawings when practical, and individually sleeved D-size drawings.
- B. The manual shall include: Equipment Data Pages, Equipment Introduction and Operation, Warranty, Long Term Storage, Troubleshooting, Maintenance and Lubrication, Spare Parts List, Equipment Listing, Catalog Cuts, and Drawings.
- C. Field start-up reports as described in paragraph 3.3 (Manufacture Services) shall be submitted after start-up for owner's insertion into approved O&M manual.

### 3.04 SPARE PARTS

- A. One (1) complete set wear liners for each conveyor
- B. One zero speed switch.
- C. One E-stop safety switch.

**END OF SECTION**

## SECTION 14620 MANUAL CHAIN HOIST

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. Provide One (1) manual chain hoist and hand propelled trolley where shown on the Drawings as specified herein and as needed for a complete and proper installation.

#### 1.2 SUBMITTALS

- A. Submit for review, shop drawings showing the following:
  - 1. Materials list of items proposed to be provided under this Section.
  - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
  - 3. Shop drawings showing general layout, installation, materials, finishes, construction and assembly.
  - 4. Name and address of the nearest service and maintenance organization that stocks repair parts.

#### 1.3 QUALITY ASSURANCE

- A. Referenced manufacturer of manual trolley hoist is Columbus McKinnon and Coffing Hoists with supplier being Engineer Systems, Inc. of Lexington, SC or approved equal.
- B. Codes and standards:
  - 1. In addition to complying with pertinent requirements of governmental agencies having jurisdiction, comply with ANSI B30.16, "Safety Standards for Overhead Hoists".
  - 2. In the event of conflict between or among pertinent codes, standards, and regulations, comply with the more stringent requirements.
- C. Equipment must be the standard product of a manufacturer regularly engaged in the production of manual trolley hoists for a minimum of five (5) consecutive years within the Continental United States of America.
- D. Manufacturer to be a member of the Hoist Manufacturer's Institute.

**1.4 WARRANTY**

- A. The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION.

**1.5 DELIVERY, STORAGE, HANDLING**

- A. All equipment shall be crated to protect it against damage during shipment.
- B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from time of shipment until unit installation is completed and the units and equipment are ready for operation.

**PART 2 - PRODUCTS**

**2.1 MANUAL TROLLEY HOIST**

- A. Provide manual trolley hoist for operation on standard S-beam.
- B. All hoisting equipment shall be guaranteed to meet or exceed all of the above specifications.
- C. Due regard shall be given in design for the safety of operation and durability of parts.
- D. Parts most subject to replacement shall be readily accessible and replacement parts shall be interchangeable.
- E. Materials shall be properly selected for the stresses encountered when the equipment is used in accordance with the manufacturer's recommendations.
- F. Provide hoists that are made in the United States.

**2.2 CHAIN HOIST**

- A. Provide chain operated hoist(s) having the following attributes:

## MANUAL CHAIN HOIST

<b>Location</b>	<b>Capacity</b>	<b>Lift</b>	<b>Hand Chain Length*</b>	<b>Trolley Connection (Hooked or Mounted)</b>	<b>Trolley Type (Manual or Geared)</b>
Dewatering Building	1-Ton	20-feet	16-feet	Mounted	Geared

\*Length is distance from hoist downward

**B. Chain**

1. Load chain to be zinc-plated chain.
2. Hand chain to be zinc-plated or aluminum unwelded chain.

**C. Provide high strength aluminum alloy castings in frame and covers.**

**D. Provide for easy dismantling to make periodic inspections or for replacing chains or parts simple, requiring only a small wrench and screwdriver.**

**E. Provide high efficiency spur gearing.**

**F. Provide enclosed contoured Weston type load brake.**

1. Brake to operate efficiently, regardless of any lubrication on its surfaces and whether hot or cold, wet or dusty.

**G. Provide load chain guide that completely shrouds load sheave, guides chain into load wheel and effectively shields these parts from entry of foreign objects.**

**H. Provide hand chain guide designed to eliminate fouling and to permit angular pull on the hand chain.**

**I. Provide top hook trolley connection assembly where indicated on the schedule:**

1. Hook design to permit hoist to rock and swivel under load.
2. Alloy crosshead rocks in rolled steel straps welded to frame.
3. Hook to be drop-forged alloy steel, heat treated.
4. Hook shall open before fracturing.

**J. Provide bottom hook assembly of forged, alloy steel operating on thrust bearing with full swiveling action.**

1. Provide safety hook design with bronze snap springs.

- K. Provide a fabricated Type 304 stainless steel chain bucket.
- L. Provide load limiter for automatic protection from overload.

**2.3 GEARED TROLLEY**

- A. Provide for each hoist where indicated in the schedule one (1) precision bearing type trolley.
- B. Ball bearings to be lifetime lubricated.
- C. Provide heavy rolled steel sideplates shaped to give trolley unit stability and rigidity.
  - 1. Extend beyond the wheels to act as bumpers.
  - 2. Connect the two halves to each trolley with steel equalizing pins, providing load equalization and smooth operation.
- D. Provide alloy cast iron trolley wheels through-hardened for long wear and continuing roundness.
  - 1. Machine wheel treads to provide smoothest possible rolling motion.
  - 2. Rigidly support steel axles in the side frame and set at the same angle as the I-beam flange.
- E. Provide semi-steel trolley blocks to reinforce the side plates as well as the equalizing pin.
- F. Provide a heavy steel suspension clevis.

**2.4 FINISH**

- A. Factory paint all ferrous metal surfaces except those in rolling or sliding contact using the manufacturer's standard products.

**2.5 OTHER MATERIALS**

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.



**PART 3 - EXECUTION**

**3.1 SURFACE CONDITIONS**

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

**3.2 INSTALLATION**

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations and Shop Drawings as approved by the Engineer, and with pertinent requirements of governmental agencies having jurisdiction, anchoring components firmly into position for long life under hard use.

**3.3 ADJUSTMENT**

- A. Upon completion of the installation, carefully inspect each component and verify that all items have been installed in their proper location, adequately anchored, and adjusted to achieve optimum operation.

**END OF SECTION**

**SECTION 15001**  
**WATER MAIN PIPING, VALVES AND ACCESSORIES**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    This Section covers the Work necessary to furnish and install, complete, the piping, valves, meters and accessories specified herein in order to complete the water main extension and services, including connections to existing mains and facilities.

1.02    GENERAL

- A.    Like items of material provided hereunder shall be the end products of one (1) manufacturer. All materials shall be manufactured in the United States of America unless otherwise noted by the Engineer.
- B.    See Section GENERAL REQUIREMENTS, which contain information and requirements that apply to the Work specified herein and are mandatory for this project.

1.03    HIGHWAY PERMITS

- A.    Highway permits for State and Federal highway right-of-way construction will be obtained by the owner following the award of Contract. The Contractor shall assist the Engineer in preparing the permit applications, including locating existing utilities, selecting the desired pipe locations, and staking the desired pipe locations, and staking the permit stations. The permit shall be submitted by the Owner and the Contractor shall pay the permit bond required by the Highway Department.
- B.    The actual location of pipes along State and Federal highway rights-of-way shall be as required by the Highway Department and the final permit.

**PART 2      PRODUCTS**

2.01    DUCTILE IRON PIPE

- A.    Ductile iron pipe shall be centrifugally cast, Grade 60-42-10 iron, ANSI A21.51, AWWA C151, cement-mortar lined and seal coated in accordance with ANSI A21.4.
- B.    Ductile iron pipe pressure class shall be as follows unless shown or required otherwise.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

12" or less – Pressure Class 350

14" -20" - Pressure Class 250

24" – Pressure Class 200

30" and up – Pressure Class 150

- B. Joints shall be as follows unless shown or required otherwise:
  - 1. Typical buried pipe: push-on joint.
  - 2. Creek crossings: TR-Flex by U.S. Pipe, Flex-Ring by American, or equal.
  - 3. Bridge crossings: TR-Flex by U.S. Pipe, Flex-Ring by American, or equal.

### 2.02 PVC PIPE

- A. Polyvinyl chloride (PVC) pipe shall comply with ASTM D1784 for PVC materials and ASTM D2241 for PVC pipe and shall meet the requirements of NSF 14 and 61 standards for potable water supply. PVC pipe shall be supplied in lengths not less than twenty (20) feet.
- B. Joints shall be push-on type spigot and bell with integral bell homogeneous with the pipe. Gaskets shall be rubber meeting the requirements of ASTM F477 and D3139 and shall be locked into the bell groove.
- C. The pipe classes shown below shall be defined according to the Standard Pipe Diameter Ration (SDR) as defined by ASTM D2241. Pipe Class will be shown on the plans:
  - 1. Class 160 Pipe: SDR 26.
  - 2. Class 200 pipe: SDR 21.
  - 3. Class 250 Pipe: SDR 17.
- D. PVC pipe shall be as manufactured by North American Pipe Corporation, or equal.
- E. Locator wire or metallic detector tape shall be included with all PVC mains and all plastic service tubing as per Owners request. Locator wire shall be No. 14 solid insulated copper wire buried approximately six (6) inches above the top of the pipe.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

### 2.03 FITTINGS

- A. Fittings for piping shall be cement-lined cast iron or ductile iron with mechanical joint ends and conforming to AWWA C110 and C111 or C153. Fittings less than twelve (12) inches shall be rated two hundred-fifty (250) psi minimum working pressure and fittings twelve (12) inches and larger shall be rated for one hundred-fifty (150) psi minimum working pressure.
- B. Provide PVC adapters as required to connect fittings to PVC pipe.

### 2.04 THRUST RESTRAINT

- A. Thrust restraint shall be provided by mechanical thrust restraints as shown in the details on the Drawings except where concrete thrust blocks are indicated.
- B. Restrained joint systems shall be used where indicated. Concrete thrust blocks may be used in lieu of mechanical restraints if approved by the Engineer. Restrained joints shall be equal to TR-Flex by U.S. Pipe or Flex-Ring by American Cast Iron Pipe. Field Lok gaskets by U.S. Pipe or Fast-Grip gaskets by American Cast Iron Pipe may also be used for pipe sizes up to twenty-four (24) inches in diameter.
- C. Restraining system consisting of mechanical joints with retainer glands and screws applicable for ductile iron pipe shall be equal to Megalug as manufactured by EBAA Iron may be used.

### 2.05 CASING PIPE

- A. Casing pipe shall be steel, ASTM A139, Grade B with welded field joints. Casing wall thickness shall be min. 0.250 inches for all sizes thirty-six (36) inches and smaller and shall conform to State of Alabama Highway Department Section 862 for larger diameters. Casing pipe shall be shop coated with primer internally and externally, and final coated with bituminous paint on the exterior.
- B. Casing Spacers: Carrier pipe shall be supported inside the casing with approved casing spacers, sized as required for the casing diameter. Casing spacers shall be CCI Model CSC (or approved equal) heavy-duty carbon steel with glass filled polymer runners.
- C. Casing End Seals: shall be seamless neoprene with stainless steel banding. End seals shall be CCI model ESC or approved equal.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

- D. The approximate locations and lengths of encasements are shown on the Drawings for bidding information, but the exact location and length of encasement will be determined by the appropriate highway department.

### 2.06 VALVES

#### A. General:

1. Valves shall be suitable for the intended service. Renewable parts including disc, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein. Valves shall be suitable for the exposure they are subject to, buried, interior or exterior, as applicable.
2. Unless otherwise shown, valves shall be the same size as the adjoining pipe. For the purpose of designating the type and grade of valve desired, a manufacturer's name and list or figure number is given in the following Specifications. Valves of equal quality by other manufacturers will be considered in accordance with the GENERAL CONDITIONS.
3. Valve ends shall be as specified, as shown on the Drawings, and to suit the adjacent piping.
4. Buried service operators shall have a two (2) inch AWWA operating nut. All moving parts of the valve and operators shall be enclosed in the housing to prevent contact with the soil. Exposed operators shall have manual handwheel or lever operator as specified for the valve type.

#### B. Valve Types:

1. Gate Valves:
  - a. Gate valves for buried water service shall be resilient wedge type. The valve body, bonnet and wedge shall be constructed of ductile iron, with all internal and external ferrous surfaces having a fusion bonded epoxy coating, complying with ANSI/AWWA C550. The exterior of the ductile iron wedge shall be encapsulated with nitrite rubber. Ductile iron wrench nuts, O-rings and thrust washers shall be used to achieve watertight seals and ease of operation. Valves shall be Series 2500 American Flow Control, or equal.
  - b. Tapping valves shall comply with the Specifications for gate valves specified hereinbefore. Tapping valves shall be American-Darling 565, M&H Style 751, or equal. Tapping valve shall include cast iron tapping sleeve equal to M&H Style 974.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

### 2. Check Valves:

- a. CV-1: Swing check valves two (2) inches through thirty-six (36) inches shall be in accordance with AWWA C508 and shall be flanged end, cast iron body, bronze mounted valves, with solid bronze hinges and stainless steel hinge shaft. Valves two (2) inches through twelve (12) inches shall be rated one hundred seventy-five (175) pounds and fourteen (14) inches through thirty-six (36) inches rated one hundred-fifty (150) pound cold water, non-shock. Valves shall be fitted with adjustable outside lever and spring. Valves shall be M&H Valve Style 60-SL; American Darling No. 50 Line; or equal.

- C. Valve Boxes: Valve boxes shall be cast iron two (2) piece adjustable heavy roadway type with 5-1/4-inch diameter and appropriate length for the installation. Include cast iron lid with the word "WATER" cast into the top of the lid. Extension pieces, if required, shall be the manufacturer's standard type. All units shall be complete with all necessary bases and accessories. Units shall be Mueller H-10364, Clow F-2452, or equal.

## 2.07 HYDRANTS

### A. Fire Hydrant Specification (5-1/4" Main Valve)

Fire hydrants purchased or installed shall meet or exceed all applicable requirements and tests of ANSI and the latest revisions of AWWA Standard C502. Fire hydrants shall meet all test requirements and be listed by Underwriters Laboratories Inc. Fire hydrants shall meet all test requirements and have full approval of Factory Mutual. Fire hydrants shall meet the following requirements

1. Fire hydrants shall be rated for a working pressure of 250 Psig. (1725 kPa).
2. Fire hydrants shall be of the compression type, opening against the pressure and closing with the pressure.
3. Fire hydrants shall have a minimum 5-1/4" main valve opening and a minimum inside lower/upper barrel diameter (I.D.) of 7" to assure maximum flow performance. Pressure loss at 1,000 GPM shall not exceed the following values:  
  
4.5" Pumper Nozzle: 2.50psi
4. Fire hydrants shall be three-way in design, having one pumper nozzle (size as specified) and two 2-1/2" hose nozzle(s). Nozzle thread type shall be as specified by the end-user. Nozzles shall thread

## WATER MAIN PIPING, VALVES AND ACCESSORIES

counterclockwise into hydrant barrel utilizing “o” ring seals. A suitable nozzle lock shall be in place to prevent inadvertent nozzle removal.

5. The bonnet assembly shall provide an oil reservoir and lubrication system that automatically circulates lubricant to all stem threads and bearing surfaces each time the hydrant is operated. This lubrication system shall be sealed from the waterway and any external contaminants by use of “o” ring seals. An anti-friction washer shall be in place above the thrust collar to further minimize operating torque. The oil reservoir shall be factory filled with a low viscosity; FDA approved non-toxic oil lubricant which will remain fluid through a temperature range of -60° F. to +150° F.
6. The operating nut shall be a one piece design, manufactured of ASTM B-584 bronze. It shall be pentagon/square in shape and the nut dimensions shall be as specified by the end-user. The operating nut shall be affixed to the bonnet by means of an ASTM B-584 bronze hold down nut. The hold down nut shall be threaded into the bonnet in such a manner as to prevent accidental disengagement during the opening cycle of the hydrant. The use of Allen head set screws as a means of retention is unacceptable. A resilient weather seal shall be incorporated into the hold down nut, for the purpose of protecting the operating mechanism from the elements.
7. The direction of the opening shall be **Open Left**. An arrow shall be cast on the bonnet flange to indicate the specified opening direction.
8. The hydrant bonnet shall be attached to the upper barrel by not less than eight **316 Stainless Steel** bolts and nuts and sealed by an “o” ring.
9. Hydrants shall be a “traffic-model” having upper and lower barrels joined at the ground line by a separate and breakable “swivel” flange providing 360° rotation of upper barrel for proper nozzle facing. This flange shall employ not less than eight **316 Stainless Steel bolts**. The safety flange segments shall be located under the upper barrel flange to prevent the segments from falling into the lower barrel when the hydrant is struck. The pressure seal between the barrels shall be an “o” ring. The proper ground line shall be cast clearly on the lower barrel and shall provide not less than 18” of clearance from the centerline of the lowest nozzle to the ground. Hydrants shall be painted **Mueller Yellow (Mueller paint code 14)**.
10. The operating stem shall consist of two pieces, not less than 1 1/4” diameter (excluding threaded or machined areas) and shall be connected by a stainless steel safety coupling. The Upper and Lower operating stem shall made from **17-4 Stainless Steel**. The safety coupling shall have an integral internal stop to prevent the coupling from sliding down into the lower barrel when the hydrant is struck. Screws, pins, bolts, or fasteners used in conjunction with the stem couplings shall also be stainless steel.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

The top of the lower stem shall be recessed 2" below the face of the safety flange to prevent water hammer in the event of a "drive over" where a vehicle tire might accidentally depress the main valve.

11. The lower barrel shall be an integrally cast unit. The use of threaded on or mechanically attached flanges is deemed unacceptable. The hydrant bury depth shall be clearly marked on the hydrant lower barrel.
12. Composition of the main valve shall be a molded rubber having a durometer hardness of 95 +/- 5 and shall be reversible in design to provide a spare in place. Plastic (polyurethane) main valves are unacceptable. The main valve shall have a cross section not less than 1".
13. Hydrants shall be equipped with (2) two drain valves which drain the barrel when the hydrant is closed and seal shut when the hydrant is opened. These drain valves shall be an integral part of the one piece bronze upper valve plate. They shall operate without the use of springs, toggles, tubes, levers or other intricate synchronizing mechanisms.
14. The upper valve plate, seat ring and drain ring (shoe bushing) must be ASTM B-584 bronze and work in conjunction to form an all bronze drain way. A minimum of two (2) internal and two (2) external drain openings are required. Drains ported through an iron shoe must be bronze lined.
15. The bronze seat ring shall thread into a bronze drain ring (or shoe bushing) providing a bronze to bronze connection. Seat rings shall be "o" ring pressure sealed.
16. The shoe inlet size and connection type shall be as specified (flanged, MJ, etc.), having ample blocking pads for sturdy setting and the MJ connection must have two strapping lugs to secure the hydrant to piping. A minimum of six **316 Stainless Steel** bolts and nuts is required to fasten the shoe to the lower barrel.
17. The interior of the shoe including the lower valve plate and stem cap nut shall have a protective coating that meets the requirements of AWWA C-550. If a stem cap nut is utilized, it must be locked in place by a stainless steel lock washer or similar non-corrosive device that will prevent the cap nut from backing-off during normal use.
19. Hydrants shall be warranted by the manufacturer against defects in materials or workmanship for a period of ten years (10) from the date of manufacture. The manufacturing facility for the hydrant must have current ISO certification.
20. Hydrants shall be Mueller Super Centurion 250 or approved equal.



## WATER MAIN PIPING, VALVES AND ACCESSORIES

21. Hydrants shall be cast, manufactured, machined and assembled in the USA.
23. The (isolation) Gate Valve shall be of the same manufacture as the hydrant and must have Mueller cast into the bonnet.

Failure to comply with any of these above requirements is sufficient cause for rejection of proposed hydrants.

The city reserves the right to accept only those materials which are in full compliance with these specifications and deemed most advantageous to its interests.

### 2.08 SERVICE ASSEMBLIES

1. Meters shall conform to AWWA C700, split case type, 5/8 inch by 3/4 inch size or two (2) inch size, positive displacement type, straight reading in gallons, with hermetically sealed and magnetically driven register and leak detector indicator separate from the sweep hand. All meters shall be first line, manufactured and assembled in the United States.
  2. Meters shall include meter connections and shall have hinged bronze cover with manufacturer's serial stamp, white glazed enamel dial with large black register figures. The register shall be completely separated from the measuring chamber and shall be driven by permanent magnets. The main case shall be connected with bolts only, screws shall not be permitted.
  3. Whether the project involves a new system or extension to an existing system, the Owner reserves the right to require a specific meter manufacturer in order to establish or maintain standardization. The meters shall be equal to Sensus with all bronze cases.
- A. Brass Cocks, Stops, and Clamps
1. Corporation cocks shall be 3/4 inch unless shown otherwise on the Drawings. Cocks shall be brass, complying with AWWA C800 and equal to Mueller H-15000 for copper tubing and Mueller H-15008 for plastic tubing.
  2. Curb stops shall be 3/4 inch with full opening unless shown otherwise on the Drawings. Stops shall be brass, complying with AWWA C800 and equal to Ford B-43-232W with lock out wing.
  3. Service clamps shall be used for PVC main connections and shall be equal to Mueller bronze service clamp with corporation cock thread.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

- B. Backflow Preventer: Backflow preventers shall be  $\frac{3}{4}$  inch, complying with ADEM cross connection regulators, rated for one hundred-fifty (150) psi, and equal to A. Y. McDonald Series II or Watts No. 7 dual check valve.
- C. Meter Boxes: Meter boxes shall be plastic, approximately twelve (12) inches by seventeen (17) inches by (12) inches deep, rectangular shape with plastic top, hinged reading lid and cast-in magnet.
- D. Service Pipe:
  - 1. Copper tubing shall conform to Federal Specifications WW-T-799 Type K. Size shall be  $\frac{3}{4}$  inch unless shown otherwise on the Drawings.

### 2.09 RECONNECTION OF EXISTING SERVICE ASSEMBLIES

- A. Brass Cocks, Stops, and Clamps.
  - 1. Corporation cocks shall be  $\frac{3}{4}$ -inch unless shown otherwise on the Drawings. Cocks shall be brass, complying with AWWA C800 and equal to Mueller H-15000 for copper tubing and Mueller H-15008 for plastic tubing.
  - 2. Curb stops shall be  $\frac{3}{4}$ -inch with full opening unless shown otherwise on the Drawings. Stops shall be brass, complying with AWWA C800 and equal to Ford B-43-232W with lock out wing.
  - 3. Service clamps shall be used for PVC main connections and shall be equal to Mueller bronze service clamp with corporation cock thread.
- B. Copper tubing shall conform to Federal Specifications WW-T-799, Type K. Size shall be  $\frac{3}{4}$  inch unless shown otherwise on the Drawings.

### 2.10 PRECAST CONCRETE VALVE/METER VAULT

- A. Precast valve or meter vaults shall be of the size shown on the Drawings or as required to contain the necessary equipment and provide minimum clearances as shown on the Drawings. Vault shall include concrete footings and walls with hinged aluminum access doors. Vaults with depths greater than four (4) feet shall be provided with aluminum ladder attached to one (1) wall. Vaults shall be as manufactured by Hughes Supply, Eagle Wholesale Supply, or equal.

### 2.11 UTILITY MARKERS

- A. Continuous glass fiber and resin reinforced composite utility markers shall be installed at each valve location and locations shown on the drawings. Utility markers shall be 3.75 inches wide and a minimum of 66 inches in length. Markers shall be installed with an embedment depth of 18-inches. Markers shall be blue and imprinted with white lettering: *'Caution Water Pipeline'*. Utility

## WATER MAIN PIPING, VALVES AND ACCESSORIES

markers shall be Utility Marker brand as manufactured by Carsonite Composites or equal.

### PART 3 EXECUTION

#### 3.01 TRENCH EXCAVATION AND BACKFILL

##### A. General:

1. Trenches for mains shall be excavated in the locations shown on the Plans or as directed by the Engineer.
2. All trees, telephone and power poles along the line of Work shall be protected. Where clearing or partial clearing of the right-of-way is necessary, complete before the start of trenching. Cut trees and brush as near to the ground surface as practical, remove all stumps, and remove for disposal. Do not remove trees over two (2) inches in diameter unless they are within four (4) feet of the pipe centerline, without permission from the Engineer. Protect from damage all privately owned shrubs or plants unless approved by the Engineer. If necessary for protection, remove and replace trees, shrubs, or plants by balling the root system and placing in stockpiled topsoil, watering as required. Should any tree, shrub, or plant that has been disturbed as a result of its removal, or otherwise damaged by the Contractor, die within six (6) months from the time it was disturbed or damaged, it shall be replaced in kind and size by the Contractor.
3. Unless boring and jacking is required as shown on the Drawings, cut all bituminous and concrete pavements, curbs and sidewalks before excavation of the trenches with an approved pavement saw, hydrohammer, or approved pavement cutter. Pavement and concrete materials removed shall be hauled from the site and not used for trench backfill. No driveway or road shall be inaccessible at the end of the day's Work and all street crossings shall be backfilled and opened to traffic each day.

##### B. Trench Excavation:

1. Trench widths shall be as required to properly install the mains, but not less than twelve (12) inches wide. The trench depths shall be as required to provide a minimum pipe cover of three (3) feet, unless otherwise approved by the Engineer.
2. At all times provide and maintain ample means and devices to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until the backfill at the pipe zone has been completed.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

### C. Trench Backfill:

1. The Contractor may backfill the trenches before hydrostatic testing, but is responsible for locating and repairing all leaks until a satisfactory hydrostatic test is completed.
2. When backfill is placed mechanically, push the backfill material onto the slope of the backfill previously placed and allow to slide down into the trench. Do not push backfill into the trench in such a way as to permit free fall of the material until at least two (2) feet of cover is provided over the top of the pipe. Under no circumstances allow sharp, heavy pieces of material to drop directly onto the pipe or the tamped material around the pipe. Do not use backfill material of consolidated masses larger than  $\frac{1}{2}$  cubic foot.
3. Backfill trenches beneath roads, paving and sidewalks by placing material in six (6) inch lifts and compacting each lift with mechanical tampers or vibratory compactors to at least ninety-five (95%) percent of the relative maximum compaction as determined by AASHTO T99.
4. Backfill trenches in other areas by placing materials in loose lifts as described hereinbefore and leave the backfill material neatly mounded so that after normal settlement the finished surface will meet with existing grade.
5. Any excess or deficiency of backfill material which becomes apparent after settlement and within the warranty period shall be corrected by disposing of excess material, or adding additional material where required.
6. Any settlement noted in backfill, fill, or in structures built over the backfill or fill within one (1) year warranty period in accordance with the General Conditions will be considered to be caused by improper compaction methods and shall be corrected at no cost to the Owner. Structures damaged by settlement shall be restored to their original condition by the Contractor at no cost to the Owner.

### 3.02 PIPE INSTALLATION

- A. Handling Material: Provide and use proper implements, tools, and facilities for the safe and proper prosecution of the Work. Lower all pipe, fittings, and appurtenances into the trench, piece by piece, by means of a crane, slings, or other suitable means and in such a manner as to prevent damage to the pipeline materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.
- B. Cleaning Pipe and Fittings: Remove all dirt, blisters, lumps, and excess coating from the bell and spigot ends of each pipe. Wipe the outside of the spigot and the inside of the bell until joints are clean, dry, and free from oil and grease before the pipe is laid.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

- C. Cutting Pipe: Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe or leaving a beveled end as recommended by the manufacturer. Dress cut ends to remove sharp edges or projections which may damage the rubber gasket.
- D. Laying Pipe: Unless otherwise directed, lay pipe with bell end facing in the direction of the laying. For lines on an appreciable slope, face bells upgrade at the discretion of the Engineer. Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of one (1) inch. Wherever it is necessary to deflect from a straight line, the maximum deflection per joint shall be as recommended by the pipe manufacturer.
- E. Joining Push-On Joint Pipe: Lay and join pipe in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for the installation. Lubricant for the pipe shall be furnished by the pipe manufacturer.
- F. Joining Mechanical Joint Pipe and Fittings: Install in accordance with manufacturer's recommendations. After cleaning ends and gasket, slip the gland and gasket on the plain end, lubricating if necessary to facilitate sliding the gasket into place. Guide the end of the pipe into the bell of the pipe previously laid, locating the spigot centrally in the bell. Place the gasket into position and insert the bolts in the holes. When tightening bolts, bring the gland up toward the flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively at a time. Do not overstress bolts to compensate for poor alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble after cleaning.

### 3.03 ROAD AND HIGHWAY UNDERCROSSINGS

- A. Open Cut Undercrossings: Complete trench excavation and backfill for open-cut undercrossings as hereinbefore specified under Trench Excavation and Backfill.
  - 1. All labor, equipment, and materials required to open cut road crossings as designated on drawings including but limited to excavation, boring, piping, pipe supports, casing, backfill, and clean-up, grassing, etc.. Payment shall be based on unit price.
- B. Casing Installation:
  - 1. Jacked or bored casings shall be continuously welded at joints for a rigid, watertight encasement.

## WATER MAIN PIPING, VALVES AND ACCESSORIES

2. All labor, equipment, and materials required to bore road crossings as designated on drawings including but limited to excavation, boring, piping, pipe supports, casing, backfill, and clean-up, grassing, etc..
3. Bored installations shall have a hole diameter which shall not exceed the OD of the casing pipe by more than one (1) inch. Where unstable soil conditions are found to exist, boring operations shall be conducted in such a manner as not to be detrimental to the facility being crossed. If excessive voids or too large a bored hole results, or if it is necessary to abandon a bored hole, prompt remedial measures shall be taken by the Contractor, subject to review by the Engineer and approval of the controlling agency of the facility being crossed.
4. Once boring and jacking operations are started, the Work shall be continuous until completed in order to guard against "freezing" of the casing due to settlement and compaction of surrounding soil. Casing shall be installed at a uniform slope.

### C. Carrier Pipe Installation:

1. The entire length of casing shall be complete before any carrier pipe is placed therein. Carrier pipe materials and installation shall conform to the requirements specified elsewhere except as hereafter indicated or as required by the controlling agency permit.
2. Where timber cradles are required, strap the cradles to the pipe before sliding into casing. Pipe barrel shall bear continuously on cradles.
3. The carrier pipe may be pushed or pulled into the casing as pipe lengths are assembled. Pipe installation shall conform to requirements specified herein, including testing.

### D. Pavement Replacement:

1. All Work associated with the pavement replacement shall be done in strict accordance with the State of Alabama Highway Department Standard Specifications.
2. Pavement shall be immediately replaced provided weather conditions or other factors permit. Should conditions prevent immediate repaving, apply a temporary approved cold patch for the full trench width and maintain until such time as the final asphalt surface course can be completed.

## 3.03 VALVE INSTALLATION

### A. Valves:

## WATER MAIN PIPING, VALVES AND ACCESSORIES

1. Before installation, the valves shall be thoroughly cleaned of all foreign material, and shall be inspected for proper operation, both opening and closing, and to verify that the valves seat properly. Valves shall be installed so that the stems are set vertical. Jointing shall conform to AWWA C600 or AWWA C603 as applicable. Joints shall be tested with the adjacent pipeline.
2. Flange faces and mechanical joint sockets shall be thoroughly cleaned before the joint is assembled.

### B. Valve Boxes:

1. Center the valve boxes and set plumb over the wrench nuts of the valve. Set valve boxes so that they do not transmit shock or stress to the valves. Set the valve box covers flush with the finished surface as shown. Cut extensions to the proper length so that the valve box does not ride on the extension when set at grade.
2. Backfill shall be the same as specified for the adjacent pipe. Place backfill around the valve boxes and thoroughly compact to a density equal to that specified for the adjacent trench and in such a manner that will not damage or displace the valve box from proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed, and backfilled at the Contractor's sole expense.

### C. Connection to Existing Water Mains:

1. Points of connection to existing water mains shall be exposed prior to trenching of the new line not less than forty-eight (48) hours prior to the anticipated connection time. The Contractor shall immediately notify the Engineer if the connection cannot be made in accordance with the Drawings.
2. All connections to the existing system and all testing of the new line must be with the authorization of, and in the presence of, the authorized representative of the water system. Opening of valves and use of water from the water system will be done by the system.
3. Connections to an existing system using a tapping machine shall be completed in accordance with the manufacturer's recommendations. Where cut-ins are permitted to be made in existing pipes, the Work shall be conducted at such a time and in such a manner as to minimize the interruption of service. Necessary pipe, fittings, and valves shall be assembled at the site ready for installation before water is shut off in the existing main. Once water service has been shut off, the Work shall be

## WATER MAIN PIPING, VALVES AND ACCESSORIES

prosecuted vigorously and shall not be halted until the line is restored to service.

### 3.04 SERVICE CONNECTIONS

- A. Service pipe shall be laid with a minimum cover of thirty (30) inches, except on State and Federal highway rights-of-way the minimum cover shall be as required by the Highway Department but not less than thirty-six (36) inches.
- B. Trenching and backfilling for services shall be hereinbefore specified for water mains, except pavements or sidewalks shall not be cut. Where the service pipe crosses a paved street or sidewalk it shall be laid by means of pushing, jetting or boring.
- C. Copper tubing as hereinbefore specified shall be used for all standard service connections, including State, Federal and County Road crossings, unless otherwise noted. In general, service piping will extend from the main to a point near the property line designated by the water system.
- D. Mains shall be tapped for service connections at an angle of not more than thirty (30°) degrees to the horizontal. Use only suitable tapping equipment and the coupon removed from tapping the main must be delivered to the Engineer.

### 3.05 HYDROSTATIC TESTING

- A. General: Make pressure and leakage tests on all newly laid pipe. The Contractor shall provide all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The Engineer will monitor and witness the tests before the installed pipe is approved. Pressure tests must be completed before payment is made for that section of pipe.
- B. Test Pressure: Each section of pipe shall be slowly filled with water to the test pressure shown in the piping schedule or to the pressure class rating of the pipe. Pressure shall be applied by a motor-driven pump. The test duration shall be six (6) hours for covered pipe and three (3) hours for uncovered pipe. The Contractor shall provide a pressure chart recorder for the duration of each test.
- C. Procedure: Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, taps shall be made at points of highest elevation and plugged afterward. At the end of the test period, the Contractor will inject a sufficient quantity of water into the pipe section to re-establish the specified pressure. The Contractor shall provide suitable means to determine the quantity of water lost by leakage during the test. The Engineer must witness the quantity of water leakage and pressure recording and sign both before approving the test.



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- D. Allowable Leakage: Exposed piping shall not have any visible leakage. For buried pipelines less than 500 LF the allowable leakage shall be zero (0) gallons. For lengths more than more than 500 LF the allowable leakage shall be less than the amount determined by the following formula:

$$L = \frac{(10) D L_e}{126720}$$

126720

Where            L = Allowable leakage, gallons per hour

D = Nominal diameter of pipe, inches

L<sub>e</sub> = Length of pipe, feet

- E. Allowable Loss of Pressure: The maximum allowable drop in pressure from the test pressure shall be no greater than five (5) percent of the test pressure.
- F. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

### 3.06    DISINFECTION

- A. General: After pipelines, valves, fittings, and appurtenances have been installed and tested, they shall be disinfected in accordance with AWWA C651 or as modified by any governing agency having jurisdiction. The Contractor shall provide all equipment and materials necessary to adequately disinfect all facilities.
- B. Flushing: Before sterilizing, flush all foreign matter from the line. Flushing velocities shall be at least 2.5 feet per second. For large diameter pipelines where it is impractical to flush the pipe at this velocity, clean the pipeline in place from the inside by brushing, sweeping and swabbing, then flush the line at a lower velocity.
- C. Disinfection: Disinfect with a chlorine solution having a free chlorine residual of fifty (50) ppm. The solution shall be injected into the pipe through a corporation stop or suitable tap in the top of the pipeline. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the existing water mains or so that contaminated water does not enter any disinfected mains.
- D. Retention Period: The chlorine solution shall remain in the pipeline for twenty-four (24) hours or long enough to destroy all nonspore-forming bacteria, whichever is greater. Operate all valves, hydrants, and other appurtenances during disinfection to assure that the chlorine solution is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise

## **WATER MAIN PIPING, VALVES AND ACCESSORIES**

may not receive the solution. After the retention period is complete, flush the chlorinated solution from the line until a chlorine residual of 0.2 ppm has been achieved.

- E. Bacteriological Samples: After flushing, collect a minimum of two (2) water samples for bacteriological analysis at a rate of at least one (1) per mile of water main disinfected and submit to a laboratory certified by ADEM. Where new connections to existing piping are made, at least one (1) sample per affected area of the system shall be collected and analyzed. All samples shall indicate absence of Total and Fecal Coliform. Contractor shall repeat disinfection procedure until satisfactory results have been obtained. The bacteriological results shall be sent directly to the Engineer.

**END OF SECTION**

**SECTION 15002**  
**GRAVITY SEWER, MANHOLES AND ACCESSORIES**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    This section covers the work necessary to furnish and install, complete, the gravity sewer, manholes and service laterals specified herein in order to complete the gravity sewer and laterals, including connections to existing facilities.

1.02    GENERAL

- A.    Like items of material provided thereunder shall be the end products of one manufacturer.

1.03    SUBMITTALS

- A.    Shop Drawings: Furnish the following:
  - 1.    Precast Manhole Base Sections: Details of construction.
  - 2.    Manhole steps.
- B.    Quality Control Submittals: Furnish the following:
  - 1.    Precast Manhole Sections: Manufacturer's results of tests performed on representative sections to be furnished.
  - 2.    Certified load test data for manhole steps.

**PART 2      PRODUCTS**

2.01    CARBON STEEL PIPE, AND FITTINGS

- A.    Pipe shall be carbon steel, seamless or electric resistance welded, ASTM A53, Grade B or ASTM A106, Grade B. Pipe wall thickness for two (2)-inch and smaller shall be Schedule 80, pipe wall thickness for 2½ inch and larger shall be Schedule 40 with wall thickness 0.375 inches. Pipe shall have an epoxy coating system inside and out as manufactured by Tnemec. Coatings shall be submitted with piping for approval.
- B.    Joints for two (2)-inch and smaller shall be threaded, all joints 2½-inch and larger shall be butt welded where required for connections to equipment.

## GRAVITY SEWER MANHOLES AND ACCESSORIES

### 2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe shall be centrifugally cast, Grade 60-42-10 iron, ANSI A21.51, AWWA C150, cement-mortar lined and seal coated in accordance with AWWA C110, Thickness Class 50.
- B. Joints shall be flanged unless shown or required otherwise.

### 2.03 PVC PIPE

- A. Polyvinyl chloride (PVC) pipe shall comply with ASTM D3034-81 for PVC materials and ASTM F679, minimum pipe stiffness 115 psi at 5% deflection, and shall meet the extra strength minimum of Standard Diameter Ratio 35. PVC pipe shall be supplied in lengths not less than 20 feet.
- B. Joints shall be push-on type spigot and bell with integral bell homogeneous with the pipe. Gaskets shall be rubber meeting the requirements of ASTM F477 and D3212 and shall be locked in to the bell groove.
- C. The pipe classes shown below shall be defined according to the Standard Pipe Diameter Ratio (SDR) as defined by ASTM D2241. Pipe class will be shown on the plans.
  - 1. Class 160 pipe: SDR 26
  - 2. Class 200 pipe: SDR 21
  - 3. Class 250 pipe: SDR 17
  - 4. Gravity sewer pipe: SDR 35
- D. PVC pipe shall be as manufactured by North American Pipe Corporation, or equal.

### 2.04 TRENCH STABILIZATION MATERIAL

- A. Trench stabilization material shall be three-inch minus river-run or pit-run gravel, crushed gravel, or crushed rock; free from clay balls, roots, and organic matter; well-graded from coarse to fine, with less than 8 percent by weight passing the 1/4-inch sieve.

### 2.05 GRANULAR PIPE BASE AND PIPE ZONE MATERIAL

- A. Granular pipe base and pipe zone shall be Natural stone; washed, free of clay. Shale, organic matter; graded in accordance with ASTM C136 to meet the

## GRAVITY SEWER MANHOLES AND ACCESSORIES

requirements of AHD Std. Spec., Section 801, Size No. 6 or No. 57, stone may be used if approved by the Engineer.

### 2.06 GRANULAR FILL

- A. Granular fill shall be natural sand or sand gravel, free from dirt, clay balls, and organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction, and less than 20 percent by weight passing the No. 200 sieve.

### 2.07 CONCRETE

- A. Concrete shall have 4,000 psi compressive strength at 28 days. Portland cement shall conform to ASTM C150, Type II.

### 2.08 MORTAR/GROUT

- A. Mortar shall be standard premixed meeting ASTM C387, or proportion 1 part portland cement to 2 parts clean, well-graded sand which will pass a 1/8-inch screen.
- B. Admixtures: May be included but do not exceed the following percentages of weight of cement:
  - 1. Hydrated Lime: 10 percent.
  - 2. Diatomaceous Earth or Other Inert Material: 5 percent.
- C. Consistency:
  - 1. Tongue-and-Groove Type Manhole Joint: Such that mortar will readily adhere.
  - 2. Confined Groove (Keylock) Manhole Joint: Such that excess mortar will be forced out of groove and support is not provided for section being placed.

### 2.09 PRECAST MANHOLE RISER SECTIONS

- A. Minimum 48 inches in diameter, conforming to ASTM C478 and the following:
  - 1. Minimum Wall Thickness: 5" inches.
  - 2. Provide eccentric cones for manholes. Cones shall have same wall thickness and reinforcement as riser section.
  - 3. Top and bottom of sections shall be parallel.
  - 4. Manhole Steps: Cast in sections by the manufacturer.

## GRAVITY SEWER MANHOLES AND ACCESSORIES

5. Joints: Tongue-and-groove or confined groove with mastic. Confined Oring with rubber gaskets meeting ASTM C443.
  6. Manhole couplings or flexible boots or sleeves either cast in or grouted into manhole wall for watertight seal on manhole-pipe connection.
- B. Source Tests:
1. Prior to delivery of any size precast manhole section to job site, conduct yard tests at point of manufacture.
  2. Precast sections to be tested will be selected at random from stockpiled material to be supplied for the job.
  3. All test specimens shall be mat-tested and meet the permeability test requirements of ASTM C14.

### 2.10 PRECAST BASE SECTIONS AND BASES

- A. Acceptable as an option if approved by ENGINEER.
- B. Base Sections: Base slab integral with sidewalls.
- C. Base Slab: Minimum 6 inches thick with No. 4 reinforcing bars, 8-inch centers, both directions in center of slab. Tie reinforcing steel to wall steel.

### 2.11 MANHOLE EXTENSIONS

- A. Concrete Grade Rings for Extensions: Maximum 6 inches high with a minimum of one No. 2 reinforcing bar centered in the ring.
- B. Manhole Encapsulation System: CCI Piping Systems WrapidSeal or approved equal
1. Shall be installed on the corbel and joint sections of the manhole. shall be installed from the frame to 4" below the cone and lowest grade ring joint.
  2. Installer shall follow all manufacturer's procedures and specifications to ensure proper application.
- C. Preformed plastic manhole gaskets shall be used in lieu of mortar type joints between each concrete grade ring.

### 2.12 PREFORMED PLASTIC MANHOLE GASKETS

- A. Provid in lieu of mortar type joints.
- B. Conform to requirements of Federal Specification SS-S-00210.

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### C. Manufacturers:

1. Hamilton Kent Manufacturing Co., Box 178, Kent, OH 44240, Kent-Seal No. 2.
2. K. T. Snyder Co., Inc., Central National Bank Bldg., Houston TX 77002, Ram-Nek.

### 2.13 MANHOLE STEPS

- A. Shall be PSI-PF, manufactured by M.A. Industries Inc., Kelly & Dividend Dr., Peachtree City, GA 30269, or equal.
- B. Design: Provide certification that steps are capable of withstanding the vertical and horizontal load test specified in ASTM C478.

### 2.14 MANHOLE FRAMES AND COVERS

- A. Shall be 24-inch clear opening as manufactured by Neenah Foundry R-1916-F. Frames shall have 4-1" anchor bolt holes for bolting to concrete manhole. Frames shall be watertight with bolted lids. The word SEWER in raised 2" letters shall be cast in lid.

### 2.15 PIPE AND FITTINGS FOR SERVICE LATERALS

- A. All lateral connections shall be 4-inch nominal diameter comprised of the same material as the sewer main. Bedding and backfill requirements shall be the same as specified herein for the sewer mains.
- B. Except by permission of the ENGINEER, long-radius bends shall be used at all changes in direction. Pipe and fittings for individual service connections shall be of one type of material throughout.

## PART 3 EXECUTION

### 3.01 WELDING STEEL PIPE

- A. General: In accordance with the latest edition of Section IX, ASME Boiler and Pressure Vessel Code.
- B. Welding Procedure Specifications:
  1. Qualify all welding procedure specifications prior to fabrication in accordance with the ASME Boiler and Pressure Vessel Code, Section IX.
  2. Identify all welding procedure Specifications by number and reference the procedure number on all fabrication Drawings.

## GRAVITY SEWER MANHOLES AND ACCESSORIES

### C. Welding and Welding Operators:

1. Qualify all welders and welding operators prior to fabrication in accordance with ASME Boiler and Pressure Vessel Code, Section IX.
2. Include qualifications for all welding positions to be employed in the fabrication.

### D. Materials:

1. Use welding products within the limits recommended by their manufacturers.
2. Keep electrodes, filler wires, and fluxes clean, dry, and properly stored according to manufacturer's recommendations. Do not use electrodes, filler wires, or fluxes that are damp, greasy, or oxidized.
3. Do not use backing rings.
4. Consumable inserts may be used if included in the qualified welding procedure specification. Match the chemistry of the consumable insert with the base metal and weld metal chemistry.

## 3.02 FABRICATION OF STEEL PIPE

### A. End Preparation:

1. Machine shaping of pipe ends is the preferred method.
2. Oxygen or arc cutting is acceptable only if the cut is smooth and true and all slag is removed either by chipping or grinding.
3. Beveled Ends for Butt Welding: Meet the requirements of ANSI B16.25.

### B. Cleaning: After completion of shop or field fabrication and after erection, clean all piping inside and outside to remove all loose scale, weld spatter, dirt, loose debris, and foreign material.

### C. Alignment and Spacing:

1. Align ends to be joined within existing commercial tolerances on diameters, wall thickness, and out-of-roundness.
2. Root Opening of the Joint: As stated in the welding procedure Specification.



## GRAVITY SEWER MANHOLES AND ACCESSORIES

### 3.03 CORROSION PROTECTION

- A. Install coating as specified.

### 3.04 EXAMINATION, INSPECTION, AND TESTING OF STEEL WELDING

- A. Required Examinations:
  - 1. Perform examination in accordance with the ANSI Code for Pressure Piping B31.3 (Piping Code).
  - 2. Perform examination for every pipe thickness and for each welding procedure, progressively, for all piping covered by this Section.

### 3.05 PIPE PREPARATION AND HANDLING - GENERAL

- A. Each pipe and fitting shall be carefully inspected before the exposed pipe or fitting is installed. The interior and exterior protective coating shall be inspected, and all damaged areas patched in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- B. Use proper implements, tools, and facilities for the safe and proper protection of the pipe. Carefully handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe.
- C. Care shall be taken not to damage linings when handling pipe.

### 3.06 CUTTING PIPE

- A. Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.
- B. Dress cut ends of pipe in accordance with the type of joint to be made. Dress cut ends of mechanical joint pipe to remove sharp edges or projections, which may damage the rubber gasket. Dress cut ends of push-on joint pipe by beveling, as recommended by the pipe manufacturer. Dress cut ends of pipe for flanged coupling adapters as recommended by the manufacturer.

### 3.07 FABRICATION OF FLANGED PIPE - GENERAL

- A. Flanged ductile iron pipe and steel pipe shall be fabricated in the shop, not in the field, and delivered to the job site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the manufacturer. Flanges for ductile iron shall be faced after fabrication in accordance with ANSI A21.15/AWWA C115.

## GRAVITY SEWER MANHOLES AND ACCESSORIES

### 3.08 JOINTING PIPE - GENERAL

- A. Flanged: Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to assure proper seating of the flange gasket. Bolts shall be tightened so the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak, the gaskets shall be removed and reset and bolts re-tightened.

### 3.09 TRENCH EXCAVATION AND BACKFILL

- A. General:
  - 1. Trenches for mains shall be excavated in the locations shown on the plans or as directed by the ENGINEER.
  - 2. All trees, telephone and power poles along the line of work shall be protected. Where clearing or partial clearing of the right-of-way is necessary, complete before the start of trenching. Cut trees and brush as near to the ground surface as practicable, remove all stumps, and remove for disposal. Do not remove trees over 2 inches in diameter unless they are within 4 feet of the pipe centerline, without permission from the ENGINEER. Protect from damage all privately owned shrubs or plants unless approved by the ENGINEER. If necessary for protection, remove and replace trees, shrubs, or plants by balling the root system and placing in stockpiled topsoil, watering as required. Should any tree, shrub, or plant that has been disturbed as a result of its removal, or otherwise damaged by the CONTRACTOR, die within 6 months from the time it was disturbed or damaged, it shall be replaced in kind and size by the CONTRACTOR.
  - 3. Cut all bituminous and concrete pavements, curbs and sidewalks before excavation of the trenches with an approved pavement saw, hydrohammer, or approved pavement cutter. Pavement and concrete materials removed shall be hauled from the site and not used for trench backfill. No driveway or road shall be inaccessible at the end of the day's work and all street crossings shall be backfilled and opened to traffic each day.
  - 4. All excess excavation not required or suitable for backfill or filling shall become property of the CONTRACTOR and shall be disposed of off the site.

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### B. Trench Excavation:

1. Trench widths shall be as required to properly install the mains, but not less than 24 inches wide. The trench depths shall be as shown on the drawings.
2. At all times provide and maintain ample means and devices to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until backfill at the pipe zone has been completed.

### C. Trench Backfill:

1. Provide imported granular pipe base material under gravity sewer pipe for full width of trench. Minimum depth of base shall be 4 inches unless otherwise directed by the ENGINEER.
2. The pipe zone shall be considered to include the full width of the excavated trench from the bottom of the pipe to the top of the pipe. Particular attention must be given to this area to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone. Pipe zone material shall be the same material used for the pipe base. This material shall be placed, in a manner approved by the ENGINEER, simultaneously on both sides of pipe in lifts not to exceed 4 inches. Backfill in the pipe zone shall be compacted by approved mechanical tamping methods. The minimum required compaction shall be 95 percent relative compaction, as determined by ASTM D 1557, latest edition.
3. The CONTRACTOR may backfill the trenches before air testing, but is responsible for locating and repairing all leaks until a satisfactory test is completed.
4. When backfill is placed mechanically, push the backfill material onto the slope of the backfill previously placed and allow to slide down into the trench. Do not push backfill into the trench in such a way as to permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Under no circumstances allow sharp, heavy pieces of material to drop directly onto the pipe or the tamped material around the pipe. Do not use backfill material of consolidated masses larger than 1/2 cubic foot.
5. Backfill trenches beneath roads, paving and sidewalks by placing previously specified imported granular material in 6-inch lifts and compacting each lift with mechanical tampers or vibratory compactors to at least 95 percent of the relative maximum compaction as determined by AASHTO T99.

## **GRAVITY SEWER MANHOLES AND ACCESSORIES**

6. Backfill trenches in other areas by placing material in loose lifts as described herein before and leave the backfill material neatly mounded so that after normal settlement the finished surface will meet the existing grade.
7. Any excess or deficiency of backfill material which becomes apparent after settlement and within the warranty period shall be corrected by regrading, disposal of excess material, and adding additional material where required.
8. Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the 1-year warranty period in accordance with the General Conditions will be considered to be caused by improper compaction methods and shall be corrected at no cost to the OWNER. Structures damaged by settlement shall be restored to their original condition by the CONTRACTOR at no cost to the OWNER.

### **3.10 PIPE INSTALLATION**

- A. Handling Material: Provide and use proper implements, tools, and facilities for the safe and proper prosecution of the work. Lower all pipe, fittings, and appurtenances into the trench, piece by piece, by means of a crane, slings, or other suitable means and in such a manner as to prevent damage to the pipeline materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.
- B. Cleaning Pipe and Fittings: Remove all dirt, blisters, lumps, and excess coating from the bell and spigot ends of each pipe. Wipe the outside of the spigot and the inside of the bell until joints are clean, dry, and free from oil and grease before the pipe is laid.
- C. Cutting Pipe: Cut pipe in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe or leaving a beveled end as recommended by the manufacturer. Dress cut ends to remove sharp edges or projections, which may damage the rubber gasket.
- D. Laying Pipe: Lay pipe with bell end facing upgrade. Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of 1 inch.
- E. Joining Push-On Joint Pipe: Lay and join pipe in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for the installation. Lubricant for the pipe shall be furnished by the pipe manufacturer. Place sufficient amount of pipe zone material to secure the pipe from movement before the next joint is installed. Provide bell holes at each joint so that the joint can be assembled properly while maintaining uniform pipe support

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- F. Joining Mechanical Joint Pipe and Fittings: Install in accordance with manufacturer's recommendations. After cleaning ends and gasket, slip the gland and gasket on the plain end, lubricating if necessary to facilitate sliding the gasket into place. Guide the end of the pipe into the bell of the pipe previously laid, locating the spigot centrally in the bell. Place the gasket into position and insert the bolts in the holes. When tightening bolts, bring the gland up toward the flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively at a time. Do not over stress bolts to compensate for poor alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble after cleaning.
- G. Installation of Lateral Connection Tees or Wyes: Install tee or wye fittings in accordance with the Sewer Service Connection Details shown on the Drawings. Provide all tees with caps or plugs, as specified. Provide a minimum 2-foot wide compacted gravel base under tees installed in trenches less than 12 feet deep.
- H. Line and Grade:
  - 1. Laterals: Minimum slope for laterals shall be 1/4 inch per foot.
  - 2. Sewer Mains: Do not deviate from line or grade, as established by the ENGINEER, more than 0.05% for grade, provided that such variation does not result in a level or reverse sloping invert. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness. Establish line and grade for pipe by the use of lasers or by transferring the cut from the offset stakes to batter boards set in the trench at maximum intervals of 25 feet. Match the existing line and grade of the manhole to manhole section being replaced. Maintain a minimum of three sets of batter boards with string line ahead of the pipe laying at all times. If batter boards in the trench prove impractical because of trench conditions, submit other methods of grade and alignment control the ENGINEER for approval. Hand-grade base to proper grade ahead of pipe laying. Base shall provide a firm, unyielding support along entire pipe length.

### 3.11 HIGHWAY & ROAD UNDERCROSSINGS

- A. Open Cut Undercrossings: Complete trench excavation and backfill for open-cut undercrossings as hereinbefore specified under Trench Excavation and Backfill.
- B. Pavement Replacement: As specified in accordance with the Alabama Department of Transportation Standard Specifications for Highway Construction, latest edition.

## GRAVITY SEWER MANHOLES AND ACCESSORIES

- C. Casing Installation:
  - A. Casing pipe shall be steel, ASTM A139, Grade B with welded field joints. Casing wall thickness shall be min. 0.188 inches for all sizes thirty-six (36) inches and smaller and shall conform to State of Alabama Highway Department Section 862 for larger diameters. Casing pipe shall be shop coated with primer internally and externally, and final coated with bituminous paint on the exterior.
  - B. Carrier pipe shall be supported inside the casing with pressure-treated timbers, sized as shown on the Drawings. Straps for pipe supports shall be ½ inch wide stainless steel bands, or equal.
  - C. The approximate locations and lengths of encasements are shown on the Drawings for bidding information, but the exact location and length of encasement will be determined by the appropriate highway department.

### 3.12 LATERAL CONNECTIONS

- A. Laterals shall be laid to the property line with a minimum cover of 3 feet at the locations shown on the Drawings.
- B. Trenching and backfilling for services shall be as hereinbefore specified.
- C. Maximum deflection permissible with any one fitting shall not exceed 45 degrees and shall be accomplished with long-radius curves or bends. Short-radius elbows or curves will not be permitted, except by permission of the ENGINEER or where shown on the Drawings.
- D. Provide ends of all service connection lines and fittings with standard watertight plugs, caps, and stopper, suitably braced to prevent blowoff during internal hydrostatic or air testing.

### 3.13 LOW PRESSURE AIR TEST

- A. General: Make pressure and leakage tests on all newly laid pipe after cleaning. The CONTRACTOR shall provide all necessary equipment and material, and conduct the tests. The ENGINEER will monitor and witness the tests before the installed pipe is approved. Pressure tests must be completed before payment is made for that section of pipe.
- B. Air Test:
  - 1. The test shall be conducted between each two adjacent manholes. All sewer sections within the installed system shall be tested.
  - 2. All wyes, tees, or end of slide sewer stubs shall be plugged with flexible-joint caps, or acceptable alternate, securely fastened to withstand the

## GRAVITY SEWER MANHOLES AND ACCESSORIES

internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible-jointed lateral connection or extension.

3. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds/square inch greater than the average back pressure of any ground water that may submerge the pipe. At least 2 minutes shall be allowed for temperature stabilization before proceeding further.

If piping is not below ground water, 5 psi may be applied and maintained for minimum times shown in after the 2 minute stabilization period.

4. The pipeline shall be considered to have passed the low pressure air test if the time required for the low pressure exfiltration pressure drops from 3.5 psi to 3.0 psi, (in excess of back pressure from ground water submerging the pipe) shall not be less than that shown in the following table.

5. Air Pressure Adjustment for Pipeline below Groundwater:

The air pressure correction, which must be added to the 3.5 psig normal test starting pressure, shall be calculated by dividing the average vertical height in feet of ground water above the invert of the sewer pipe to be tested by 2.31. The result gives the air pressure correction in pounds per square inch to be added. (For example, if the average vertical height of groundwater above the pipe invert is 2.8 feet, the additional air pressure required would equal 2.8 divided by 2.31 or 1.2 psig. This would require a minimum starting pressure of 3.5 plus 1.2 or 4.7 psig). In not case should the starting pressure exceed 9.0 psig.

6. The pipeline will be considered to have passed the low pressure air test if the time required for the internal air pressure to drop not more than .5 psi is equal to or greater than that shown in the following table:

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PIPE SIZE (Inches)	MINIMUM TIME (Minutes)
4" Pipe	2.5
6" Pipe	4.0
8" Pipe	5.0
10" Pipe	6.5
12" Pipe	7.5
15" Pipe	9.5
18" Pipe	11.5

Note: For pipe size not indicated minimum time in minutes = pipe size (inches) x .625.

- C. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

**3.14 GRASSING**

- A. All disturbed areas within rights-of-way shall be seeded in accordance with Section 652 of the State of Alabama Highway Department Standard Specifications, latest edition.

**3.15 MANHOLE BASE**

- A. Use approved precast manhole base with first manhole section integral with base.
- B. If material in bottom of trench is unsuitable for supporting manhole, excavate below the base as directed by ENGINEER, and backfill to required grade with trench stabilization material, as hereinbefore specified.

**3.16 PLACING PRECAST MANHOLE SECTIONS**

- A. Section Installation:
1. Thoroughly clean ends of sections to be joined.



## GRAVITY SEWER MANHOLES AND ACCESSORIES

2. Place mastic on groove of lower section.
  3. Set next section in-place.
  4. Rub seam joints inside & out with non shrink grout (hydraulic cement).
  5. Fill all lift holes inside & out with non shrink grout (hydraulic cement).
  6. Completed Manholes: Rigid and watertight.
- B. Preformed Plastic Gaskets: If used in lieu of mortar joints, install in accordance with manufacturer's instructions and the following:
1. Carefully inspect precast manhole sections to be joined.
  2. Do not use sections with chips or cracks in the tongue.
  3. Use only pipe primer furnished by gasket manufacturer.
  4. Install gasket material in accordance with manufacturer's instructions.
  5. Completed Manholes: Rigid and watertight.
- C. Rubber Gasketed Joints: Install in accordance with manufacturer's instructions.

### 3.17 MANHOLE INVERT

- A. Construct as shown with smooth transitions to ensure an unobstructed flow through manhole. Remove sharp edges or rough sections which tend to obstruct flow.

### 3.18 DROP ASSEMBLIES

- A. Construct drop assemblies as shown, at locations shown.

### 3.19 FLEXIBLE JOINTS

- A. Provide joints in all pipe not more than 1-1/2 feet from manhole walls. Lay pipes entering manholes on compacted granular fill extending to undisturbed earth.
- B. Where last joint of the line laid up to manhole is between 1-1/2 and 6 feet from manhole wall, provide a flexible joint in the manhole wall.
- C. Shorten pipes laid out of manhole to ensure first joint is no more than 1-1/2 feet from manhole base.

## GRAVITY SEWER MANHOLES AND ACCESSORIES

### 3.20 MANHOLE EXTENSIONS

- A. Install extensions as shown, to height not exceeding 12 inches.
- B. Lay grade rings in mortar with sides plumb and tops level. Seal joints with mortar as specified for manhole sections, and make watertight.

### 3.21 MANHOLE FRAMES AND COVERS

- A. Install on top of manholes to positively prevent infiltration of surface or groundwater into manholes.
- B. Frame to bolt onto top of manhole. Surface of concrete manhole top to be coated with mastic prior to seating & bolting of frame.
- C. Set tops of covers flush with surface of adjoining pavement or ground surface, unless otherwise shown or directed.
- D. At locations shown, install exterior manhole frame to structure seals in accordance with manufacturer's instructions.

### 3.22 FIELD QUALITY CONTROL

- A. Hydrostatic Testing of Manholes:
  - 1. When, in ENGINEER'S opinion, the groundwater table is too low to permit visual detection of leaks, hydrostatically test all project manholes.
  - 2. Procedure: Plug inlets and outlets and fill manhole with water to height determined by ENGINEER.
  - 3. A manhole may be filled 24 hours prior to time of testing, if desired, to permit normal absorption into the pipe walls to take place.
  - 4. Leakage in each manhole shall not exceed 0.1 gallon per hour per foot of head above the invert.
  - 5. Repair manholes that do not meet the leakage test, or do not meet specified requirements from visual inspection.
  - 6. If more than 25 percent of the manholes tested fail the hydrostatic test, test all or as many manholes as ENGINEER deems necessary.

### 3.23 NEGATIVE AIR PRESSURE (VACUUM) TEST

- A. General
  - 1. The test method as outlined in ASTM C1244 shall be followed.

## GRAVITY SEWER MANHOLES AND ACCESSORIES

2. The contractor shall furnish all facilities, equipment and personnel as required to conduct the vacuum test.
3. The test shall be conducted after the manhole installation.
4. The contractor shall furnish evidence to the engineer that all test equipment is in proper working order.
5. The test shall be conducted in the presence of the Engineer.

### B. Preparation

1. All pipes entering the manhole shall be temporarily plugged.
2. Care shall be taken to securely brace plugs as to prevent them from being drawn into the manhole during the test.

### C. Procedure

1. The test head shall be placed at the top of the manhole.
2. A vacuum of 10 inches of mercury shall be drawn on the manhole.
3. The time shall be measured for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury.
4. The manhole shall pass if the time required for the vacuum reading to drop from 10 inches to 9 inches of mercury meets or exceeds the values listed.
5. If the manhole fails the vacuum test, the Contractor shall make all necessary repairs to the manhole and shall retest the manhole.

**GRAVITY SEWER MANHOLES  
AND ACCESSORIES**

**MINIMUM VACUUM TEST TIMES (SECONDS) FOR MANHOLES BASED ON  
DIAMETER AND DEPTH**

**MANHOLE DIAMETER (INCHES)**

Manhole Depth (FT.)	48	60	72	96	120
8	17	26	33	45	57
10	21	33	41	54	67
12	25	39	49	63	77
14	30	46	57	72	87
16	34	52	65	81	97
18	38	57	73	90	107
20	42	65	81	99	117
22	46	72	89	108	127
24	51	78	97	117	137
26	55	85	105	126	147
28	59	91	113	135	157
30	63	98	121	144	167

Test times for manholes less than 8 feet shall be the same as indicated for the 8 feet depth manholes.

**3.24 MANHOLE COATING**

- A. Coat the manhole interior with coal tar epoxy as manufactured by Sherwin Williams, or equal.

**END OF SECTION**

**SECTION 15004**  
**FORCE MAIN AND ACCESSORIES**

**PART 1        GENERAL**

1.01    WORK INCLUDED

- A.      This section covers the work necessary to furnish and install, complete, the force main, valves, and accessories specified herein.

1.02    GENERAL

- A.      Like items of material provided thereunder shall be the end products of one manufacturer. All materials shall be manufactured in the United States of America unless noted by the Engineer.

**PART 2        PRODUCTS**

2.01    DUCTILE IRON PIPE FITTINGS

- A.      Pipe: Centrifugally cast Grade 60-42-10 iron, ANSI A21.51, AWWA C151, cement-lined and seal-coated in accordance with ANSI A21.4, unless otherwise noted in the Piping Schedule, Thickness Class 50.
- B.      Joints:
  - 1.      Flanged, mechanical joint, push-on, or proprietary restrained as specified herein, with application as shown on Drawings.
  - 2.      Flanged joint pipe shall conform to ANSI/AWWA C115 and shall use ductile iron flanges.
- C.      Fittings: Gray or ductile iron, 1030 kPu (150 psi) minimum working pressure, cement-lined and seal-coated. Where taps are shown on fittings, tapping bosses shall be provided. ANSI B16.1 fittings shall be used only for nonstandard fittings not manufactured under ANSI/AWWA C110 and ANSI/AWWA C153.
  - 1.      Flanged: ANSI/AWWA C110 and ANSI B16.1, faced and drilled 125-pound ANSI standard.
  - 2.      Mechanical Joint: ANSI/AWWA C110, ANSI/AWWA C111, and ANSI/AWWA C153.
  - 3.      Proprietary Restrained: Clow Corp., Super-Lock Joint; American Cast Iron Pipe Co., Flex-Ring Joint or Lok-Ring Joint; U.S. Pipe, TR Flex, or equal. Any joint employing setscrews or field welded retainers is unacceptable, unless shown otherwise.

## FORCE MAIN AND ACCESSORIES

- D. Piping Flanges: Ductile iron, ANSI A21.15/AWWA C115, threaded, 1700 kPa (250 psi) working pressure, ANSI 56 kg (125-pound) drilling.
- E. Piping Bolts:
  - 1. For Class125 FF Flanges: Carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.
  - 2. For Mechanical Joint: Manufacturer's standard.
- F. Piping Gaskets:
  - 1. Gaskets for mechanical, push-on, and proprietary restrained joints shall be rubber, conforming to ANSI A21.11, AWWA C111.
  - 2. Gaskets for flanged joints shall be 3mm (1/8-inch) thick, cloth-inserted rubber conforming to applicable parts of ANSI B16.21 and AWWA C207, unless otherwise specified. Gasket material shall be free from corrosive alkali or acid ingredients and suitable for use in sewage or potable waterlines.
- G. Lubricant: Lubricant for joints shall be manufacturer's standard.

### 2.02 PVC PIPE AND FITTINGS

- A. Pipe: Polyvinyl chloride (PVC) pipe shall comply with ASTM D1784 for PVC materials and ASTM D2241 for PVC pipe. PVC pipe shall be supplied in lengths not less than 6.1m (20 feet).
- B. Joints: Joints shall be push-on type spigot and bell with integral bell homogeneous with the pipe. Gaskets shall be rubber meeting the requirements of ASTM F477 and D3139 and shall be locked in to the bell groove.
- C. Class: The pipe classes shown shall be defined according to the Standard Pipe Diameter Ratio (SDR) as defined by ASTM D2241.
- D. Manufacture: PVC pipe shall be as manufactured by North American Pipe Corporation, or equal.
- E. Locator wire: Locator wire shall be included with all PVC Mains. Locator wire shall be No. 10 stranded TW insulated copper wire or metallic tape buried approximately 12 inches above the top of the pipe.
- F. Fittings: Fittings for piping shall be cement-lined cast iron or ductile iron with mechanical joint ends and conforming to AWWA C110 and C111. Fittings less than 305mm (12 inches) shall be rated for 1725 kPa (250 psi) minimum working pressure and fittings 305 mm (12 inches) and larger shall be rated for 1025 kPa (150 psi) minimum working pressure.

## FORCE MAIN AND ACCESSORIES

Provide PVC adapters as required to connect fittings to PVC pipe.

- G. Lubricant for joints shall be manufacturer's standard.

### 2.03 VALVES

A. General:

1. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein. Valves shall be suitable for the exposure they are subject to, buried, interior or exterior, as applicable.
2. Unless otherwise shown, valves shall be the same size as the adjoining pipe. For the purpose of designating the type and grade of valve desired, a manufacturer's name and list or figure number is given in the following specifications. Valves of equal quality by other manufacturers will be considered in accordance with the General Conditions.
3. Valve ends shall be as specified, as shown on the Drawings, and to suit the adjacent piping.
4. Buried service operators shall have a 51mm (2-inch) AWWA operating nut. All moving parts of the valve and operators shall be enclosed in the housing to prevent contact with the soil. Exposed operators shall have manual handwheel or lever operator as specified for the valve type.

B. Valve Types:

1. ARV-1: Sewage combination air valves shall perform the functions of an air and vacuum valve plus an air release valve. The air and vacuum portion of the valve shall automatically exhaust large quantities of air during filling of a system and allow air to re-enter during draining or when a vacuum occurs. The air release portion shall automatically exhaust small amounts of entrained air that may accumulate in a system. Sewage combination air valves shall be a single body unit. Valves shall be designed for 1030 kPa (150 psi) working pressure and built with standard elongated bodies. All valves shall have cast iron, ductile iron, or semi-steel bodies and covers with stainless steel float and trim, built to manufacturer's standards, suitable for sewer service. Valves shall be as manufactured by APCO, Valve and Primer Corp.; Val-Matic Valve and Mfg. Corp.; or equal.

### 2.04 CASING PIPE

- A. Casing pipe shall be steel, ASTM A139, Grade B with welded field joints. Casing wall thickness shall be min. 0.188 inches for all sizes thirty-six (36) inches and smaller and shall conform to State of Alabama Highway Department Section 862

for larger diameters. Casing pipe shall be shop coated with primer internally and externally, and final coated with bituminous paint on the exterior.

- B. Carrier pipe shall be supported inside the casing with pressure-treated timbers, sized as shown on the Drawings. Straps for pipe supports shall be ½ inch wide stainless steel bands, or equal.
- C. The approximate locations and lengths of encasements are shown on the Drawings for bidding information, but the exact location and length of encasement will be determined by the appropriate highway department.

**PART 3 EXECUTION**

**3.01 TRENCH EXCAVATION AND BACKFILL**

**A. General:**

- 1. Trenches for mains shall be excavated in the locations shown on the plans or as directed by the ENGINEER.
- 2. All trees, telephone and power poles along the line of work shall be protected. Where clearing or partial clearing of the right-of-way is necessary, complete before the start of trenching. Cut trees and brush as near to the ground surface as practicable, remove all stumps, and remove for disposal. Do not remove trees over 51mm (2 inches) in diameter unless they are within 1.22 meters (4 feet) of the pipe centerline, without permission from the ENGINEER. Protect from damage all privately owned shrubs or plants unless approved by the ENGINEER. If necessary for protection, remove and replace trees, shrubs, or plants by balling the root system and placing in stockpiled topsoil, watering as required. Should any tree, shrub, or plant that has been disturbed as a result of its removal, or otherwise damaged by the CONTRACTOR, die within 6 months from the time it was disturbed or damaged, it shall be replaced in kind and size by the CONTRACTOR.
- 3. Unless boring and jacking is required as shown on the Drawings, cut all bituminous and concrete pavements, curbs and sidewalks before excavation of the trenches with an approved pavement saw, hydrohammer, or approved pavement cutter. Pavement and concrete materials removed shall be hauled from the site and not used for trench backfill. No driveway or road shall be inaccessible at the end of the day's work and all street crossings shall be backfilled and opened to traffic each day.

**B. Trench Excavation:**

- 1. Trench widths shall be as required to properly install the mains, but not less than 305mm (12 inches) wide. The trench depths shall be as required



## FORCE MAIN AND ACCESSORIES

to provide a minimum pipe cover of 0.91 meters (3 feet), unless otherwise approved by the ENGINEER.

2. At all times provide and maintain ample means and devices to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe, and until backfill at the pipe zone has been completed.

### C. Trench Backfill:

1. The CONTRACTOR may backfill the trenches before hydrostatic testing, but is responsible for locating and repairing all leaks until a satisfactory hydrostatic test is completed.
2. When backfill is placed mechanically, push the backfill material onto the slope of the backfill previously placed and allow to slide down into the trench. Do not push backfill into the trench in such a way as to permit free fall of the material until at least 0.61 meters (2 feet) of cover is provided over the top of the pipe. Under no circumstances allow sharp, heavy pieces of material to drop directly onto the pipe or the tamped material around the pipe. Do not use backfill material of consolidated masses larger than 0.15 cubic meter (1/2 cubic foot).
3. Backfill trenches beneath roads, paving and sidewalks by placing material in 152mm (6-inch) lifts and compacting each lift with mechanical tampers or vibratory compactors to at least 95 percent of the relative maximum compaction as determined by AASHTO T99.
4. Backfill trenches in other areas by placing material in loose lifts as described hereinbefore and leave the backfill material neatly mounded so that after normal settlement the finished surface will meet the existing grade.
5. Any excess or deficiency of backfill material which becomes apparent after settlement and within the warranty period shall be corrected by regrading, disposal of excess material, and adding additional material where required.
6. Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the 1-year warranty period in accordance with the General Conditions will be considered to be caused by improper compaction methods and shall be corrected at no cost to the OWNER. Structures damaged by settlement shall be restored to their original condition by the CONTRACTOR at no cost to the OWNER.

### 3.02 PIPE INSTALLATION (PVC)

- A. Handling Material: Provide and use proper implements, tools, and facilities for the safe and proper prosecution of the work. Lower all pipe, fittings, and appurtenances into the trench, piece by piece, by means of a crane, slings or other suitable means and in such a manner as to prevent damage to the pipeline

## FORCE MAIN AND ACCESSORIES

materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.

- B. Cleaning Pipe and Fittings: Remove all dirt, blisters, lumps, and excess coating from the bell and spigot ends of each pipe. Wipe the outside of the spigot and the inside of the bell until joints are clean, dry, and free from oil and grease before the pipe is laid.
- C. Cutting Pipe: Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe or leaving a beveled end as recommended by the manufacturer. Dress cut ends to remove sharp edges or projections, which may damage the rubber gasket.
- D. Laying Pipe: Unless otherwise directed, lay pipe with bell end facing in the direction of the laying. For lines on an appreciable slope, face bells upgrade at the discretion of the ENGINEER. Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of 25mm (1 inch). Wherever it is necessary to deflect from a straight line, the maximum deflection per joint shall be as recommended by the pipe manufacturer.
- E. Joining Push-On Joint Pipe: Lay and join pipe in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for the installation. Lubricant for the pipe shall be furnished by the pipe manufacturer.
- F. Joining Mechanical Joint Pipe and Fittings: Install in accordance with manufacturer's recommendations. After cleaning ends and gasket, slip the gland and gasket on the plain end, lubricating if necessary to facilitate sliding the gasket into place. Guide the end of the pipe into the bell of the pipe previously laid, locating the spigot centrally in the bell. Place the gasket into position and insert the bolts in the holes. When tightening bolts, bring the gland up toward the flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tighten all nuts progressively at a time. Do not over stress bolts to compensate for poor alignment. If effective sealing is not attained at the maximum torque, disassemble the joint and reassemble after cleaning.

### 3.03 ROAD AND HIGHWAY UNDERCROSSINGS

- A. Open Cut Undercrossings: Complete trench excavation and backfill for open-cut undercrossings as hereinbefore specified under Trench Excavation and Backfill.
- B. Casing Installation:
  - 1. Jacked or bored casings shall be continuously welded at joints for a rigid, watertight encasement.

## FORCE MAIN AND ACCESSORIES

2. Bored installations shall have a hole diameter which shall not exceed the OD of the casing pipe by more than 25mm (1 inch). Where unstable soil conditions are found to exist, boring operations shall be conducted in such a manner as not to be detrimental to the facility being crossed. If excessive voids or too large a bored hole results, or if it is necessary to abandon a bored hole, prompt remedial measures shall be taken by the CONTRACTOR, subject to review by the ENGINEER and approval of the controlling agency of the facility being crossed. The dry bore method shall be used. No water and bentonite is to be used during boring operations.
3. Once boring and jacking operations are started, the work shall be continuous until completed in order to guard against the "freezing" of the casing due to settlement and compaction of surrounding soil. Casing shall be installed at a uniform slope.

### C. Carrier Pipe Installation:

1. The entire length of casing shall be complete before any carrier pipe is placed therein. Carrier pipe materials and installation shall conform to the requirements specified elsewhere except as hereafter indicated or as required by the controlling agency permit.
2. Where timber cradles are required, strap the cradles to the pipe before sliding into casing. Pipe barrel shall bear continuously on cradles.
3. The carrier pipe may be pushed or pulled into the casing as pipe lengths are assembled. Pipe installation shall conform to requirements specified herein, including testing.

### D. Pavement Replacement:

1. All work associated with the pavement replacement shall be done in strict accordance with the Alabama Department of Transportation Standard Specifications.
2. Pavement shall be immediately replaced provided weather conditions or other factors permit. Should conditions prevent immediate repaving, apply a temporary approved cold patch for the full trench width and maintain until such time as the final asphalt surface course can be completed.

## 3.04 VALVE INSTALLATION

### A. Valves:

1. Before installation, the valves shall be thoroughly cleaned of all foreign material, and shall be inspected for proper operation, both opening and closing, and to verify that the valves seat properly. Valves shall be installed so that the stems are set vertical. Jointing shall conform to

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AWWA C600 or AWWA C603 as applicable. Joints shall be tested with the adjacent pipeline.

2. Flange faces and mechanical joint sockets shall be thoroughly cleaned before the joint is assembled.

### 3.05 HYDROSTATIC TESTING

- A. General: Make pressure and leakage tests on all newly laid pipe. The Contractor shall provide all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The Engineer will monitor and witness the tests before the installed pipe is approved. Pressure tests must be completed before payment is made for that section of pipe.
- B. Test Pressure: Each section of pipe shall be slowly filled with water to the test pressure shown in the piping schedule or to the pressure class rating of the pipe. Pressure shall be applied by a motor-driven pump. The test duration shall be six (6) hours for covered pipe and three (3) hours for uncovered pipe. The Contractor shall provide a pressure chart recorder for the duration of each test.
- C. Procedure: Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, taps shall be made at points of highest elevation and plugged afterward. At the end of the test period, the Contractor will inject a sufficient quantity of water into the pipe section to re-establish the specified pressure. The Contractor shall provide suitable means to determine the quantity of water lost by leakage during the test. The Engineer must witness the quantity of water leakage and pressure recording and sign both before approving the test.
- D. Allowable Leakage: Exposed piping shall not have any visible leakage. For buried pipelines less than 500 LF the allowable leakage shall be zero (0) gallons. For lengths more than more than 500 LF the allowable leakage shall be less than the amount determined by the following formula:

$$L = \frac{(10) D L_e}{126720}$$

Where      L = Allowable leakage, gallons per hour  
              D = Nominal diameter of pipe, inches  
              L<sub>e</sub> = Length of pipe, feet

- E. Allowable Loss of Pressure: The maximum allowable drip in pressure from the test pressure shall be no greater than five (5) percent of the test pressure.
- F. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

3.06 HANDLING PIPE (DUCTILE IRON)

- A. Care shall be taken not to damage the cement lining when handling the pipe.

3.07 CUTTING PIPE (DUCTILE IRON)

- A. Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.

3.08 DRESSING CUT ENDS (DUCTILE IRON)

- A. Dress cut ends of pipe in accordance with the type of joint to be made.
- B. Dress cut ends of buried pipe joints to remove sharp edges or projections, which may damage the rubber gasket.
- C. Dress cut ends of push-on joint pipe by beveling, as recommended by the pipe manufacturer.
- D. Dress cut ends of pipe for flexible couplings and flanged coupling adapters, as recommended by the coupling or adapter manufacturer.

3.09 FABRICATION OF FLANGED PIPE (DUCTILE IRON)

- A. Flanged pipe shall be fabricated in the shop, not in the field, and delivered to the jobsite with flanges in place and properly faced. Flanges shall be faced after fabrication in accordance with ANSI A21.15/AWWA C115.

3.10 JOINTING PIPE (DUCTILE IRON)

- A. Flanged: Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to assure proper seating of the flange gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.
- B. Mechanical, Proprietary Restrained, and Push-On Joint: Join pipe with mechanical, proprietary restrained, and push-on type joints in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstances.

**3.11 GRASSING**

- A. All disturbed areas within state highway rights-of-way shall be seeded in accordance with Section 652 of the Alabama Department of Transportation Standard Specifications.

**PART 4 PAYMENT**

**4.01 GENERAL**

- A. Payment at the unit prices stated in the Proposal for pipe, including mechanical or restrained joints, fittings, valves, equipment, and other items shall constitute full compensation for all work required for furnishing, installing and testing each unit of that item.

**4.02 PIPING**

- A. No payment for pipe or fittings, in place, will be made until the pipe has successfully passed the leakage test.
- B. Payment for pipe will be made at the unit price per linear foot stated in the Proposal. The measurement for payment will be the field-measured centerline length of the pipe, in place, within the limits shown. Laying lengths of valves and fittings will not be excluded from pipe measurements.

**4.03 FITTINGS**

- A. Payment for furnishing and installing fittings will be made at the unit prices stated in the Proposal.

**4.04 CUT-INS**

- A. Payment for furnishing equipment and completing all cut-ins will be made at the unit price for each cut-in stated in the Proposal.

**4.05 ROAD AND HIGHWAY UNDERCROSSINGS**

- A. Payment for road and highway bores shown on the Drawings will be based on the lump sum price stated in the Proposal for each crossing. Payment on the lump sum basis shall constitute full compensation for all permits, labor, materials, and equipment required to complete the installation, within the limits shown. No additional payment for trench excavation and backfill, for furnishing and placing pipe, or for any other items will be made within the limits of the crossings shown on the Drawings. Payment to the CONTRACTOR for any services provided by the Permittee shall also be included in this item.

## **FORCE MAIN AND ACCESSORIES**

- B. Payment for road open-cut undercrossings shown on the Drawings will be based on the lump sum price stated. Payment on the lump sum basis shall constitute full compensation for all permits, labor, materials, and equipment required to complete the installation, within the limits shown. No additional payment for trench excavation and backfill, for furnishing and placing pipe, or for any other items will be made within the limits of the crossings shown on the Drawings. Payment to the CONTRACTOR for any services provided by the Permittee shall also be included in this item.

### **4.06 CLEARING AND GRUBBING**

- A. Payment will be made for clearing and grubbing, including furnishing all equipment, tools, labor, and incidentals necessary to complete the work at the unit price stated in the Proposal.

**END OF SECTION**

**SECTION 15100**  
**VALVES AND APPURTENANCES**

**PART 1      GENERAL**

**1.01    SCOPE OF WORK**

- A.    Furnish all materials, equipment and incidentals required to install complete and ready for operation, all valves shown on the Drawings and specified herein, including required specialty hardware, all bolts including flange bolts, threaded rods, anchor bolts, complete with washers and nuts. Bolts, threaded rods, nuts and washers to be galvanized steel. Anchor Bolts shall be type 316 stainless steel.
  
- B.    The equipment shall include, but not be limited to, the following. All items specified herein may not be included in this project.
  - 1.    Valve Actuators - General
  - 2.    Valve Actuators - Powered
  - 3.    Butterfly Valves for Fluid Service (Metal Body)
  - 4.    Butterfly Valves for Fluid Control (Cavitation and/or Metal)
  - 5.    Butterfly Valves for Air Service
  - 6.    Butterfly Dampers
  - 7.    Gate Valves
  - 8.    Resilient Seated Gate Valves
  - 9.    Knife Gate Valves
  - 10.   Plug Valves
  - 11.   Ball Valves
  - 12.   Check Valves
  - 13.   Globe Valves
  - 14.   Plastic Valves
  - 15.   Needle Valves
  - 16.   Pressure Regulating Valves
  - 17.   Solenoid Valves
  - 18.   Corporation Stop and Stop and Waste Valves
  - 19.   Air and/or Air/Vacuum Valves (General [and/or Sewage Use])
  - 20.   Air Release Valves
  - 21.   Air and Vacuum Valves for Vertical Turbine Pumps
  - 22.   Air/Vacuum Valves (Hydraulically Operated)
  - 23.   AirNacuum Valves (Normal Operation)
  - 24.   Vacuum Relief Valves
  - 25.   Combination Air and AirNacuum or Vacuum Relief Valves
  - 26.   Surge Relief Valves
  - 27.   Cone Valves
  - 28.   Telescoping Valves
  - 29.   Pinch Valves
  - 30.   Basin Pressure Relief Valves
  - 31.   Mud Valves (Plug Drain Valves)
  - 32.   Hose Hydrants



## VALVES AND APPURTENANCES

33. Flush-Type Hydrants
34. Flap Gates (Flap Valves)
35. Hose End Valves
36. Water Blender Assembly
37. Pressure Relief Valves
38. Gas Valves
39. Backwash Valves
40. Water Pressure Regulators
41. Insulating Fittings
42. Sleeve Type Valves

### 1.02 RELATED WORK

- A. Piping and disinfection for potable water systems is included in the respective Sections 15110.
- B. Valves on all HVAC systems, plumbing and/or chemical systems, not noted herein are included in their respective Sections of Division 15 and/or 11.
- C. Pipeline appurtenances are included herein or in Section 15110.
  1. Unions
  2. Flanged Joints
  3. Dielectric Connectors
  4. Plugs and Caps
  5. Miscellaneous Adaptors
  6. Vents and Drains
  7. Shock Absorbers
  8. Line Strainers
  9. Service Clamps
  10. Cleanouts
  11. Floor Drains
  12. Quick-Connect Couplings
  13. Mechanical Sleeve Seals
  14. Flexible Connectors
  15. Expansion Joints
  16. Harnessing and Restraints
  17. Pressure Gauges
  18. Diaphragm Seals
  19. Thermometers
  20. Rotometers, Flow Indicators and Flow Meters
  21. Static Mixers
  22. Pipe Cleaning Equipment
  23. Spray Nozzles
  24. Batch Meters
  25. Chemical Diffusers
  26. Diffuser Sockets

## VALVES AND APPURTENANCES

27. Educator for Dry Chemical Handling
- D. Pipe hangers, supports and anchorage are included in Section 15110.
- E. Instrumentation and Electrical, not specified herein, are included in Divisions 13 and 16.
- F. Valve tags are included in Division 1.
- G. Field painting is included in Section 09900.
- H. Sluice and Slide and Weir Gates are included in Division 11.
- I. Certain appurtenances for individual types of pipe or systems are specified with the specific type of pipe or system. However, additional items are specified in this Section.
- J. Certain items similar to those specified in this Section may be specified to be furnished and installed with individual equipment or systems. In case of a conflict, those individual equipment or system requirements shall govern.
- K. Electric valve operators of all types, rate of flow controllers (including modulating valves and operators) and other types of valves which are part of the automated instrumentation (such as some solenoid valves) may be included herein. Valve operators shall be mounted at the factory on the valves as specified herein, as part of the work of this Section.
- L. Buried valves and appurtenances are included in Section 2.09.A.3 below. 1.03 SUBMITTALS
- M. Submit, in accordance with Section 01300, materials required to establish compliance with this Section. Submittals shall include the following:
1. Certified drawings showing all important details of construction and dimensions.
  2. Descriptive literature, bulletins and/or catalogs of the equipment.
  3. The total weight of each item.
  4. A complete bill of materials.
  5. Additional submittal data, where noted with individual pieces of equipment.
- N. Test Reports
1. Provide certified hydrostatic test data, per manufacturer's standard procedure or MSS-SP-61 for all valves.

### O. Certificates

1. For each valve specified to be manufactured, tested and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

### P. Operating and Maintenance Data

1. Operating and maintenance instructions shall be furnished to the Engineer as provided in Section 01730. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and other information required to instruct operating and maintenance personnel unfamiliar with such equipment.

## 1.03 REFERENCE STANDARDS

### A. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
3. ASTM A159 - Standard Specification for Automotive Gray Iron Castings.
4. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
5. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
6. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings.
7. ASTM A536 - Standard Specification for Ductile Iron Castings.
8. ASTM B30 - Standard Specification for Copper-Base Alloys in Ingot Form.
9. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings

### B. American Water Works Association (AWWA)

1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
2. AWWA C500 - Metal-Seated Gate Valves Supply Service
3. AWWA C504 - Rubber-Seated Butterfly Valves
4. AWWA C507 - Ball Valves, 6-in Through 48-in (150mm Through 1200mm)
5. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-in (50mm) Through 24-in (600mm) NPS
6. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
7. AWWA C511 - Reduced-Pressure Principle Backflow Prevention

## VALVES AND APPURTENANCES

### Assembly

8. AWWA C540 - Power-Actuating Devices for Valves and Sluice Gates
9. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
10. AWWA C800 - Underground Service Line Valves and Fittings

### C. American National Standards Institute (ANSI)

1. ANSI B2.1 – Specifications for Welding Procedures and Performance Qualifications
2. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250
3. ANSI B16.10 - Face-to-Face and End-to-End Dimensions of Valves
4. ANSI B16.104 - Butterfly Valves

### D. American Iron and Steel Institute (AISI)

### E. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS-SP-61 - Pressure Testing of Steel Valves.
2. MSS-SP-67 - Butterfly Valves.
3. MSS-SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS-SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS-SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service.
6. MSS-SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
7. MSS-SP-80 - Bronze Gate, Globe, Angle and Check Valves.
8. MSS-SP-82 - Valve Pressure Testing Methods
9. MSS-SP-98 - Protective Coatings for the Interior of Valves, Hydrants and Fittings.

### F. National Electrical Manufacturers Association (NEMA)

### G. Underwriters Laboratories (UL)

### H. Factory Mutual (FM)

1. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Valves and appurtenances shall be products of well established firms who are fully experienced, (minimum of 10 years), reputable and qualified in the manufacture of the particular equipment to be furnished.
2. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with this Section as applicable.
3. All units of the same type shall be the product of one manufacturer.

B. Certifications

1. The manufacturers shall furnish an affidavit of compliance with Standards referred to herein as specified in Paragraph 1.03C above. Refer to PART 3 for testing required for certain items in addition to that required by referenced standards.

C. Provide the services of a qualified and factory-trained service representative of the manufacturer to provide operational and maintenance instruction, for a 1 day, 8 hour period for:

1. Valve motor operators, of any size.
2. Valve hydraulic operators, of any size.
3. Valve pneumatic operators, of any size.
4. Pressure regulating valves.
5. Air release, air and vacuum valves.
6. Surge relief valves.
7. Cone valves.
8. Dashpot-style check valves

D. Inspection of the units may also be made by the Engineer or other representative of the Owner after delivery. The equipment shall be subject to rejection at any time due to failure to meet any of the specified requirements, even though submittal data may have been accepted previously. Equipment rejected after delivery shall be marked for identification and shall be removed from the job site at once.

1.05 SYSTEM DESCRIPTION

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of wastewater, sludge, air and chemicals, water as noted on the Drawings.

## VALVES AND APPURTENANCES

- B. Valves, appurtenances and miscellaneous items shall be installed as shown on the Drawings and as specified, so as to form complete workable systems.
- C. Unless otherwise noted all powered valve operators shall have:
  - 1. Valves larger than 3-in: electric operators 460 Volt, 3 Phase, 60 Hz.
  - 2. Solenoid valves: 120 volt, single phase, 60 Hz, NEMA 4 enclosure, continuous duty Class F coils and manual operator.
  - 3. See other paragraphs for additional requirements.

### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be received and stored properly to prevent damage or deterioration prior to installation.
- B. Packing and Shipping
  - 1. Care shall be taken in loading, transporting and unloading to prevent injury to the valves, appurtenances, or coatings. Equipment shall not be dropped. All valves and appurtenances shall be examined before installation and no piece shall be installed which is found to be defective. Any damage to the coatings shall be repaired as acceptable to the Engineer.
  - 2. Prior to shipping, the ends of all valves shall be acceptably covered to prevent entry of foreign material. Covers shall remain in place until installation.
    - a. All valves 3-in and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.
    - b. Valves smaller than 3-in shall be shipped and stored as above except that heavy cardboard covers may be used on the openings.
    - c. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until the valve is installed and put into use.
    - d. Any corrosion in evidence at the time of acceptance by the Owner shall be removed, or the valve shall be removed and replaced.
- C. Storage and Protection
  - 1. Special care shall be taken to prevent plastic and similar brittle items from being directly exposed to the sun, or exposed to extremes in temperature, to prevent deformation.

## VALVES AND APPURTENANCES

See the individual piping sections and manufacturer's information for further requirements.

### a. MAINTENANCE

- A. Special tools and the manufacturer's standard spare parts, if required for normal operation and maintenance for one year of service, shall be supplied with the equipment in accordance with Section 01730 and where noted, as specified herein.
- B. Provide all special tools required for normal maintenance.

### b. WARRANTY

- A. The equipment manufacturer shall guarantee the valves against defect in design, material and workmanship for a period of twenty-four (24) months after date of shipment.

## PART 2 PRODUCTS

### 2.05 MATERIALS AND EQUIPMENT - GENERAL

- A. Reference is made to Division 1 for additional requirements, including nameplates, provisions for temporary pressure gauges, protection against electrolysis and anchor bolts.
- B. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- C. Valves and appurtenances shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.
- D. Valves and appurtenances shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard referenced, cast in raised letters or indelibly marked upon some appropriate part of the body.
- E. Unless otherwise noted, items shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher and suitable for the pressures noted where they are installed.
- F. Joints, size and material - unless otherwise noted or required by the Engineer:
  - 1. Valves and appurtenances shall be of the same nominal diameter as the pipe or fittings they are connected to.
  - 2. Buried Valves shall have MJ connections where applicable.

## VALVES AND APPURTENANCES

### 3. End Connections for all valves:

<u>Type</u>	<u>Size</u>	<u>End Connection</u>
Gate	2" and Smaller 2½" and Larger	Screwed Flanged
Butterfly	12" and Larger	Flanged/MJ
Plug or Ball	2" and Smaller 2½" and Larger	Screwed Flanged/MJ
Check Valve	2" and Smaller 2½" and Larger	Screwed Flanged
Diaphragm	3" and Larger	Flanged

- G. Provide all special adaptors required to ensure compatibility between valves, appurtenances and adjacent pipe.
- H. Valves and actuators located outdoors but not within a building; within maximum 2-ft above liquid; in vaults; or where otherwise noted shall be especially designed for submerged service where water may completely submerge the valve and operator. All other units shall be, at a minimum, weather tight.

#### 2.06 VALVE ACTUATORS - GENERAL

- A. See the Paragraph 2.1-H above for submergence requirements.
- B. The valve manufacturer shall supply and integrally, rigidly mount all actuators, including any type of manual or powered actuators, on valves at the factory. The valves and their individual actuators shall be shipped as a unit.
- C. Unless otherwise noted, valves shall be manually actuated; nonburied valves shall have an operating wheel, handle or lever mounted on the operator; buried valves and those with operating nuts shall have a non-rising stem with an AWWA 2-in nut.
- D. Except as otherwise shown on the Drawings or specified herein, all valves 3-in diameter or larger, with the valve center line located 7-ft or more above the operating floor, shall be provided with chain wheel operators complete with chain guides and hot dipped galvanized steel chain, which loop within 4-ft of the operating floor.
- E. All actuators shall be capable of moving the valve from the full open to full close position and in reverse and holding the valve at any position part way between full open or closed.



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- F. Each operating device shall have cast on it the word "OPEN" or "CLOSE" and an arrow indicating the direction of operation.
- G. Floor boxes for operating nuts recessed in concrete shall be standard cast iron type, cast-in-place, with fastening top by Clow or equal.
- H. Stem guides shall be of the adjustable wall bracket type, bronze bushed, with maximum spacing of 10-ft as manufactured by Clow; Rodney Hunt or equal. Extended operating nuts and/or stems shall have universal joints and pin couplings, if longer than 10-ft and a rating of at least five times the maximum operating torque. Stem adaptors shall be provided.
- I. Where required by the installation, or as specified, provide the following: extended stem; floorstand and handwheel; position indicator and etched or cast arrow to show direction of rotation to open the valve; resilient, moisture-resistant seal around stem penetration of slab.
- J. Gear Actuators
  - 1. Unless otherwise noted, gear actuators shall be provided for the following: all valves of larger than 8-in nominal diameter; all buried valves with operating shaft mounted horizontally (butterfly, plug, etc); where specified and/or indicated on the Drawings; where manual operator effort is greater than 80 ft-lbs rim pull.
  - 2. Gear actuators shall be of the worm or helical gear type with output shaft perpendicular to valve shaft, having a removable hand wheel mounted on the output shaft. Unless noted they shall conform to AWWA C504, but except with butterfly valves, need not be certified.
  - 3. Actuators shall be capable of being removed from the valve without dismantling the valve or removing the valve from the line.
  - 4. Gearing shall be machine-cut steel designed for smooth operation. Bearings shall be permanently lubricated, with bronze bearing bushings provided to take all thrusts and seals and to contain lubricants. Housings shall be sealed to exclude moisture and dirt, allow the reduction mechanisms to operate in lubricant and be of the same material as the valve body.
  - 5. Manual operator input effort to the handwheel shall be a maximum of 40 ft-lbs for operating the valve from full open to full close, under any conditions. Gear actuators shall indicate valve position and have adjustable stops. Maximum handwheel size shall be 24-in diameter.
- K. Additional valve actuators are included with the individual valve types and as noted in Paragraph 1.02 above.
- L. All position indication and direction of opening arrows shall be embossed, stamped, engraved, etched or raised decals.

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- M. Unless otherwise noted, all valves larger than 3-in nominal diameter shall be provided with position indicators at the point of operation.

### 2.07 VALVE ACTUATORS - POWERED

- A. Electrical actuators furnished as part of this Section shall comply with AWWA C540.
- B. Unless otherwise noted all electric or other powered actuators shall utilize worm gear or helical gearing for all size valves.
- C. The motorized actuator shall comprise motor, reduction gearing, detachable drive bushing, thrust bearing and emergency hand wheel local position indicator, together with torque and position limit switches, thermostatically controlled space heater, terminals and integral controls. The actuator shall be a self-contained, totally enclosed unit with position lights, push buttons and position and status contacts.
- D. The handwheel drive shall permit manual operation in a reasonable time, related to valve size. Failure of motor drive or gearing should not prevent manual operation. Handwheel shall not operate when motor operates. Motor shall be unable to operate when handwheel is operating.
- E. Continuous mechanical dial indication of valve end positions shall be incorporated.
- F. Open and close torque and/or position limit switches to suit the valve type shall be provided for travel control, with means to prevent unwanted tripping on torque during initial unseating.
- G. Furnish position indicating switches on valves. Switches shall be single pole, double throw, at either limit of open or close or both limits as shown. Switches shall be enclosed in a NEMA 4 enclosure and contacts shall be rated 5 Amps minimum 120 VAC.

### 2.08 BUTTERFLY VALVES FOR FLUID SERVICE (METAL BODY)

- A. Butterfly valves and operators up to 72-in diameter shall conform to AWWA 0504, Class B, except as specified herein. The manufacturer shall submit an affidavit of compliance stating that the valves have been manufactured and tested in accordance with AWWA C504 and specifically listing all exceptions. Valves shall have a minimum 150 psi pressure rating or higher as noted on the Drawings or in this Section and be manufactured by Dezurik; Henry Pratt; Keystone or equal.
- B. Butterfly valves for above grade shall be flanged end with face to face dimensions in accordance with Table 2 of AWWA C504 for short-body valve. All valves for dead end shut off service shall be flanged type.

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- C. Valve seats shall be full resilient seats retained in the body or on the disc edge in accordance with AWWA C504. Valve discs shall be constructed of cast iron, ASTM A48, Class 40; Ni-resist, ASTM A436, Type 1; or ductile iron, ASTM A536, Grade 65-45-12.
1. For valves 24-in in diameter and larger, when the resilient seats are attached to the body, discs shall have Type 304 stainless steel seating edges. When the resilient seat is attached to the disc, it shall be fastened with a one piece Type 304 stainless steel retaining ring, Type 304 stainless steel Nylock set screws and a mating Type 304 stainless steel ring shall be installed in the valve body.
  2. Resilient seats shall be Hycar or equal. Seats shall be fully adjustable and replaceable with the valves in place for all valves 24-in in diameter and larger.
- D. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Permanently self-lubricating body bushings shall be provided and shall be sized to withstand bearing loads. Stuffing box of liberal dimensions shall be provided at the operator end of the vane shaft.
1. Packing shall be of the self compensating V-type. A sealing element utilizing O-rings shall also be acceptable for up to and including 24-in valves. Over 24-in, pull down seals using a square braid of graphite fiber is an acceptable alternate.
  2. Packing shall be held in place by a bolted corrosion resistant retainer plate or gland; retainer clips are not acceptable. For 30-in or larger, use a stuffing box with follower gland.
  3. Replacement of seals, for all size butterfly valves, shall not require removal of the valve from the line. In addition adjustment or replacement of seals on valves of 30-in or larger shall not require disturbing any part of the valve or operator assembly, except any packing follower gland.
- E. The valve shaft shall be of Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. No reductions of shaft diameter will be allowed except at the operator connection. Any reduction shall have a full radius fillet.
- F. In general, the butterfly valve actuator shall conform to the requirements of AWWA C504, insofar as applicable and as specified herein.
- G. Gearing for the actuators where required shall be totally enclosed in a gear case in accordance with AWWA C504.

- H. The manual actuators shall conform to AWWA C504, insofar as applicable. Actuators shall have permanent indicators with raised or engraved marks to show position of the valve disc.

3.03 BUTTERFLY VALVES FOR AIR SERVICE

- A. Valves shall be wafer style, except for dead end service, where flanged valves shall be used. Valve body shall be cast iron ASTM A126 Class B. Disc shall be bronze, semi-steel or ductile iron ASTM A536 with a disc edge of IVIonel, Type 316 stainless steel, or welded nickel machined to a smooth surface. Valve shall have an air profile (undercut) disc. Resilient seats shall be reinforced Nordel (EPDM).
- B. Air butterfly valves shall be suitable for 250 degree F continuous and 300 degree F intermittent operation.
- C. All valves shall be furnished with self lubricated bearings of TFE coated stainless steel. Shaft seals shall be provided to prevent air leakage and to protect bearings from internal or external corrosion. Use EPDM or Buna-N O-rings or self adjusting packing.
- D. Shafts shall be one piece and shall be of Type 316 stainless steel. Shafts shall be finish ground and polished to minimize bearing and shaft seal wear. Shafts of 8-in and larger valves shall have a non-adjustable thrust collar.
- E. Valves 8-in and smaller shall have 10-position levers. All manually actuated valves 10-in and larger shall be operated using a geared actuator. All units to have adjustable open and closed position stops with provision to prevent accidental adjustment changes. Operating shaft shall be supported axially and radially at input end by permanently lubricated bronze thrust and sleeve bearings. Actuators for throttling service shall conform to AWWA C504.
- F. Butterfly valves for air service shall meet ANSI B16.104 and MSS-SP-67, except as modified herein. They shall be manufactured by DeZurik, Pratt, Keystone or equal.
- G. Butterfly valves for air service, of pressures higher than [25] psi and/or larger than 24-in diameter shall comply with the above requirements.

- BUTTERFLY DAMPERS

- A. Butterfly dampers shall be used at duct connections to tanks. Dampers shall provide shut-off of air flow from the tank into the duct system and shall be designed for 3-in w.c. of vacuum service to 5-in of water column.
- B. Dampers shall be of fabricated Type 316 stainless steel, of circular configuration, with flanged end connections to match ANSI B16.1 flange drilling pattern. Dampers shall be resilient seating with Neoprene seats installed on the disc and

## VALVES AND APPURTENANCES

held in place by a fiberglass reinforced polyester retaining ring with FRP bolts and nuts. The disc shaft shall be supported by resilient bushings and shall utilize packing or O-ring seals at the shaft connection to the operator.

- C. The operator shall be a hand lever with ability to latch in either the fully opened or fully closed position.

- GATE VALVES (2-1/2 -IN AND SMALLER)

- A. Gate valves 2-1/2-in diameter and smaller shall have flanged, screwed, or solder ends as required and shall be brass, or bronze, or Type 304 stainless steel solid wedge, union bonnet, rising-stem gate valves such as Figures 47 and 48 as manufactured by Jenkins Brothers or similar products as manufactured by Crane; Fairbanks; Kennedy Valve Manufacturing Co.; Lukenhiemer or equal.
- B. All water valves 2-1/2-in and 3-in unless noted otherwise, shall be brass body gates and shall be Jenkins No. 1240, or Hammond 1B-647.

- GATE VALVES (3-IN AND LARGER)

- A. General Requirements

1. Unless otherwise specified below, these requirements shall apply to all gate valves.
2. Gate valves shall meet the requirements of AWWA C500 and AWWA C509 as applicable to the type of valve specified.
3. Buried and submerged valves shall be furnished with mechanical joints and stainless steel hardware; non-rising stem design.
4. Exposed valves shall be furnished with Class 125 flanged ends; provide valves with outside screw and yoke.
5. All-metal valves shall be manufactured of ASTM A126 Cast Iron, Class B, with bronze mounting design.
6. Rising stem valves shall be sealed with adjustable and replaceable packing; valve design must permit packing replacement under operating system pressures with only moderate leakage.
7. Non-rising stem valves shall use a double O-ring stem seal except that packing shall be used where geared operators are required.
8. Except as otherwise specified, valves shall be rated for the following working water pressures:

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Valve Size	Pressure (psig)
3-in to 12-in	200
14-in to 20-in	150
24-in and greater	50

- a. All valve bodies shall be hydrostatically tested to at least twice the rated working water pressure. In addition, valves shall be seat-tested, bi-directional at the rated working pressure, with seat leakage not to exceed one fluid ounce per inch of valve diameter per hour. Provide certificates of testing.
9. Flanged valves to have face-to-face dimensions per ANSI B16.10 and flanges per ANSI B16.1.
10. Exposed valves 16-in and larger to have valve by-pass.
11. All bonnet and packing gland bolts shall be zinc or cadmium electroplated steel; packing gland bolts shall have bronze nuts.
12. Exposed valves 16-in and greater indicated for horizontal stem installation shall be furnished with rollers, tracks and scrapers and enclosed bevel gear grease case.
13. Provide geared operator and chainwheel, chain and chain guides for valves with handwheel centerline more than 7-ft above operating level.
14. All valves shall be marked per AWWA Standards, including name of manufacturer, valve size and working pressure and year of manufacture.
15. Unless otherwise indicated, valves 12-in and smaller shall be capable of installation in the vertical or horizontal position, and sealing in both directions at the rated pressure.
16. Valve operation shall be counterclockwise for potable water; clockwise for wastewater and other non-potable waters. Provide permanent label showing "OPEN" and arrows.
17. Metal-seated valves shall be coated internally and externally with an asphaltic varnish, per AWWA C500. Resilient seated valves shall be coated, interior and exterior, with fusion bonded epoxy per AWWA C550.

B. Valve Applications

1. Valves for Potable Water Service.
  - a. Double disc design manufactured by American-Darling Valve; Kennedy Valve; M&H Valve Company or equal.
  - b. Double revolving disc manufactured by American-Darling Valve.
2. Valves for Wastewater Service
  - a. Resilient seated design manufactured by American-Darling Valve; Kennedy Valve; IVI&H Valve or Clow Corp.
  - b. Double revolving disc manufactured by American-Darling Valve.
3. At the Contractor's option and unless otherwise indicated, any of the listed valve styles may be used, at no additional cost to the Owner.

C. Valve Requirements

1. Double Disc
  - a. Conform to AWWA C500.
  - b. Wedging surfaces shall be bronze, monel or stainless steel.
2. Double Revolving Disc
  - a. Conform to applicable provisions of AWWA C500.
  - b. Wedging surfaces shall be monel or stainless steel.
  - c. Discs fully free to rotate and guided in travel by cast surfaces.
  - d. Disc rotation shall produce a self-cleaning action during opening or closing.
  - e. Wedging forces applied only when discs are in seating position.
3. Solid Wedge
  - a. Conform to AWWA C500,
  - b. Tongue and grooved guides for wedges.
4. Resilient Seated
  - a. Conform to AWWA C509. Also UL and FM approved.
  - b. Internal and external epoxy coating of valve body, including bonnet, per AWWA C550.
  - c. Gate shall be encapsulated with synthetic rubber. It shall be bonded and vulcanized in ( accordance with ASTM D429 Method B.
  - d. No recesses in valve body.

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### D. Buried Valves

1. Conform to the requirements above, except mechanical joint bell ends per AWWA C111.
  - a. All exposed valve hardware (nuts, bolts, washers, etc) including bonnet, bonnet cover, stuffing box, gear adapter shall be Type 304 stainless steel.
2. Non-rising stem design, double O-ring seals for non-gearred valves and shall incorporate packing for geared valves.
3. Provide valve box, 2-in operating nut and extension stem and stem cover.

### E. Tapping Valves and Sleeves

1. Tapping valves shall comply with the same requirements as solid wedge or double disc gate valves except they shall have the flanged end and port opening modified for tapping service. Valves shall be capable of passing a full nominal sized cutter without damage to the valve. The tapping sleeve shall be gray cast iron or ductile iron mechanical joint type with the outlet flange conforming to MSS-SP-60.
2. All water valves, 4-in and larger, shall be iron body gates, bronze trim, flanged ends, O.S.&Y. pattern, solid wedge, rising spindle, Jenkins No. 651, or Hammond 1R-1140.

## 1. KNIFE GATE VALVES

- A. All knife gate valves shall be flanged knife gate valves for 150 psi working pressure. Valves shall be marked for direction of flow and round bar wedges and gate guides shall be installed in the liner body to force the gate against the seat. The gate shall be a beveled knife edge. Valves shall have metal to metal seating, with a raised seat face with a relief groove to allow the gate to push solid particles aside to prevent material packing in the seat area. All wetted surfaces shall be Type 304 stainless steel with ductile iron cast body and stainless steel trim. Packing gland bolts shall be Type 304 stainless steel with plated, self-locking nuts. Seats shall be solid stainless steel.
- B. The valves shall have full port straight-through opening. Flanges shall be drilled to match connecting piping. Knife gate valves shall be Series L as manufactured by DeZurik Inc., similar model as manufactured by ITT; Red Valve Co. or equal].
- C. Where noted the valve shall have a full bonnet.

## 1. PLUG VALVES

- A. Plug valves shall be of the offset disc type, 1/4 turn, non-lubricated, serviceable (able to be repacked) under full line pressure and capable of sealing in both directions at the rated pressure. The disc shall be completely out of the flow path



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when open. Plug valves specified herein shall be by DeZurik or approved equal. All manufacturers named or otherwise, must comply completely with this Section.

1. For clean liquid or screened sewage, all size plug valves shall have a minimum port area of 80 percent.
  2. On sludge and scum lines, all valves 24-in and larger shall have a minimum 100 percent open port area; for all other valves, a minimum port area shall be 80 percent when measured by the percent cross-sectional area of equivalent size (nominal same diameter) pipe.
  3. All plug valves for whatever service, shall be capable of passing "pigging" cleaning equipment (using a Girard or similar cleaning pig of full nominal pipeline diameter) in either direction and manufacturer shall so certify that this may be done without the use of special equipment.
- B. Valves shall be rated at minimum 175 psi WOG (Water, Oil and Gas) working pressure for sizes 4-in to 12-in inclusive and at minimum 150 psi WOG working pressure for sizes 14-in and larger.
1. All plug valves under this Paragraph shall be performance, leakage and hydrostatically tested in accordance with AWWA C504, except as modified herein.
  2. At the above rated minimum working pressures, the valves shall be certified by the manufacturer as permitting zero leakage for a period of at least 1/2 hour with pressure applied in either direction.
  3. At the direction of the Engineer, the valve manufacturer may be requested to perform a valve seat leakage test, witnessed by the Engineer to prove compliance with this Section.
- C. Valve bodies shall be of cast iron, 30,000 psi tensile strength, ASTM A126, Grade B, or of ductile iron, ASTM A536 and of the top entry, bolted bonnet design, cast with integral flanges conforming to the connecting piping. All exposed bolts, nuts and washers shall be zinc or cadmium-plated, except for buried or submerged valves, which shall have Type 316 stainless steel hardware.
- D. The valve disc shall:
1. Be cast iron ASTM A126, Grade B, or ductile iron, ASTM A536, Grade 65-45-12.
  2. Be removable without removing the valve from the line.
  3. Have an integral upper and lower shaft which shall have seals on the upper and lower journals to prevent entrance of solids into the journals.
  4. Be one piece for all valves up to 14-in and maximum two piece for larger [non-throttling] valves.

## VALVES AND APPURTENANCES

- E. Shaft bearings shall be permanently lubricated, rigidly backed TFE, stainless steel or bronze at both upper and lower stem journals. The operator shaft shall have easily replaceable seals, which shall be externally adjustable and repackable without removing the bonnet from the valve, or shall have self adjusting packing.
  - F. The valve seating surface shall provide full 360 degree seating by contact of a resilient seating material on the disc mating with welded-in high nickel content overlay seating surface in the body.
    - 1. The seating design shall be resilient and of the continuous interface type having consistent opening and closing torques and shall be non jamming in the closed position. Screw-in seats shall not be acceptable.
    - 2. Discs shall have a full resilient facing of neoprene or Buna-N.
  - G. The methods of mounting the actuator to the valve shall provide an air gap between the two. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel. Hardware on actuators shall be of the same materials as the valves.
  - H. Unless otherwise required, due to location or operation, each valve 6-in and smaller shall be provided with its own securely attached lever. Provide adjustable limit stops for both opening and closing and a clearly marked position indicator.
  - I. Plug valves shall be installed so that the direction of flow through the valve and the shaft orientation is in accordance with the manufacturer's recommendations. Unless otherwise noted, shaft shall be horizontal, with plug opening up.
1. BALL VALVES
- A. Stainless Steel Ball Valves
    - 1. Ball valves for water service shall be stainless steel body, full bore, fire-safe, rated for a line pressure of 150 psig. Except as noted, ball valves shall comply with AWWA C507.
    - 2. The design of the valve shall be such that it shall provide suitable seating in both directions. In order to determine the position of the ball within the valve (open or closed), there shall be an easily visible, permanent, indicator located conspicuously on the valve. Ball valves shall have Type 316 stainless steel seating surfaces. Seats shall Butadiene. The fully open port area shall be approximately 100 percent of the nominal pipe area.
    - 3. Valve shafts shall be ground and polished and shall be Type 304 stainless steel. Teflon-lined bearings shall be supplied in both trunnions of the valve body.

## VALVES AND APPURTENANCES

4. The valves shall be constructed so that the seals, seats and balls are accessible for replacement without dismantling the piping. The valves shall not require lubrication but shall have stuffing boxes which can be packed with the valve in service without undue leakage. Ball valves shall be as manufactured by Henry Pratt Co., Aurora, IL; Willamette, Portland, OR or equal.
  5. Valve actuators shall conform to AWWA C507 and as specified herein.
- B. Ball valves for plant water piping shall be manual and electric actuated, bronze, resilient seated, regular port, threaded two piece bolted body type valves. The body and cap shall be of brass, ASTM B30, the ball and stem of Type 316 stainless steel and the seats and seals of TFE. The valves shall have full floating ball and shall be non lubricated. Valve seats shall be easily accessible and replaceable. Valves shall be rated to 250 psi and shall be as manufactured by Neles-Jamesbury; WKM or equal.
1. CHECK VALVES
- A. Check valves for metallic lines of 2-in to 24-in diameter shall be swing type and shall meet the requirements of AWWA C508. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, nonshock and hydrostatically tested at 300 psi.
1. When there is no flow through the line, the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.
  2. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.
  3. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. The position of the weight shall be adjustable. Various weights shall be provided and installation approved by the Engineer. Lever shall be installed to the horizontal in the closed position, for both horizontal and vertical pipeline installations.
  4. Check valves shall be by Golden Anderson; Clow; or equal.
- B. Check valves 2-in and smaller for installation in copper and steel pipes shall be bronze, swing type, 125 lb with solder or screwed ends.
- C. Wafer style check valves for air service shall be of the dual disk type with bodies constructed of cast iron, ASTM A126, Class B. Disc shall be fabricated of ductile iron, ASTM A536 and shall be electroless nickel plated. Body seat material shall be Buna-N. Spring material shall be Type 316 stainless steel. The ends shall be plain. The valve shall be by APCO; Val-Matic; GA; Keystone or equal.

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- D. Wafer style check valves for sludge and water service shall be iron body, semi lugged type with 316 SS spring, lever and weight. Valves shall installed between flanges while using a flange coupling adaptor or a dismantling joint. Valves shall be fitted with a Buna-N seat, Buna-N outside diameter seal and 316 stainless steel bolts. Disc plate, disc plate arm and stem shall be 316 stainless steel rated for a 125 PSI differential. Valves shall be Prince Model 813/815 or equivalent.
- E. Ball check valves for [submersible pump discharges], [mainline], metallic piping shall have bodies constructed of cast iron, ASTM A159, Class 35. Sinking and/or Rising ball shall be type fabricated of hollow steel with vulcanized Nitrile rubber covering. Ball check valves shall be Type 2016 as manufactured by Flygt Corporation, similar by GA; Empire or equal.
- F. All check valves 3-in and smaller shall be similar to Hammond 1B-940, or Jenkins No. 92A. Check valves 4-in and larger shall be flanged and similar to Hammond 1R-1124 or Jenkins No. 624.
- G. Rubber flapper Swing Check Valves
  1. The Rubber Flapper Swing Check Valve shall have a heavily constructed cast iron body and cover. The body shall be long pattern design (not wafer) with integrally cast-on end flanges. The flapper shall be Buna-N having an "O" ring seating edge and be internally reinforced with steel.
  2. Flapper to be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position during flow through the valve. Flapper shall be easily removed without need to remove valve from line. Check Valves to have full pipe size flow area. Seating surface to be on a 45° angle requiring the flapper to travel only 35° from closed to full open position, for minimum head loss and non-slam closure.
  3. Buna-N Flapper (hi-strength coated fabric - coated both sides with 70 Duro) which creates an elastic spring effect, molded internally, to assist the flapper to close against a slight head to prevent slamming.
  4. Valve designed for 175 psi working pressure for water, oil or gas. The Valve shall be suitable for above ground or buried service. Stainless cover bolts must be furnished for buried service.
  5. Valve exterior to be painted Phenolic Primer Red Oxide for high resistance to corrosion.
  6. The Valve Manufacturer shall have been regularly engaged in the design and manufacture of Rubber Flapper Swing Check Valves for at least five years and shall submit a list of at least five separate installations in service for a minimum of five years for engineer approval prior to release to manufacture.

## VALVES AND APPURTENANCES

7. Materials of construction shall be certified in writing to conform to ASTM specifications as follows:

Body & Cover Cast iron ASTM A126 Gr. B  
Rubber Flapper Buna-N

8. Valves to be APCO Series 100 Rubber Flapper Swing Check Valve, as manufactured by Valve & Primer Corporation, Schaumburg, Illinois, U.S.A or equal by Val-Matic, GA or Crispin.

### 1. GLOBE VALVES

- A. Globe valves for lines shall have a bronze body, renewable full plug stainless steel disc, renewable stainless steel seat and 400 lb cold water non-shock working pressure. Globe valves shall be Figure 3245P as manufactured by Walworth Co.; Valley Forge, PA or equal.

### 1. PLASTIC VALVES

#### A. General

1. All valves shall be certified as completely compatible with the intended and specified service; compatibility shall apply to the material of the valve and internal components, including all seals, gaskets, O-rings and washers; solvents and primers used in valve joint make-up shall be specifically in conformance with the written instructions of the valve supplier. Service chemicals and service conditions are shown in the piping sections in Division 15.
2. Except as otherwise specified valve ends shall be socket-type designed for solvent welding. The valve manufacturer shall provide specific recommendations for solvent and primer.
3. Valve material shall be the same as the piping service except as specified.
  - a. PVC shall be Type 1, Grade 1, per ASTM D1784 classification, made from unplasticized polymer, and generally suitable for service to 120 degrees F.
  - b. CPVC shall be Type 4, Grade 1, per ASTM D1784, classification generally suitable for service to 180 degrees F.
  - c. Polypropylene (PP) shall conform to the material requirements of ASTM D4101 for copolymer polypropylene. Generally suitable for service to 195 degrees F.
  - d. PVDF (polyvinylidene fluoride) shall be manufactured from high molecular weight polymers of vinylidene fluoride. Generally suitable for service to 250 degrees F.
  - e. The manufacturer of the valves shall retain material source quality documentation and shall furnish it to the Engineer upon request.

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4. Unless otherwise specified:
    - a. O-rings, valve seats and stem seals shall be teflon, or teflon encapsulated elastomer. Alternative materials may not be substituted without complete documentation provided to the Engineer of service suitability.
    - b. Gaskets shall be made from PTFE-bonded sheet material, GORE-TEX manufactured by W.L. Gore & Associates; AV Low-Torque gaskets by Asahi/America or equal.
    - c. Valve external hardware shall be Type 316 stainless steel. No internal metallic components shall be exposed to the service fluid.
    - d. No factory or field coatings shall be applied to the valves.
  5. All valves, except butterfly valves shall have a non-shock service pressure rating of not less than 120 psig at 70 degrees F
  6. All valves shall be given hydrostatic and pressure and leakage tests at the factory. Provide certified copy of test results.
  7. Valves shall be the standard, catalogued products of the following manufacturers:
    - a. Chemtrol
    - b. Asahi/America
    - c. Plast-O-Matic
    - d. Hayward
  8. Valves specified as furnished with equipment or equipment systems shall comply with these requirements.
- B. Ball Valves
1. Ball valves shall be the socket-ended type, unless otherwise specified, with full-port opening.
  2. Provide quarter-turn manual valve operator and valve seat adjustability.
  3. Plastic valves in sodium hypochlorite service shall have the ball drilled to permit venting of pressure and gas from the confined ball cavity, when the valve is closed. The drilling shall vent to the upstream end of the valve. The drilling shall be 1/8-in opening, de-burred. An arrow shall be inscribed on the valve body to indicate direction of flow.
- C. Butterfly Valves
1. Valves shall be of the lined body design with PVC body and PP disc with only the liner and the disc as wetted parts. The liner shall be molded and formed around the body, functioning as a gasket on each side of the valve. Double O-ring seals on top and bottom disc trunnions will fully

## VALVES AND APPURTENANCES

isolate a Type 316 or 304 straight-through stem. Liner and seal shall be Buna-N.

2. The valves shall be of the lug or wafer style, suitable for dead-end service.
3. Each valve shall be furnished with a lever actuator on sizes through 6-in; gear operator on sizes 8-in and larger.

### D. Diaphragm Valves

1. Valves shall have [flanged, socket or spigot, threaded, double-union] ends.
2. Valve body and bonnet shall be of solid [PVC, CPVC, PP, PVDF]
3. Diaphragms shall be [Teflon, EPDM, Buna-N, Butyl, Hypalon, Neoprene, Natural Rubber]
4. The valve shall have a full-width weir, designed for throttling, and complete bubble-tight closure.
5. Provide a handwheel valve-operator, with a stainless steel stem, a cast stem sleeve and a clear plastic stem cover with a position indicator; provide an adjustable limit stop to prevent overtravel.

### E. Needle Valves shall be designed for close control of flow throttling with a multi-turn valve handle.

### F. Check Valves

1. Ball check valves shall be double-union style with socket ends, solid and completely spherical ball and capable of either horizontal or vertical mounting.
2. Swing Check valves shall be flanged, full-ported, with top entry access for disc inspection and removal. Furnish with outside lever and weight, with weight position along lever arm adjustable.

### G. Backpressure Regulating/Control Valves

1. Spring-loaded diaphragm design, fully-adjustable pressure setting, set to assure continuous positive pressure at the pump discharge.
2. Furnish with teflon diaphragms and elastomer-coated springs.

### H. Pressure Relief Valves

1. Angle-pattern design, with adjustable relief pressure and locking nut. Spring-loaded with pressure adjustable over range up to 100 psig.

## VALVES AND APPURTENANCES

2. The valve spring shall be elastomer-coated and isolated from the process flow. Provide teflon diaphragms.
3. Relief valves shall be piped as indicated, and if not indicated, the relief piping shall be directed to the floor or adjacent gutter or drain.
4. Pressure relief valve settings shall be set to a pressure as recommended by the pump or equipment supplier and adjusted at the time of equipment testing, inspection and start-up.

### 1. NEEDLE VALVES

- A. Needle valves shall have a cast bronze body and be constructed in accordance with ASTM B62 and shall be designed for an operating pressure of 125 psi and a 200 psi maximum test pressure. Ends shall be ANSI B2.1 threaded. The valves shall have a rising bronze stem and non-slip malleable iron hand wheel.
- B. The needle valves shall be Figure 680 as manufactured by the William Powell Company, Cincinnati, OH, or Figure 88 as manufactured by Crane Company, Valve Division, Chicago, IL or equal.

### 1. PRESSURE REGULATING VALVES

- A. Pressure regulating valves shall be factory tested. Outlet pressure shall be easily field adjustable over the pressure ranges and meet the criteria noted on the Drawing.
- B. All pressure regulating valves shall have flanged connections, or shall have unions mounted in the pipe on each side of the valve.
- C. Strainers for installation upstream of pressure regulating valves are specified elsewhere. The pressure regulating valve manufacturer shall specify the screen mesh or size of perforations that are required to protect the regulating valve. The valve supplier shall furnish both valve and strainer.
- D. Pressure Regulating Valves - 3-in and larger
  1. Valves 3-in and larger and for pressure regulating shall be flanged with globe body, fully bronze mounted, external pilot operated, diaphragm type single seat with seat base equal to size of valve and shall be equal to the Figure 4500D Pressure Reducing Valve as manufactured by GA Industries Inc., Pittsburg, PA; Clayton Model 90 by Cla-Val Company, Newport Beach, CA; Bailey, Fresno, CA; similar models by Ross; OCV; Watts/Muesecos or equal.
  2. The valve shall be packed with teflon material acceptable to the Engineer to ensure tight closure and prevent metal to metal friction and sticking. The valve shall be furnished with indicator rod, to show position of opening of the piston, and pet cocks for attachment to valve body for receiving gauges for testing purposes.



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3. The pilot valve, controlling operation of the main valve, shall be easily accessible and so arranged to allow for its removal from the main valve, while the main valve is under pressure. The pilot valve shall be easily adjustable without removal of the springs, weights or use of special tools. The control piping on the valves shall have strainers to prevent plugging of control mechanisms.
  4. The design shall be such that repairs and dismantling internally of main valve may be made without its removal from the line.
  5. The unit shall be flanged. The valve body shall be constructed of cast iron.
  6. The valve shall [maintain pre-adjusted downstream pressure for varying rates of flow through the positioning of the [piston] [diaphragm] by the pilot without causing: water hammer or waste of water and without cavitation].
- E. Pressure Regulating Valves - 2-in and Smaller
1. Pressure regulating valves 2-in and smaller shall be rated 150 psig working pressure, with bronze and brass body; renewable stainless steel seat and flexible diaphragm of suitable material. Outlet pressure shall be easily field adjustable over the pressure ranges tabulated.
  2. Pressure regulating valves 2-in and smaller shall be Figure No. 43D as manufactured by GA Industries, Inc.; Model 30A by Bailey or equal.

### 2.17 SOLENOID VALVES

- A. Solenoid valves shall be packless piston type direct acting for sizes less than 1-in and internal pilot operated for sizes 1-in and larger, 2-way or 3-way, valves and shall be ASCO Valve; Red Hat by Automatic Switch Co., similar by Atkomatie Valve Co. or equal for air and water service.
- B. Valves shall be energize to open, except for valves on water seal lines to pumps which shall be energize to close.
- C. Valves shall have forged brass bodies, NPT end connections of the connected piping Type 304 stainless steel internal parts, and Buna-N or Ethylene Propylene valve seats. Valves shall have a minimum 150 psig safe working pressure and zero minimum operating pressure differential. Connections shall be threaded.
  1. Except as otherwise specified herein, valves shall be as noted in PART 1.
- D. Solenoid valves on bypass piping shall be installed whether shown or not.
- E. Note that solenoid valves may be shown on Electrical and/or Mechanical Drawings, or may only be specified.

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### 2.18 CORPORATION STOPS AND STOP AND WASTE VALVES

- A. Corporation stops shall be of bronze or brass and shall be designed and manufactured in accordance with AWWA C800, except as modified herein.
- B. Corporation stops shall have Mueller inlet threads except that corporation stops for use with service clamps shall have IPS threads. Where corporation stops are used with plastic pipe, a brass companion flange shall be provided on the outlet of each corporation stop.
- C. Stop and waste valves shall be similar to corporation stops as manufactured by Crane; Ford; McDonald or equal.

### 2.19 AIR AND/OR AIR/VACUUM VALVES - GENERAL

- A. This Section applies to all air release, air/vacuum, hydraulically operated air/vacuum valves, vacuum relief, combination air and air/vacuum or vacuum relief or similar valves.
- B. Valves shall be supplied with shutoff gate or ball valves with operator handle or lever removed. Valves shall be properly vented and piped to drain.
- C. Attention is directed to the requirement that valve's pressure rating be at least equal to the attached pipe's rating.
- D. Valves shall be [special non-clean water type or other] proper model by Val-Matic; APCO; GA; Crispin or equal.
- E. For service on sewage, sludge (of any type) and non-screened water, the valves shall be of the special sewage type, performing similar functions for specific type of valve as noted for water.
  - 1. The valves shall have Type 316 stainless steel trim and float, with an adjustable viton seat and be supplied with backwash accessories
  - 2. A valved outlet with hose connections for flushing water connection (where flushing accessories are required) shall be provided within a distance that hoses, supplied with the valve, may reach. Proper cross connection prevention shall be provided.

### 2.20 AIR RELEASE VALVES

- A. Air release valves shall be installed to release any small accumulations of air which may collect while pipe is in operation and under pressure.

The small orifice assembly air release valve shall automatically release air accumulations from the pipe while under positive pressure. When the valve body fills with air, the float ball shall fall to open the small orifice and exhaust the air to atmosphere. When the air has been exhausted, the float ball shall be buoyed up and tightly close the small orifice.

## VALVES AND APPURTENANCES

- C. The small orifice assembly shall be furnished with cast iron body and cover (ASTM A126 Class B). The float ball shall be constructed of stainless steel and attached to a stainless steel lever mechanism. A resilient, Buna-N seat shall be attached to the lever mechanism for drop-tight closure.
- D. Separate air release valves shall be manufactured by APCO; Val-Matic; GA; Crispin or equal of the special type for use with non-clean water.

### 2.21 AIR AND VACUUM VALVES FOR VERTICAL TURBINE PUMPS

- A. Air and vacuum valves for vertical turbine pumps shall be designed to allow large quantities of air to escape out the orifice when the pump is started and close water tight when the liquid enters the valve. The air valve shall also permit large quantities of air to re-enter through the orifice when the pump is stopped to prevent a vacuum from forming in the pump column.
- B. The valve shall consist of a body, cover, baffle, (of ASTM A48 Cast Iron) and Buna-N seat. The baffle will be designed to protect the float from direct contact of the rushing air and water to prevent the float from closing prematurely in the valve. The seat shall be fastened into the valve cover, without distortion and shall be easily removed, if necessary.
- C. For valves up to and including 3-in, the entire float and baffle assembly must be shrouded with a perforated water diffuser (brass) to prevent the water column entering the valve, slamming the float shut and to eliminate water hammer in the system. For valves of 4-in and larger, the valves shall be mounted on top of a surge, slow-closing check valve.
- D. The discharge orifice shall be fitted with an adjustable throttling device (iron) to regulate the flow of air escaping, to establish a pressure loading on the rising column of water, to minimize shock to the pump and check valve. The valve shall have non-slamming closing feature.
- E. The float shall be ASTM A240 stainless steel, designed to withstand a minimum of 1000 psi. The float shall be center guided and not free floating for positive seating.
- F. Air and vacuum valves for vertical turbine pumps shall be of special design for this service. The manufacturer of the valve shall confirm in writing that unit is suitable for type and size of pump, as shown on Drawings and as specified herein. Unit shall be by Val-Matic; APCO; GA; Crispin or equal.

### 2.22 AIR/VACUUM VALVES (HYDRAULICALLY OPERATED)

- A. Where noted, air/vacuum valves of the hydraulically operated type shall be used alone or piped with separate air release valves specified elsewhere in this Section.
- B. The main body shall be three piece construction, having a flanged inlet and flanged outlet. The cross-sectional flow area throughout shall be greater than the

equivalent inlet pipe size. The float shall be non-collapsible heavy cast bronze or stainless steel, center guided from both ends with a one piece stainless steel shaft. The stainless steel shaft shall connect to the top cylinder piston rod by means of an alignment coupler. The coupler shall prevent any shaft or piston rod binding due to misalignment and allow the float to move freely to shut-off or open.

- C. The valve shall be normally open and vent large volumes of air during filling of the water pipeline without restriction. Fluid velocity, upon entering and discharging through the valve, shall cause the float to shut-off into a resilient seat, at a controlled rate. The hydraulic control closing system shall be independent from the line fluid, but an integral part of the valve.
- D. The hydraulic control system shall be pressurized by means of a hydropneumatic oil accumulator, with sufficient pressure to overcome any friction losses due to contact between guide bearing surfaces and to ensure the valve will open under vacuum conditions. Pressure may be increased in the accumulator to cause the valve to open in advance of the vacuum condition forming.
- E. The adjustable control valve, for setting the time cycle of shut-off, shall be located externally and easily accessible, so that adjustments can be made without the need of dismantling any portion of the valve.
- F. Upon demand of a negative pressure in the pipeline, the hydraulic control closing system shall not interfere and the valve shall open freely, allowing large volumes of air to enter the system to break the vacuum. Returning secondary surge wave shall not cause the valve to shut-off fast. Instead the returning surge wave will be dissipated through the open valve, while the time cycle of controlled shut-off is repeated.
- G. The heavy cast bronze float and stainless steel guide shaft assembly shall be counter- balanced in a manner to be virtually in a state of equilibrium.
- H. Unit shall be Series 7000 APCO Hydraulically Controlled Air & Vacuum Valve, as manufactured by Valve & Primer Corp.; Val-Matic Series 1100; RCAV; GA or equal.
- I. Any revision in the design and/or construction of the vaults, piping, appurtenances, equipment and other items required by the use of other units, shall be made at no additional cost to the Owner and be as approved by the Engineer.

### 2.23 AIR/VACUUM VALVES (NORMAL OPERATION)

- A. The large orifice assembly air and vacuum valve shall automatically exhaust air from a pipeline during the initial filling of the pipeline. The large orifice assembly shall not blow shut while exhausting air, even while venting air at sonic velocity. When all air has been exhausted from the pipeline, the large orifice float ball shall be buoyed up to seat tightly against a resilient seat ring. The large orifice float ball shall remain tightly closed while the pipeline is under

positive pressure. Should the pipeline pressure fall below atmospheric pressure (such as during draining or a line break), the large orifice float ball shall automatically fall away from the seat ring and permit air to enter the pipeline.

- B. The large orifice assembly shall be furnished with cast iron body and cover (ASTM A126 Class B). A resilient, Buna-N seat ring shall be affixed to the valve cover. The float ball shall be constructed of stainless steel with a minimum pressure rating of 1,000 psi. The float ball shall be free floating within the valve body; guide stems, linkages or levers attached to the float are not acceptable.
- C. Unit shall be manufactured by GA; APCO; Val-Matic or equal. Special type for use with non-clean fluids shall be provided.

### 2.24 VACUUM RELIEF VALVES

- A. Units shall be similar to the Air/Vacuum valve specified above, except only having the vacuum portion of operation.
- B. Unit shall be manufactured by GA; APCO; Val-Matic; Crispin or equal. Special type for use with non-clean fluids shall be provided.

### 2.25 COMBINATION AIR AND AIR/VACUUM OR VACUUM RELIEF VALVES

- A. Units shall be a small orifice (air release) valve mounted on a large orifice air/vacuum relief valve of the proper type and size as noted on the Drawings. Individual valves shall be as specified previously.
- B. The small orifice valve shall be piped to the body of the large orifice valve by non-corrosive piping equal in size to the small orifice inlet connection. An isolating stop valve (with operator removed) shall be furnished between the small and large orifice valves.
- C. One piece units performing all functions may be utilized, as acceptable to the Engineer. Component valves shall be as previously specified and by one manufacturer. Special type shall be supplied for non-clean fluid.

### 2.26 SURGE RELIEF VALVES

- A. The valve manufacturer shall submit to the Engineer calculations confirming that unit's size is proper for the system to be installed.
- B. Surge relief valves shall function to open when the system pressure exceeds the pressure for which the field adjustable pilot valve is set. Valves shall open rapidly and close slowly at a predetermined rate of speed. Provision shall be made to regulate the closing speed of the valves. The valves shall be completely piped ready for installation.
- C. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area and the area on the upper surface of the piston is of a greater area than the underside of the

piston. No diaphragm will be permitted within the main valve body.

- D. The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be accomplished by the valve Vee ports and not the valve seating surfaces.
- E. The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.
- F. The valve body shall be of cast iron ASTM A126 with flanges and pressure rating as noted. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze, ASTM B62, as well as the main valve operation. The valve seals shall be easily renewable. All controls and piping shall be of non-corrosive construction. A visual valve piston position indicator shall be provided.
- G. Valve shall be Figure 6700-D by GA Industries; Series 3000 (angle-pattern) or Series 6500 (globe-pattern) by APCO or equal. Layout shown is based on GA Industries unit.

### 2.27 CONE VALVES

- A. The valve manufacturer shall have a minimum of 10 years experience in the manufacture of cone valves. Valves to be by Willamette, Portland, OR or equal.
- B. Each cone valve shall consist of three main parts:
  - 1. Conical closing element, referred to as the plug, shall be the principle moving element within valve body. Plug shall have full unobstructed waterway equal to diameter of body and adjacent piping.
  - 2. Valve body shall have full unobstructed circular inlet and outlet equal to nominal diameter of specified size of valve and adjacent piping.
- 2.03 Valve head shall be so designed that it will totally enclose the large diameter of valve body and support valve operating mechanisms.
- C. Operating mechanism shall permit adjustment of seating, include a threaded lift nut to perform the seating function and a rotator attached to the valve shaft which shall impart a rotary motion to the plug. Operation of cone valve shall employ an axial motion to lift plug from its seat, followed by a rotary movement of plug to open valve. Closing movement of valve plug shall be in reverse order.
- D. An indicator plate shall be provided on the mechanism cover and an indicator attached to outer end of valve shaft, which will indicate position of plug opening with respect to opening in body. A bushing shall be included where the shaft extends through the mechanism cover.

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- E. Inlet and outlet part of cone valve body shall be provided with seat rings of monel electrically fused into body materials and sufficiently raised above internal surface of body to assure free operation. Watenvay flanges of body shall be furnished with flanges of minimum rating same as pipe. Body shall be flanged to accommodate valve head, which shall make a registered connection with valve body.
- F. Plug shall be provided with one set of raised monel seat rings electrically fused into plug material, one each at right angles to plug openings for seating when valve is closed.
- G. Upper and lower plug trunnions shall be cast integrally with valve plug. Trunnions and pivot bearings in body and head shall be bronze bushed and designed to withstand full maximum bearing loads possible for the operating conditions specified. Maximum allowable pressure on projected area of trunnion bearings shall not exceed 3000 psi.
- H. Valve shaft shall be hard chrome overlaid where it passes through stuffing box in valve head.
- I. Packing for all stuffing boxes shall be replaceable and adequate for service to which it is applied.
- J. Cone valve of all sizes, or if rated less than 250 psi but 16-in diameter and larger, shall be provided with bypass piping including a bypass ball or cone valve. Bypass piping diameter shall be as noted in AWWA C500 for gate valves.
  - 1. Gearing shall be designed so the maximum load under the specified operating conditions can be transmitted on one tooth without exceeding the maximum permissible unit stresses. An efficiency of not more than 30 percent shall be used in computing the torque output by the worm gear reduction units.
  - 2. Gear reduction shall be designed such that valve closure will occur in a period of no less than 5 minutes under the specified handwheel pull (valve closure defined as 100 percent open to completely closed). Provide a weatherproof, metallic sign listing "Minimum Closure Time to be 5 Minutes - Manual Operation Only"
  - 3. All gearing shall be enclosed in dustproof and watertight steel housings. The gearing shall be grease lubricated. Worms shall be heat-treated alloy steel with the threads carburized and ground. All other gears shall be alloy steel. The shaft shall be supported on anti-friction or bronze-bushed bearings. All bolted connections between the valve components and the operating mechanism components shall be doweled.
  - 4. This shall also apply for the universal gearbox required to provide a vertical output shaft.

## VALVES AND APPURTENANCES

5. The operator, designed for submerged service, shall be able to operate the valve under maximum specified differential seating pressure with a pull as previously specified in PART 2.
6. Provide a tee handle operating wrench to fit the operating nut.

### 2.28 TELESCOPING VALVES

- A. Each telescoping valve shall be a complete assembly, consisting of nonrising stem, telescoping slip tube, valve stand with indicator and motor. Valve stands shall be of fabricated steel and shall be furnished with base flange drilled for anchorage bolts. Anchor bolts and hardware shall be of Type 316 stainless steel.
- B. The valve stand shall support the valve lifting stem and a travel indicating device calibrated in 1/2-in increments, geared down so that the full distance travel registers on a 2-fl scale. The valves shall each have a handwheel with handle grip for rapid adjustment.
- C. The sliding valve tube shall be seamless brass or Type 304 stainless steel [5.50-in] outside diameter with a minimum wall thickness of 1/8-in to prevent corrosion and to ensure proper operation at all times and arranged to slide inside of the sludge draw-off pipe shown on the Drawings. The valve tube shall have two V-notched weirs located 180 degrees apart. A companion flange shall be mounted to allow sliding, but prevent sludge escaping through the sliding joint.
- D. The telescopic valve shall be operated by means of a motorized valve actuator. The valve shall be complete with tube guide collar made of steel and Neoprene gasket for sealing. The actuator local control shall be mounted remotely within reach of the operator.
- E. The valve and actuator mounting bracket shall be capable of withstanding, without damage, the stall torque of the actuator with torque and limit switches disconnected. The bearing shall be oil-bath lubricated and provide lost-motion hammerblow for unseating.
- F. The operating speed of the actuator shall be approximately 15 to 20-in per minute and shall be able to provide an unseating torque at least 50 percent in excess of the required valve seating torque at the specified voltage, neglecting harnmerblow effect.
- G. Telescoping valve shall be as manufactured by Envirex; FMC; Jeffery; Waterman] or equal.

### 2.29 PINCH VALVES

- A. Pinch valves shall be furnished, as required, with an open 125 psi ANSI flanged cast iron body.
  1. The closing mechanism shall be designed so that the upper and lower pinch bars move at the same time as the handwheel or motorized



## VALVES AND APPURTENANCES

operator is operated. The sleeve shall be natural rubber and shall close to form a leak-proof seal. The inside diameter of the sleeve shall be equal to the inside diameter of the pipe.

2. Pinch valves shall be Series 75 as manufactured by Red Valve Co; ONYX; or equal.

### 2.30 HOSE HYDRANTS

- A. Hose hydrants for installation on the potable water lines shall consist of a in globe valve with two (2) 3 in hose connections and one 4in "steamer" connection as detailed on the Drawings.

### 2.31 FLUSH-TYPE HYDRANTS

- A. Fire Hydrants shall meet as manufactured by Mueller "Super Centurian".
- B. Proper back flow prevention devices shall be provided in accordance with local regulations.

### 2.32 MUD VALVES

- A. Mud valves shall be flanged, bronze mounted, non-rising stem. Frame, cover, yoke, and stem extension shall be cast iron. The stem shall be stainless steel and lift nuts shall be bronze. Provide stem extension and upper stem support. The stem shall be designed for operation by a standard tin square wrench. The upper stem support shall be supported from the channel walls, not the grating.
- B. Mud valves shall be Clow Fig. F-3075; Mueller; Troy, Waterman; or equal.

### 2.33 FLAP GATES (FLAP VALVES)

- A. Flap gates and accessories shall be of the size, type, material and construction as shown on the Drawings and as specified herein. Flap gates shall be as manufactured by [Hydro Gate; Rodney Hunt; Waterman; Clow (circular smaller units only)] or equal with opening sizes as indicated.
- B. The seat shall be flat back and shall be cast in one piece with a raised section around the perimeter of the waterway opening to provide for mounting the seating faces. The raised section shall provide a seating plane diverging top to bottom, from the plane of the mounting flange to assist in positive closure of the cover. The seat shall be shaped to provide two bosses extended above the top of the waterway opening for mounting the pivot lugs. Pivot lug bosses and the back of the seat shall be drilled and tapped for mounting studs.
- C. Unless otherwise indicated, flap gates shall be provided with mountings to enable bolting directly to a circular pipe flange. Gaskets and mounting bolts shall be provided.

## VALVES AND APPURTENANCES

- D. Where not indicated to be mounted on pipe flanges, wall thimbles shall be supplied, of heavy one piece castings of the "F" type. Length of thimbles shall be as follows

<u>GREATEST GATE DIMENSION</u>	<u>MINIMUM THIMBLE LENGTH</u>
Gates 36-in and smaller	8-in
Gates 42-in through 90-in	12-in
Gates 96-in and larger	15-in

1. The surfaces to be cast into the concrete shall be free of paint, oil and grease at time of installation. Studs and nuts shall be provided for attaching the gate. Mastic shall be provided to form a seal between the front face of the thimble and the back of the gate seat.
  2. The front flange shall be machined to a plane and shall be drilled and tapped to mate to the gate seat.
  3. The vertical centerline shall be clearly shown at the top and bottom by permanent marks on the machined face. The word "top" shall be stamped in the machined face near the top centerline.
- E. Each pivot lug shall be cast in one piece. Lugs shall have double bosses to place the top hinge pins in double shear when they are assembled through the link. The lugs shall be adjustable in the horizontal plane without removal of the cover from the gate links. The adjustment shall allow the top pivot point to be moved toward the gate seat for reduced sensitivity of the cover, or moved away from the gate seat to provide opening with minimum differential head. Two corrosion resistant studs shall be used to connect each pivot lug to the gate seat.
- F. The links connecting the cover and pivot lugs shall be heavy duty and cast in one piece. Each link shall be provided with commercial grade corrosion resistant brushings at each pivot point. The manufacturer shall certify that bushings and links are permanently lubricated. The bottom of the links shall be provided with an adjusting screw to properly align seating faces on the cover with respect to the seat. The links shall be designed to limit the double hinge action, preventing the cover from rotating sufficiently to become wedged in the open position.
- G. The cover shall be cast in one piece with necessary reinforcing ribs, with a lifting eye for manual operation and with bosses to provide a pivot point connection with the links. Bosses shall be designed to place the hinge pins in double shear when the gate is assembled.
- H. A full width dovetail slot shall be machined around the perimeter of the cover and the seat. Corrosion resistant dovetail seating faces shall be mounted in the slot and held securely without use of screws or other fasteners. The seating faces shall be machined to a plane with a minimum 63 micro-inch finish.

## VALVES AND APPURTENANCES

- T. All anchor bolts, assembly bolts, screws, studs and nuts shall be of ample section to safely withstand the forces created by operation of the gate under the heads indicated on the Drawings or 25-ft minimum. Quantity and size of the fasteners shall be as recommended by the manufacturer and acceptable to the Engineer.
- J. Machined surfaces shall be coated with a water-resistant, rust preventive compound (certified for potable water). All cast iron parts shall be shop cleaned and painted in accordance with the manufacturer's standard practice.
- K. Materials shall conform to the following:

Part	Material	ASTM Standard
Wall Thimble	NI-Resist	A436, Type 2
Gate:		
Seat/cover	NI-Resist	A436, Type 2
Face (seat)	Stainless Steel	A276 (AISI 316)
Face (cover)	Stainless Steel	A276 (AISI 316)
Pivot lugs/links	NI-Resist	A436, Type 2
Bushings	Stainless Steel	A276 (AISI 316)
Fasteners	Stainless Steel	A276 (AISI 316)

1. All stainless steel shall be Type 316. NI-Resist refers to austenitic gray iron castings. The manufacturer shall certify that all materials, including coatings, are suitable for constant submersion operation in a potable water and wet chlorine environment.

- L. Where noted, flap gates subjected to mild slamming action shall have a rubber seating face on the seat. Rubber seating faces shall be mounted in a dovetail slot and held securely without use of pins or screws. The seating face on the cover shall be as specified above.

### 2.34 HOSE END VALVES

- A. Hose end valves shall be globe pattern valves, similar to Fairbanks Fig. 074; Jenkins Fig. 112 or equal. Furnish cap and chain.

### 2.35 PRESSURE RELIEF VALVES

- A. Pressure relief valves shall be for positive displacement pumps and shall be iron body, with Type 304 stainless steel trim and spring, with a relieving capacity equal to the pump capacity. Valves shall be threaded on inlet and outlet and shall have an outside test lever. Valve setting shall be adjustable in the range of 50 to 100 psi. See drawings for further details.

### 2.36 GAS VALVES

## VALVES AND APPURTENANCES

- A. Gas valves 2-in and smaller shall be bronze body with threaded ends equal to Hammond BV711-T, Watts B-6800 (YRPV) or Jenkins Bros. 30-A, modified with tee handles.
- B. Gas valves larger than 2-in shall be lubricated plug valves equal to valves manufactured by Powell, Homestead and Rockwell.
- C. Gas valves on high pressure gas shall be lubricated plug valves.
- D. Gas valves shall be listed suitable for natural gas service.

### 2.37 BACKWATER VALVES

- A. Shall be similar to Zum Industries Inc. Z-1090-3 for Type "A" and Z-1091 for Type "B". Valves as manufactured by Josam Mfg. Co. or J.R. Smith will be considered equal.

### 2.38 WATER PRESSURE REGULATORS (PRV)

- A. Shall be Watts IVlueseo Regulator Co. Series 115 for 1-114-in and larger and Model 223-S for units smaller than 1-1/4-in or equal with strainer and of size noted on the Drawing. Shall be diaphragm type, pressure reducing globe valves.
- B. Provide a three valve full size bypass around each PRV.
- C. Provide strainers same material as the PRV ahead of each PRV with pressure gauges on high and low side.
- D. Smaller PRV shall have pressure setting 10 psi less than main valve.
- E. Pressure regulators and components shall be securely anchored to wall or floor at a height as directed by Engineer.
- F. Provide an adjustable pressure relief valve downstream of each PRV station.
- G. Provide concrete vault with access lid for below grade installation. Provide insulated FRP box for above grade installations. Boxes shall be sized to contain the PRV, valves and bypasses.

### 2.39 INSULATING FITTINGS

- A. Fittings shall be of type to provide control of electrolysis and similar to "Dielectric" as manufactured by Watts Regulator Co., or equal.

### 2.40 SURFACE PREPARATION AND SHOP COATINGS

- A. Notwithstanding any of these specified requirements, all coatings and lubricants in contact with potable water shall be certified as acceptable for use with that fluid.

## VALVES AND APPURTENANCES

- B. If not specified herein, coatings shall comply with the requirements of Section 09901. In case of a conflict, the requirements of this Section govern.
- C. If the manufacturer's requirement is not to require finished coating on any interior surfaces, then manufacturer shall so state and no interior finish coating will be required, if acceptable to the Engineer.
- D. The exterior surface of various parts of valves, operators, floor-stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter and thereafter one shop coat of an approved rust-inhibitive primer such as Inertol Primer No. 621 shall be applied in accordance with the instructions of the paint manufacturer or other primer compatible with the finish coat provided.
- E. Unless otherwise noted, interior ferrous surfaces of all valves shall be given a shop finish of an asphalt varnish conforming to AWWA C509, (except mounting faces/surfaces) or epoxy AWWA C550 with a minimum thickness of 4 mil.
- F. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating. Mounting surfaces shall be especially coated with a rust preventative.
- G. Special care shall be taken to protect uncoated items and plastic items, especially from environmental damage.

### 2.41 FACTORY INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

- A. Factory inspection, testing and correction of deficiencies shall be done in accordance with the referenced standards and as noted herein.
- B. See Division I for additional requirements. Also refer to PART 1, especially for required submission of test data to the Engineer.
- C. In addition to all tests required by the referenced standards, the following shall also be factory tested:
  - 1. Pressure regulating valves shall be factory tested at the specified pressures and flows.
  - 2. The non-cavitating butterfly valves, to demonstrate its non-cavitating capabilities.
  - 3. All types of air and vacuum valves.

**PART 3 EXECUTION**

**3.01 INSTALLATION - GENERAL**

- A. All valves and appurtenances shall be installed per the manufacturer's instructions in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.
- B. Install all brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings or otherwise required. Before setting these items, check all Drawings and figures which have a direct bearing on their location. The Contractor shall be responsible for the proper location of valves and appurtenances.
- C. All materials shall be carefully inspected for defects in construction and materials. All debris and foreign material shall be cleaned out of openings, etc. All valve flange covers shall remain in place until connected piping is in place. All operating mechanisms shall be operated to check their proper functioning and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.
- D. Where installation is covered by a referenced standard, installation shall be in accordance with that standard, except as herein modified, and the Contractor shall certify such. Also note additional requirements in other parts of this Section.
- E. Unless otherwise noted, joints for valves and appurtenances shall be made up utilizing the same procedures as specified under the applicable type connecting pipe joint and all valves and other items shall be installed in the proper position as recommended by the manufacturer. Contractor shall be responsible for verifying manufacturers' torquing requirements for all valves.
- F. Valves smaller than 24" shall be direct-buried with a valve box. Valves, 24" and larger, shall be buried in a vault under a minimum of 3' of cover.
- G. Each valve operator shall be tagged with a brass or stainless steel tag bearing the tag number corresponding to the tag number assigned to the valve in the Drawings. The number shall be stamped, engraved, or otherwise affixed to the tag in a manner that will not fade with time or weather.

**3.02 INSTALLATION OF MANUAL OPERATIONAL DEVICES**

- A. Unless otherwise noted, all operational devices shall be installed with the units at the factory, as shown on the Drawings or as acceptable to the Engineer to allow accessibility to operate and maintain the item and to prevent interference with other piping, valves and appurtenances.

## VALVES AND APPURTENANCES

- B. For manually operated valves 3-in in diameter and smaller, valve operators and indicators shall be rotated to display toward normal operation locations.
- C. Floor boxes, valve boxes, extension stems and low floor stands shall be installed vertically centered over the operating nut, with couplings as required and the elevation of the box top shall be adjusted to conform with the elevation of the finished floor surface or grade at the completion of the Contract. Boxes and stem guides shall be adequately supported during concrete pouring to maintain vertical alignment.

## INSPECTION, TESTING AND CORRECTION OF DEFICIENCIES

- A. See also Division I. Take care not to over pressure valves or appurtenances during pipe testing. If any unit proves to be defective, it shall be replaced or repaired to the satisfaction of the Engineer.
- B. No testing shall be performed until the manufacturer has provided written certification to the Engineer that the following installed equipment has been examined and found to be in complete accordance with the manufacturer's requirements:
- C. Functional Test: Prior to plant startup, all items shall be inspected for proper alignment, quiet operation, proper connection and satisfactory performance. All units shall be operated continuously while connected to the attached piping for at least four (4) hours, without vibration, jamming, leakage, or overheating and perform the specified function.
- D. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer.
- E. Various regulating valves, strainers, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the Engineer.

## CLEANING

- A. All items specified on the drawings or carrying potable water (including valve interiors) shall be cleaned prior to installation, testing, disinfection, and final acceptance.

## DISINFECTION

- A. Disinfection of valves and appurtenances on all potable water lines and where otherwise noted, shall be as noted in Paragraph 1.02B above.

## END OF SECTION

**SECTION 15110**  
**PIPING AND ACCESSORIES**

**PART 1      GENERAL**

**1.01    WORK INCLUDED**

- A.    This Section covers the Work necessary to furnish, install, and complete, the plant piping specified herein.

**1.02    GENERAL**

- A.    Like items of material provided hereunder shall be the end products of one (1) manufacturer.
- B.    To assure uniformity and compatibility of piping components in grooved end piping systems, fittings and coupling shall be furnished by the same manufacturer.
- C.    See CONDITIONS OF THE CONTRACT and Section GENERAL REQUIREMENTS, which contain information and requirements that apply to the work specified herein and are mandatory for this Project.

**1.03    SUBMITTALS**

- A.    In addition to the requirements of Division 1, GENERAL REQUIREMENTS, the following information shall be provided:
  - 1.    Shop Drawings:
    - a.    For piping systems greater than three (3) inches in diameter, provide double-line Drawings of each piping system to the scale stated on the Contract Drawings, locating each support, identifying the type by catalog number or shop Drawing detail number, and showing anchor locations and identifying them by shop Drawing detail number.
    - b.    Detailed information for piping thrust protection systems used at all specified locations, which enable the Engineer to determine the adequacy and acceptability of the system being submitted for review.
  - 2.    Manufacturer's written certification that the factory-applied coating system(s) is identical to the requirements specified herein. Where, in the manufacturer's opinion, the coating system(s) exceeds the requirements specified herein, submit complete technical literature of the proposed system(s) to the Engineer for review.



**PART 2      PRODUCTS**

**2.01    GENERAL**

- A.    The general materials to be used for the piping systems are shown on the Drawings and listed by service in the Piping Schedule at the end of this section. Specific material requirements are contained herein.

**2.02    PIPE IDENTIFICATION PAINTING**

- A.    All non-submerged or non-buried piping shall be painted, color coded, and labeled as specified in Section PAINTING. Color coding shall be as specified in the Piping Schedule. Submerged piping shall be coated for corrosion protections as specified in Section PAINTING. Buried piping shall receive manufacturer's standard protective coating. Pipes to receive field coatings shall be either non-primed or shop primed according to the required paint system.

**2.03    PIPE JOINTS**

- A.    Pipe joints for exposed piping shall be flanged (or welded as applicable) end for pipe larger than two (2)-inches in diameter and welded (solvent or solder, as applicable) or screwed for smaller piping, except as modified herein.
- B.    Pipe joints for buried piping (excluding subaqueous portion) shall be mechanical joint or push-on joint for ductile iron pipe and PVC pipe. Pipe joints for pressure services shall be provided with thrust restraint designed for the test pressures specified in the Piping Schedule. Ductile iron pipe shall be restrained using proprietary restrained joint pipe and fittings. Pressure service PVC pipe shall have solvent welded joints.
- C.    Pipe joints for ductile iron subaqueous service shall be flanged or restrained joint and restrained flexible joint as shown on the Drawings.
- D.    Pipe joints for steel piping shall be threaded for pipe sizes two (2)-inches and smaller and flanged or welded for pipe larger than two (2)-inches.
- E.    Grooved end pipe joints shall be used where required to join to the Owner-furnished package filters. At the Contractor's option, grooved end pipe joints may be used on exposed piping fourteen (14)-inches and smaller. All grooved end joints shall be rigid type, victaulic or equal.

**2.04    DUCTILE IRON PIPE**

- A.    Centrifugally cast, Grade 60-42-10 iron, ANSI A21.51, AWWA C151, cement-mortar lined, Class fifty (50), one hundred-fifty (150) psi minimum working pressure. Buried pipe shall be seal coated in accordance with ANSI 21.4. Non-buried pipe to receive paint for color coding shall be bare or primed for

compatibility with the final coating system. Pipe joints shall be as shown on the Drawings.

B. Fittings:

1. Gray or ductile iron, two hundred-fifty (250) psi minimum working pressure, cement-lined and seal-coated (buried applications only). Where taps are shown on fittings, tapping bosses shall be provided. ANSI B16.1 fittings shall be used only for nonstandard fittings not manufactured under ANSI/AWWA C110.
2. Flanged: ANSI/AWWA C110 and ANSI B16.1, faced and drilled one hundred twenty-five (125) pound ANSI standard.
3. Restrained: ANSI/AWWA C110 and ANSI/AWWA C111, American Cast Iron Pipe Company "Lok-Ring" or U.S. Pipe and Foundry TR Flex, or equal.
4. Mechanical Joints: ANSI/AWWA C110, ANSI/AWWA C111, and ANSI/AWWA C153.
5. Push-on: ANSI/AWWA C110 and ANSI/AWWA C111, American Cast Iron Pipe Company "Fastite" or U.S. Pipe and Foundry "Tyton" or equal.

C. Flanges:

1. Ductile iron, ANSI A21.15/AWWA C115, threaded, two hundred-fifty (250) psi working pressure, ANSI one hundred twenty-five (125) pound drilling.
2. Flange adapters shall be Series 1000 E-Z Flange as manufactured by EBAA Iron, or equal.

D. Bolts

1. For Class 250 FF Flanges: Carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.
2. For Mechanical Joint: Manufacturer's standard.
3. Gaskets for mechanical or push-on joints shall be rubber, conforming to ANSI A21.11, AWWA C111.
4. Gaskets for flanged joints shall be 1/8-inch thick, red rubber conforming to applicable parts of ANSI B16.21 and AWWA C115, unless otherwise specified. Gasket material shall be free from corrosive alkali or acid ingredients and suitable for use in potable waterlines. Gaskets shall be full-face type and shall be suitable.

## PIPING AND ACCESSORIES

- E. Lubricant for mechanical joint end piping shall be manufacturer's standard.

### 2.05 STAINLESS STEEL PIPE AND FITTINGS

- A. Pipe shall be 304L stainless steel, seamless or electric resistance welded. SST pipe shall meet all requirements of AWWA C220-12. Pipe wall thickness for two (2)-inch and smaller shall be Schedule 80, pipe wall thickness for 2½-inch and larger shall be Schedule 40.
- B. Joints for two (2)-inch and smaller shall be threaded, all joints 2½-inch and larger shall be welded or flanged where required for connections to equipment.
- C. Fittings for pipe two (2)-inch and smaller shall be threaded, one hundred-fifty (150) pound, dimensions conforming to ANSI B16.3. Fittings for pipe larger than two (2) inch shall be butt-welded, stainless steel, meeting the requirements of ANSI B16.9, to match pipe wall thickness. Unions shall be three-hundred (300) pound stainless steel, dimensions conforming to ANSI B16.3, brass to iron seat.
- D. Branch connections for pipe two (2)-inch and smaller shall be screwed tees, as specified above for fittings. Larger than two (2)-inches shall be standard weight forged steel, ASTM A105, Grade II, commercial welding branch fittings with butt-welded outlet. Straight or reducing tees shall be as specified above for fittings.
- E. Flanges shall be ASTM A182, Class 60 slip-on or welding neck type, face and drilled one hundred-fifty (150) pound, 1/16-inch raised face, ANSI B16.5 Standard, or AWWA C220, Class D hub, faced and drilled one hundred twenty-five (125) pound flat-face, ANSI B16.1 Standard. Provide welding neck flanges when abutting butt weld fittings. Welding neck bore shall match pipe ID. Machine off the raised face of steel flange when mating with a cast iron flat face flange. Flanges and gaskets for air blower piping shall be appropriate for temperatures to 300 F.
- F. Bolting shall be 316L stainless steel.
- G. Gaskets shall be 1/16-inch thick compressed nonasbestos composition flat ring type.
- H. Thread lubricant shall be teflon tape or joint compound that is insoluble in water.
- I. Gaskets for process air (blower) pipe shall be Viton temperature resistant gaskets, capable of operating to 210 C.

### 2.06 POLYVINYL CHLORIDE (PVC) PIPE (PRESSURE SERVICE)

- A. PVC pipe for pressure service shall be Schedule 80, Type I, Grade 1, or Class 1254-B, conforming to ASTM D1784 and ASTM D1785.

## PIPING AND ACCESSORIES

- B. Joints shall be socket-welded or threaded, except where connecting unions, valves, and equipment with flanged connections that may require future disassembly. Flanges shall be one (1) piece, molded hub type flat faced, one hundred twenty-five (125) pound Standard. Gaskets shall be full-face, 1/8 inch thick fabricated from ethylene propylene rubber (EPR).
- C. Fittings shall be Schedule 80 as specified above, conforming to the requirements of ASTM D2467 for socket type.
- D. All socket connections shall be joined with PVC solvent cement conforming to ASTM 2564. Manufacture and viscosity shall be as recommended by the pipe and fitting manufacturer to assure compatibility.

### 2.07 POLYVINYL CHLORIDE (PVC) PIPE (GRAVITY SERVICE)

- A. PVC pipe for gravity service shall comply with ASTM D3034-81 for PVC materials and ASTM F679, minimum pipe stiffness one hundred-fifteen (115) psi at five (5%) percent deflection, and shall meet the extra strength minimum of Standard Diameter Ratio twenty-six (26). PVC pipe shall be supplied in lengths not less than twenty (20)-feet.
- B. Joints shall be push-on type spigot and bell with integral bell homogeneous with the pipe. Gaskets shall be rubber meeting the requirements of ASTM F477 and D3212 and shall be locked in to the bell groove.
- C. Fittings shall be gray or ductile iron, cement-lined and seal-coated, ANSI/AWWA C110, or C153, mechanical joint unless shown otherwise.

### 2.08 COPPER PIPE

- A. Pipe shall be seamless copper, ASTM B88, Type L hard drawn. Tubing for lines smaller than 1/2-inch shall be Type K soft copper, ASTM B88, with commercially pure wrought copper solder joint fittings.
- B. Fittings shall be commercially pure wrought copper, socket, joint, ASTM B75, dimensions conforming to ANSI B16.22.
- C. Solder shall be 95-5 wire solder, ASTM B32, Grade TA. Do not use cored solder.

### 2.10 FLEXIBLE CONNECTIONS TO EQUIPMENT

- A. Pump seal water lines and drains, hydraulic lines to valves and their drains, and air line connections to equipment must have the flexibility to isolate equipment vibration.

### 2.11 PIPING SUPPORT SYSTEMS

- A. General:

## PIPING AND ACCESSORIES

1. Piping shall be supported, in general, as described hereinafter and as shown by the pipe support details on the Drawings. Manufacturers' catalog figure numbers are typical of the types and quality of standard pipe supports to be employed.
2. No attempt has been made to show all required pipe supports in all locations, either on the Drawings or in the details. The absence of pipe supports and details on any Drawings shall not relieve the Contractor of the responsibility for providing them throughout the facility.
3. All piping supports, guides, and fasteners shall be type 316 stainless steel.
4. All support anchoring devices, including anchor bolts, inserts and other devices used to anchor the support onto a concrete base, roof, wall or structural steel works, shall be of the proper size, strength and spacing to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
5. Where piping connects to equipment it shall be supported by a pipe support and not by the equipment. All piping shall be supported in a manner which will prevent undue strain on any valve, fitting, or piece of equipment. In addition, pipe supports shall be provided at changes in direction or elevation, adjacent to flexible couplings, and where otherwise shown.
6. Pipe support system components shall withstand the dead loads imposed by the weight of the pipes filled with water, plus any insulation. Commercial pipe supports and hangers shall have a minimum safety factor of five (5).

### 2.12 INSULATION AND HEAT TRACING

- A. Insulation on all exterior, exposed piping shall be foamed glass with a maximum K-factor of 0.4 Btu-in/hr.-sq. ft. -F at thirty (30) degrees F, a permeability rating of 0.00 perm-inch, and a maximum absorption of 0.2 percent by volume. Insulation shall be Foamglas, as manufactured by Pittsburg Corning or equal. Insulation thickness shall be two (2)-inches for pipes three (3)-inches and smaller and 1½-inches for pipes four (4)-inches to eight (8)-inches. Pipes greater than eight (8)-inches will not require insulation.
- B. Insulation on aboveground piping shall be covered with minimum 0.016-inch thick aluminum jacket. The jacket shall be held in place by a continuous friction type joint, providing a positive weatherproof seal over entire length of jacket. The circumferential joints shall be secured with preformed snap straps containing weatherproof sealant. Cover outdoor fittings with matching preformed aluminum jackets, two (2) piece elbows and flange covers, secured with stainless steel bands. Fitting covers shall be as manufactured by Childers, Papco, or equal.

## PIPING AND ACCESSORIES

- C. Heat Tracing: Furnish self-limiting one hundred-twenty (120) volt electrical heating strip for exterior exposed pipes two (2)-inches and smaller. System shall be thermostatically controlled and guaranteed by the manufacturer for a period of two (2) years. System shall be listed by Underwriter Laboratories as a self-limiting pipe tracing material for freeze protection application in ordinary locations. Heat tracing shall be manufactured by Smith-Gates Corporation, Chemlex Corporation, or equal.

### 2.13 CASING PIPE

- A. Casing pipe shall be steel, ASTM A252 Grade 2 with welded field joints. Casing wall thickness shall be min. 0.250 inches for all sizes thirty-six (36) inches and smaller and shall conform to State of Alabama Highway Department Section 862 for larger diameters. Casing pipe shall be shop coated with bituminous paint on the exterior.
- B. Carrier pipe shall be supported inside the casing with casing pipe spacers. Spacers shall be stainless steel min. 14 gauge T304 Model CCS-ER as manufactured by Cascade Waterworks Manufacturing Company, Yorkville, IL or approved equal.
- C. The approximate locations and lengths of encasements are shown on the Drawings for bidding information, but the exact location and length of encasement will be determined by the appropriate highway department.

## PART 3 EXECUTION

### 3.01 WELDING STEEL PIPE

- A. General: In accordance with the latest edition of Section IX, ASME Boiler and Pressure Vessel Code.
- B. Welding Procedure Specifications:
  - 1. Qualify all welding procedure specifications prior to fabrication in accordance with the ASME Boiler and Pressure Vessel Code, Section IX.
  - 2. Identify all welding procedure Specifications by number and reference the procedure number on all fabrication Drawings.
- C. Welding and Welding Operators:
  - 1. Qualify all welders and welding operators prior to fabrication in accordance with ASME Boiler and Pressure Vessel Code, Section IX.
  - 2. Include qualifications for all welding positions to be employed in the fabrication.
- D. Materials:

## PIPING AND ACCESSORIES

1. Use welding products within the limits recommended by their manufacturers.
2. Keep electrodes, filler wires, and fluxes clean, dry, and properly stored according to manufacturer's recommendations. Do not use electrodes, filler wires, or fluxes that are damp, greasy, or oxidized.
3. Do not use backing rings.
4. Consumable inserts may be used if included in the qualified welding procedure specification. Match the chemistry of the consumable insert with the base metal and weld metal chemistry.

3.02 FABRICATION OF STEEL PIPE

A. End Preparation:

1. Machine shaping of pipe ends is the preferred method.
2. Oxygen or arc cutting is acceptable only if the cut is smooth and true and all slag is removed either by chipping or grinding.
3. Beveled Ends for Butt Welding: Meet the requirements of ANSI B16.25.

B. Cleaning: After completion of shop or field fabrication and after erection, clean all piping inside and outside to remove all loose scale, weld spatter, dirt, loose debris, and foreign material.

C. Alignment and Spacing:

1. Align ends to be joined within existing commercial tolerances on diameters, wall thickness, and out-of-roundness.
2. Root Opening of the Joint: As stated in the welding procedure Specification.

3.03 CORROSION PROTECTION

A. Install coating as specified in Section PAINTING.

3.04 EXAMINATION, INSPECTION, AND TESTING OF STEEL WELDING

A. Required Examinations:

1. Perform examination in accordance with the ANSI Code for Pressure Piping B31.3 (Piping Code).
2. Perform examination for every pipe thickness and for each welding procedure, progressively, for all piping covered by this Section.

3.05 PIPE PREPARATION AND HANDLING - GENERAL

A. Each pipe and fitting shall be carefully inspected before the exposed pipe or fitting is installed. The interior and exterior protective coating shall be inspected, and all damaged areas patched in the field with material similar to the original. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.



## PIPING AND ACCESSORIES

- B. Use proper implements, tools, and facilities for the safe and proper protection of the pipe. Carefully handle pipe in such a manner as to avoid any physical damage to the pipe. Do not drop or dump pipe.
- C. Care shall be taken not to damage linings when handling pipe.

### 3.06 CUTTING PIPE

- A. Cut pipe with milling type cutter, rolling pipe cutter, or abrasive saw cutter. Do not flame cut.
- B. Dress cut ends of pipe in accordance with the type of joint to be made. Dress cut ends of mechanical joint pipe to remove sharp edges or Projections which may damage the rubber gasket. Dress cut ends of push-on joint pipe by beveling, as recommended by the pipe manufacturer. Dress cut ends of pipe for flanged coupling adapters as recommended by the manufacturer.

### 3.07 FABRICATION OF FLANGED PIPE - GENERAL

- A. Flanged ductile iron pipe and steel pipe shall be fabricated in the shop, not in the field, and delivered to the job site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by the manufacturer. Flanges for ductile iron shall be faced after fabrication in accordance with ANSI A21.15/AWWA C115.

### 3.08 JOINTING PIPE - GENERAL

- A. Flanged: Prior to connecting flanged pipe, the faces of the flanges shall be thoroughly cleaned of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to assure proper seating of the flange gasket. Bolts shall be tightened so the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak, the gaskets shall be removed and reset and bolts re-tightened.
- B. Mechanical and Push-on Joint: Join pipe with mechanical or push-on type joints in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstances. Thrust restraint of pressure and gravity piping shall be as specified herein and as shown in the Drawings.

### 3.09 INSTALLATION OF BURIED PIPING - GENERAL

- A. Trench excavation and backfill requirements are specified in Section EARTHWORK.

## PIPING AND ACCESSORIES

- B. All buried pipe shall be prepared as hereinbefore specified and shall be laid on the prepared sub-grade and bedded to ensure uniform bearing. No pipe shall be laid in water or when, in the opinion of the Engineer, trench conditions are unsuitable. Take all precautions necessary to prevent uplift and floating of the pipe prior to backfilling.
- C. When the pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed, and no trench water, animals, or foreign material shall be permitted to enter the pipe.

### 3.10 INSTALLATION OF EXPOSED PIPING - GENERAL

- A. Unless shown otherwise, piping shall be parallel to building lines. Hangers on adjacent piping shall be aligned where possible on common size ranges.
- B. All pipe flanges shall be set level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.
- C. Unions shall be installed where required for piping or equipment installation, even though they are not shown on the Drawings.
- D. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connected equipment.
- E. Valve handwheels shall be oriented to permit easy access to the handwheels, and to avoid interference.
- F. Tubing shall be installed straight with smooth bends. Tubing lengths shall be minimized by using hard piping up to the equipment items before transitioning to tubing.

### 3.11 INSTALLATION OF FLEXIBLE COUPLINGS AND FLANGED ADAPTERS

- A. Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Care shall be taken that the gaskets are wiped clean before they are installed. If necessary, gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Workmen tightening bolts shall use torque limiting wrenches.

### 3.12 INSULATION

- A. All piping shall be insulated in accordance with manufacturer's instructions including types of insulating cements, lagging adhesives, and weather-proof mastics.

## PIPING AND ACCESSORIES

- B. All insulation shall be applied over clean, dry surfaces with all joints butted firmly together, but not until piping system has been pressure tested and any leaks corrected. Insulation shall not extend beyond flanges nor cover nameplates or code inspection stamps. Insulation shall run continuous through wall openings, ceiling openings, and pipe sleeves, unless otherwise noted.
- C. Insulate all valve bodies, flanges, and pipe couplings. Provide removable insulation sections on all devices that require access for maintenance of equipment or removal.
- D. Finished appearance of all insulation shall be smooth and continuous. Provide coating of insulated cement where needed to obtain this result. Joints shall be lapped and the integrity of vapor seals maintained in strict accordance with manufacturer's instructions. Staples and screws shall not be used to secure components of systems that are vapor sealed.

### 3.13 INTERIM CLEANING

- A. Care shall be exercised during fabrication to prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, etc. within piping sections. All piping shall be examined to assure removal of these and other foreign objects prior to assembly. Shop cleaning may employ any conventional commercial cleaning method if it does not corrode, deform, swell, or otherwise alter the physical properties of the material being cleaned.

### 3.14 FINAL CLEANING

- A. Following assembly and testing and prior to final acceptance, all pipelines installed under this section shall be flushed with water and all accumulated construction debris and other foreign matter removed. Flushing velocities shall be a minimum of 2.5-feet per second. Protect connected equipment by using strainers or disconnecting the equipment. Accumulated debris shall be removed through drains two (2)-inches and larger by dropping spools and valves.

### 3.15 HYDROSTATIC TESTING

- A. General: Make pressure and leakage tests on all newly laid pipe. The Contractor shall provide all necessary equipment and material, make all taps in the pipe as required, and conduct the tests. The Engineer will monitor and witness the tests before the installed pipe is approved. Pressure tests must be completed before payment is made for that section of pipe.
- B. Test Pressure: Each section of pipe shall be slowly filled with water to the test pressure shown in the piping schedule or to the pressure class rating of the pipe. Pressure shall be applied by a motor-driven pump. The test duration shall be six (6) hours for covered pipe and three (3) hours for uncovered pipe. The Contractor shall provide a pressure chart recorder for the duration of each test.

## PIPING AND ACCESSORIES

- C. Procedure: Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, taps shall be made at points of highest elevation and plugged afterward. At the end of the test period, the Contractor will inject a sufficient quantity of water into the pipe section to re-establish the specified pressure. The Contractor shall provide suitable means to determine the quantity of water lost by leakage during the test. The Engineer must witness the quantity of water leakage and pressure recording and sign both before approving the test.
- D. Allowable Leakage: Exposed piping shall not have any visible leakage. For buried pipelines less than 500 LF the allowable leakage shall be zero (0) gallons. For lengths more than more than 500 LF the allowable leakage shall be less than the amount determined by the following formula:

$$L = \frac{(10) D L_e}{126720}$$

Where L = Allowable leakage, gallons per hour

D = Nominal diameter of pipe, inches

L<sub>e</sub> = Length of pipe, feet

- E. Allowable Loss of Pressure: The maximum allowable drip in pressure from the test pressure shall be no greater than five (5) percent of the test pressure.
- F. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

### 3.16 PNEUMATIC TESTING (PRESSURE SERVICES)

- A. All gas-carrying piping shall be tested using pneumatic leak tests. Pneumatic testing shall be performed using accurately calibrated instruments and oil-free, dry air. Tests shall be performed only after piping has been completely installed, including all supports, hangers and anchors, and trench backfill. All parts of the piping system shall be subjected to the test pressure specified in the piping schedule.
- B. Pneumatic tests shall begin by placing approximately twenty-five (25) psi to the piping system and inspecting for leaks using soap bubbles. After major leaks have been repaired, pressure shall be increased to approximately half of the test pressure, then increased in small increments until the required test pressure is reached. The pneumatic test pressure shall be continuously maintained for a minimum time of ten (10) minutes and for such additional time as may be necessary to conduct a soap bubble examination for leakage. The piping system shall show no evidence of leakage.

3.17 LOW PRESSURE AIR TEST (GRAVITY SERVICES)

- A. General: make pressure and leakage tests on all newly laid pipe after cleaning. The Contractor shall provide all necessary equipment and material, and conduct the tests. The Engineer will monitor and witness the tests before the installed pipe is approved. Pressure tests must be completed before payment is made for that section of pipe.
- B. Air Test: Standard five (5) psig air test in accordance with UNI-B-6-90.
- C. Correction of Excessive Leakage: Should any test of pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until the leakage of a subsequent test is within the specified allowance.

3.18 DISINFECTION

- A. General: After pipelines, valves, fittings, and appurtenances have been installed and tested, they shall be disinfected in accordance with AWWA C651 or as modified by any governing agency having jurisdiction. The Contractor shall provide all equipment and materials necessary to adequately disinfect all facilities.
- B. Flushing: Before sterilizing, flush all foreign matter from the line. Flushing velocities shall be at least 2.5 feet per second. For large diameter pipelines where it is impractical to flush the pipe at this velocity, clean the pipeline in place from the inside by brushing, sweeping and swabbing, then flush the line at a lower velocity.
- C. Disinfection: Disinfect with a chlorine solution having a free chlorine residual of fifty (50) ppm. The solution shall be injected into the pipe through a corporation stop or suitable tap in the top of the pipeline. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the existing water mains or so that contaminated water does not enter any disinfected mains.
- D. Retention Period: The chlorine solution shall remain in the pipeline for twenty-four (24) hours or long enough to destroy all nonspore-forming bacteria, whichever is greater. Operate all valves, hydrants, and other appurtenances during disinfection to assure that the chlorine solution is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the solution. After the retention period is complete, flush the chlorinated solution from the line until a chlorine residual of 0.2 ppm has been achieved.
- E. Bacteriological Samples: After flushing, collect a minimum of two (2) water samples for bacteriological analysis at a rate of at least one (1) per mile of water main disinfected and submit to a laboratory certified by ADEM. Where new connections to existing piping are made, at least one (1) sample per affected area

## PIPING AND ACCESSORIES

of the system shall be collected and analyzed. All samples shall indicate absence of Total and Fecal Coliform. Contractor shall repeat disinfection procedure until satisfactory results have been obtained. The bacteriological results shall be sent directly to the Engineer.

### 3.19 PAINTING

- A. All exposed, non-insulating piping, valves, and accessories shall be painted as specified in Section PAINTING and as directed by the Engineer. Colors shall be selected by the Owner according to submitted color charts.

**END OF SECTION**

**(Pipe Schedule Follows)**

## PIPING AND ACCESSORIES

### PIPING SCHEDULE

Service	Legend	Test Pressure and Type (psig-x)	Operating Pressure (psig)	Size (In.)	Material	Paint Color	Label	Remarks
Air Compressed	A	150-P	150	1	Stainless Steel	None	Yes	
				<1			No	
Process Air	PA	20-P	12	4-12	Stainless Steel	None	Yes	
Plant Influent	PI	150-H	40	4-16	DIP	Light Brown	Yes	Pressure
Plant Influent	PI	150-H	40	4-16	Stainless Steel	None	Yes	Pressure
Chlorine Solution	CS	100-H	80	1	Sch80 PVC	None	Yes	Pressure Service
Drain	DR	5-P	-----	1-3	Sch80 PVC	None	Yes	Pressure Service
Clarified Effluent	CI	5-P	10	12-16	DIP	Light Green	Yes	Gravity Service
Filtered Effluent	FE	100-H	5	14-16	DIP	Lt Purple	Yes	Gravity Service
Plant Water	PW	150 H	80	>3	DIP	Lt Purple	Yes	Above Grade
Potable Water	WM	120 H	60	>2"	CI 200 PVC	None	No	Buried
Potable Water	WM	100-H	60	¾-2	Sch80 PVC	Label Only	Yes	Pressure Service
Sample	SA	100-H	60	≤ 1	PVC	None	Yes	Pressure Service
Sludge	SL	5-P	-----	4-8	DIP	Dark Brown	Yes	Gravity Service
Sludge	SL	100-H	-----	4-8	DIP	Dark Brown	Yes	Pressure Service

#### General Piping Notes:

1. Buried DIP shall be interior cement lined and exterior asphaltic coated.
2. Exposed SST and PVC pipe shall not be coated (provide labels only).
3. Exposed plant water and potable water pipe less than 6" shall be insulated and heat traced.
4. Non-buried DIP shall be coated according to Section 09900 Painting. Including exposed pipe in valve/meter pits and chemical dosing manholes.

**END OF SECTION**

## **SECTION 15111 PIPE HEAT TRACING**

### **PART 1            GENERAL**

#### **1.01    REFERENCES**

- A.     The following is a list of standards which may be referenced in this section:
  - 1.     Factory Mutual.
  - 2.     Institute of Electrical and Electronics engineers, Inc. (IEEE): 515, Testing, Design, Installation and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications.
  - 3.     National Electrical Manufacturers' Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
  - 4.     Underwriters Laboratories, Inc. (UL).

#### **1.02    SUBMITTALS**

- A.     Action Submittals:
  - 1.     Manufacturer's descriptive literature.
  - 2.     Plastic Pipe Installations: Output adjustment factors for heating tape for the services indicated.
  - 3.     Pipe heat loss calculations for each pipe size to be heat traced.

#### **1.03    QUALITY ASSURANCE**

- A.     Authority Having Jurisdiction (AHJ):
  - 1.     Provide the Work in accordance with NFPA 70. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
  - 2.     Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark.

### **PART 2           PRODUCTS**

#### **2.01    SYSTEM DESIGN REQUIREMENTS**

- A.     Design Heating Load:
  - 1.     Heating load to be calculated based upon a 40 degree F delta, 20 mph wind if pipes are located outdoors, insulation as specified in Section 40 42 13, Process Piping Insulation 15112, pipe as specified in Section 15110, Process Piping-General, and shall include a 10 percent safety factor.
  - 2.     Heat loss calculations shall be based on IEEE 515, Equation 1, Page 19.



**SECTION 15112**  
**PROCESS PIPING INSULATION**

**PART 1      GENERAL**

**1.01    REFERENCES**

- A.    The following is a list of standards which may be referenced in this section:
1.    American Society of Heating, Refrigerating and Air Conditioning Engineers Inc. (ASHRAE): 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.
  2.    ASTM International (ASTM):
    - a.    B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
    - b.    C165, Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
    - c.    C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
    - d.    C178, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
    - e.    C534/C534M, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
    - f.    C547, Standard Specification for Mineral Fiber Pipe Insulation.
    - g.    C552, Standard Specification for Cellular Glass Thermal Insulation.
    - h.    C585, Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.
    - i.    C136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
    - j.    C729, Standard Specification for Aluminum Jacketing for Insulation.
    - k.    E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
    - l.    E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
  3.    International Code Council (ICC): International Energy Conservation Code (IECC).
  4.    Underwriters Laboratories Inc. (UL).

**1.02 SUBMITTALS**

- A. Action Submittals: Manufacturer's descriptive literature.
- B. Informational Submittals: Maintenance information.

**PART 2 PRODUCTS**

**2.01 PIPE AND FITTING INSULATION**

- A. Type 1- Elastomeric:
  - 1. Material: Flexible elastomeric pipe insulation, closed-cell structure in accordance with ASTM C534/C534M.
  - 2. Temperature Rating: Minus 297 degrees F to 220 degrees F.
  - 3. Nominal Density: 3 pcf to 6 pcf.
  - 4. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.25 Btu-in. /hr-square foot degrees F at 75 degrees F per ASTM CI 77 or ASTM C518.
  - 5. Maximum water vapor transmission of 0.06 perm-inch per ASTM E96/E96M, Procedure A.
  - 6. Joints: Manufacturer's adhesive.
  - 7. Flame Spread Rating: Less than 25 per ASTM E84.
  - 8. Smoke Developed Index: Less than 50 per ASTM E84.
  - 9. Manufacturers and Products:
    - a. Nomaco; K-Flex.
    - b. Armacell; AP Armaflex.
- B. Type 2- Fiberglass:
  - 1. Material: UL rated, preformed, sectional bonded fiberglass per ASTM C585 with factory applied, Kraft paper with aluminum foil vapor barrier jacket with pressure-sensitive, self-sealing lap.
  - 2. Insulation Temperature Rating: Zero to 850 degrees F.
  - 3. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.23 Btu-in./hr-square foot degrees F at 75 degrees F.
  - 4. Jacketing per ASTM CI 136 with minimum water vapor transmission for jacket of 0.02 perm-inch per ASTM E96/E96M. Furnish with no jacket if field finish system specified.
  - 5. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.
  - 6. Flame Spread Rating: Less than 25 per ASTM E84.
  - 7. Smoke Developed Index: Less than 50 per ASTM E84.

8. Manufacturers and Products:
  - a. Owens Coming Fiberglass; ASJ/SSL-11.
  - b. John Manville; Micro-Lok with Jacket.
- C. Type 3-Foamglass:
  1. Material: Cellular glass per ASTM C552.
  2. Nominal Density: 7.5 pcf.
  3. Compressive Strength: 90 psi per ASTM C165.
  4. Temperature Rating: Minus 450 degrees F to 900 degrees F.
  5. Conductivity in accordance with ASHRAE 90.1 and maximum numerical value of 0.29 Btu-in./hr-square foot degrees F.
  6. Minimum water vapor transmission for insulation of 0.00 perm-inch per ASTM E96/E96M.
  7. Joints: Matching pressure-sensitive butt strips for sealing circumferential joints.
  8. Flame Spread Rating: 0 per ASTM E84.
  9. Smoke Developed Index: 0 per ASTM E84.
  10. Follow manufacturer's recommendation, based upon temperature of piping to be insulated.
  11. Manufacturer and Product: Pittsburgh Coming; Foamglas One.
- 2.02 INSULATION AT PIPE HANGERS AND SUPPORTS
  - A. Copper, Ductile Iron, and Nonmetallic Pipe: High-density insert, thickness equal to adjoining insulation of Type 3 or other rigid insulation or manufactured pre-insulated pipe hanger and insulation shield. Extend insert beyond shield.
- 2.03 INSULATION FINISH SYSTEMS
  - A. Type F3-Aluminum:
    1. Aluminum Roll Jacketing: For straight nonmetallic piping, wrought aluminum Alloy 3003, 5005, 1100, or 3105 to ASTM B209 with H-14 temper, in accordance with ASTM C1729, minimum 0.016-inch thickness, with smooth mill finish.
    2. Vapor Barrier: Provide factory applied vapor barrier, heat and pressure bonded to inner surface of aluminum jacketing.
    3. Fitting Covers: Material as for aluminum roll jacketing, premolded, one or two piece covers, which includes elbows, tee/valves, end caps, mechanical line couplings, and specialty fittings.

4. Manufacturers:
  - a. RPR Products; Insul-Mate.
  - b. ITW, Pabco-Childers.

**PART 3 EXECUTION**

**3.01 APPLICATION**

**A. General:**

1. Insulate valve bodies, flanges, and pipe couplings.
2. Insulate and vapor seal hangers, supports, anchors, and other piping appurtenances that are secured directly to cold surfaces.
3. Do not insulate flexible pipe couplings and expansion joints.
4. Service and Insulation Thickness shall meet pipe material, use, and environment requirements.

**3.02 INSTALLATION**

**A. General:**

1. Install in accordance with manufacturer's instructions and as specified herein.
2. Install after piping system has been pressure tested and leaks corrected.
3. Install over clean dry surfaces.
4. Use insulating cements, lagging adhesives, and weatherproof mastics recommended by insulation manufacturer.
5. Do not allow insulation to cover nameplates or code inspection stamps.
6. Run insulation or insulation inserts continuously through pipe hangers and supports, wall openings, ceiling openings, and pipe sleeves, unless otherwise shown.
7. Install removable insulation sections on devices that require access for maintenance of equipment or removal, such as unions and strainer end plates.
8. Personnel Protection: Install on pipes from floor to 8 feet high. Install on pipes within 4 feet of platforms and to 8 feet high above platforms.

**B. Connection to Existing Piping:** Cut back existing insulation to remove portion damaged by piping revisions. Install new insulation.

**C. Cold Surfaces:** Provide continuous vapor seal on insulation on cold surfaces where vapor barrier jackets are used.

## PROCESS PIPING INSULATION

- D. Placement:
  - 1. Insulate valves and fittings with sleeved or cut pieces of same material.
  - 2. Seal and tape joints.
- E. Heat Traced Piping: Apply insulation after heat-tracing work is completed and inspected.
- F. Vapor Barrier:
  - 1. Provide continuous vapor barrier at joints between rigid insulation and pipe insulation.
  - 2. Install vapor barrier jackets with pipe hangers and supports outside jacket.
  - 3. Do not use staples and screws to secure vapor sealed system components.
- G. Aluminum Jacket:
  - 1. Use continuous friction type joint to hold jacket in place, providing positive weatherproof seal over entire length of jacket.
  - 2. Secure circumferential joints with preformed snap straps containing weatherproof sealant.
  - 3. On exterior piping, apply coating over insulation and vapor barrier to prevent damage when aluminum fitting covers are installed.
  - 4. Do not use screws or rivets to fasten fitting covers.
  - 5. Install removable prefabricated aluminum covers on exterior flanges and unions.
  - 6. Caulk and seal exterior joints to make watertight.

### 3.03 FIELD FINISHING

- A. Apply coating of insulating cement where needed to obtain smooth and continuous appearance.
- B. Where pipe labels or banding are specified, apply to finished insulation, not to pipe.
- C. Painting Piping Insulation (Exposed to View):
  - 1. Aluminum or color coded PVC jacketing does not require painting.
  - 2. If insulated piping system is indicated to be painted piping shall receive the following:
    - a. Prime coat in accordance with Section 09 90 00, Painting.
    - b. Finished insulation (and not pipe) shall be painted in accordance with Section 09 90 00, Painting.

## **PROCESS PIPING INSULATION**

### **3.04 SUPPLEMENTS**

- A. The supplement listed below, following "End of Section," is a part of this specification:
  - 1. Service and Insulation Thickness Table.

**END OF SECTION**

## PROCESS PIPING INSULATION

Service and Insulation Thickness								
Service Type	Pipe Legend	Thickness	Fluid Temperature (degrees F)*	Insulation	Finish Systems			
					Concealed from View	Indoors Exposed	Outdoors	Buried
HT- Piping requiring heat tracing.		Pipe Size: Insulation Thickness Inches:* 1/4-3: 1 3.5-10: 1.5 12-16: 2 18-24: 2.5		Type 2 Insulate and heat trace outside lines I' above grade. Use Type 3 insulation from I' above grade to frost depth.	None	NA	F3	NA
<p>*Use these fluid temperatures unless otherwise noted in the Piping Schedule.</p> <p>Inches*: Based upon insulation with glass fiber per ASTM C547, outdoors with 20 mph wind with 10 percent safety and no value assigned to cladding or air space at cladding. Matches the watts per foot in Section 400533, Pipe Heat Tracing. 2012 IECC requires 1-inch minimum thickness.</p>								

**SECTION 15728**  
**TEMPORARY SANITARY SEWER BY-PASS**

**PART 1      GENERAL**

**1.01    REFERENCES**

- A.    The following is a list of standards which may be referenced in this section:
  - 1.    ASTM International (ASTM):
    - a.    D3350, Standard Specification for Polyethylene Plastic Pipe and Finings Materials.
  - 2.    American Water Works Association (AWWA):
    - a.    C1101/A21.20, ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. - 48 in. (76 mm - 1219 mm), for Water.
    - b.    C1111/A21.11, ANSI Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings.
    - c.    C151/A21.51, ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

**1.02    DEFINITIONS**

- A.    Flow Control: Procedure and method to reduce or eliminate flow in a downstream sewer to a level adequate for proper sewer inspection and rehabilitation.
- B.    Temporary Bypass Pumping: Flow control method that uses a temporary bypass pumping system.

**1.03    PERFORMANCE REQUIREMENTS**

- A.    It is essential to operation of existing sewerage system that they will be no interruption in flow of sewage throughout duration of Project.
- B.    Provide, maintain, and operate temporary facilities such as dams, plugs, pumping equipment conduits, and necessary power to intercept sewage flow before it reaches point where it would interfere with the Work.
- C.    Maintain sewer flow around Work area in a manner that will not cause surcharging of sewers, damage to sewers, and that will protect public and private property from damage.
- D.    Protect water resources, wetlands, and other natural resources.

**1.04    SUBMITTALS**



## TEMPORARY SANITARY SEWER BY-PASS

### A. Informational Submittals:

1. Flow Control Plan: Submit at least 14 days prior to controlling flows. Include, as a minimum, the following:
  - a. Estimate of peak amount of flow to be controlled.
  - b. Detailed procedures for handling peak estimated flow.
  - c. Schedule.
  - d. Drawing of plug and/or bypass pump and pipeline locations and connections.
  - e. Listing of equipment.
    - 1) Bypass pump sizes, capacities, number of each size to be onsite, and power requirements including standby equipment.
    - 2) Bypass pipeline sizes and material types.
    - 3) Pump curves for each pump along with system curves for each pipe setup.
  - f. Sewer user notification plan.
  - g. Operation plan.
  - h. Emergency procedures.
2. Permits to locate and operate flow control system.

### 1.05 SEQUENCNG AND SCHEDULING

- A. Contractor will include, as part of required schedule submittals, a plan for sequencing of by-pass pumping. Bypass pumping schedule must not, at any time, interfere with continuous flow downstream.

## PART 2 PRODUCTS

### 2.01 FLOW CONTROL SYSTEM

- A. General: Provide adequate capacity and size to handle existing flows plus additional flows that may occur during periods of rainstorm.
- B. Peak flow for sanitary sewer bypass will not exceed 600gpm.

### B. Plugs:

1. Provide with taps for connection of pressure gauges and air hoses, and flow-through capability.
2. Pipe Diameters 24 inches and smaller: Use mechanical plugs with rubber gaskets or pneumatic plugs with rubber boots.
3. Pipe Diameters Larger than 24 inches:
  - a. Use inflatable bag stoppers made in two or more pieces.
  - b. Manufacturer: Lansas, Cherne Industries,

C. Pressure Gauges:

1. Contractor shall include a pressure gauge on the discharge piping from each pump located within the first 20-foot downstream from the discharge of the pump.

D. High-Density Polyethylene (HDPE) or Ductile on Discharge Piping:

1. Leak free.
2. Pressure rating at least 1.5 times the operating pressure.
3. HDPE Pressure Piping:
  - a. In accordance with ASTM D3350.
  - b. SDR of 32.5, maximum.
  - c. Joints: Butt-fusion welded.
4. Ductile Iron:
  - a. AWWA C1511A21.51, Centrifugally cast, Grade 60-42-10 iron.
  - b. Joints: Rubber gasketed push-on in accordance with AWWA C111/21.11
  - c. Fittings: In accordance with AWWA C1 IOIA21.20.
5. May reuse for subsequent flow bypass pumping system placements. Owner or Engineer, at their sole discretion, shall have right to reject sections deemed unserviceable.
6. Provide valves so that each pump and force main may be isolated and operated individually in case of leaks.

E. Bypass Pumps:

1. Fully automatic, self-priming units that do not require use of foot valves or vacuum pumps in priming system.
2. Open impeller design with ability to pump minimum 3-inch-diameter solids.
3. Able to run dry for long periods of time to accommodate cyclical nature of flows.
4. Engine: Equipped to minimize noise. Noise levels shall not exceed 86 dBA at a distance of 50 feet from the source.
5. Standby Pump: One of each size to be available onsite for immediate use, already connected to force main piping.

**PART 3 EXECUTION**

3.01 GENERAL

- A. Notify Engineer and Owner at least 48 hours prior to implementing flow control system.

## TEMPORARY SANITARY SEWER BY-PASS

- B. Operate and maintain 24 hours per day, 7 days per week, including holidays, as required, to control flow.
- C. Take all necessary precautions to ensure no private or public properties are subjected to a sewage backup or spill. Contractor shall be solely responsible for all cleanup, damages, and resultant fines in the event of a backup or spill.
- D. If flow reaches peak estimated flow that flow control system was designed for, notify Engineer and Owner immediately and, if possible, return facilities to normal operation.
- E. After the Work is completed, return facilities to normal operation and remove temporary equipment.

### 3.02 BLOCKING FLOW

- A. Flow control may consist of blocking flow with mechanical or pneumatic plugs if only a small amount of flow needs to be controlled and adequate storage is available.
- B. Use primary and secondary plugs for each flow control location.
- C. When blocking flow is no longer needed for performance and acceptance of the Work, removed plugs in a manner that permits sewage flow to slowly return to normal without surcharging or causing other major disturbances downstream.
- D. Remove temporary plugs at end of each working day and restore normal flow. If downstream work is not or cannot be completed during the workday provide, operate, and maintain bypass pumping system.
- E. Use bypass pumping if the Work cannot be scheduled at a time when flow is low or completed during low flow period.

### 3.03 BYPASS PUMPING

- A. When blocking flow in upstream sewers is not appropriate, use flow bypass pumping for reducing flow below the maximum depth or for completely bypassing flow
- B. Design, furnish, install, and maintain all power, primary and standby pumps, appurtenances, tanks and trucks, and bypass piping required to maintain existing flows and services.
- C. Obtain approval and secure all permits for placement of temporary bypass pumping system and pipeline within public right-of-way.
- D. Site Verification:

## TEMPORARY SANITARY SEWER BY-PASS

1. Locate existing utilities in area of bypass pipelines.
  2. Bypass Pipeline Location:
    - a. Minimize disturbance of existing utilities.
    - b. Confine bypass discharge pipeline within public rights-of-way or temporary construction area and permanent easement.
    - c. When bypass pipeline crosses local streets and private driveways, place bypass pipeline in trench and cover with temporary pavement.
    - d. Installation of bypass pipelines is prohibited in salt marsh/wetland areas.
- E. Flow bypass shall be done in such a manner that will not damage private or public property, or create a nuisance or public menace. Pumped sewage shall be in an enclosed pipe that is adequately protected from traffic and shall be redirected into existing piping to be conveyed downstream according to normal flow path. Dumping or free flow of sewage on private or public property, gutters, streets, sidewalks, or into storm sewers is prohibited.
- F. Pumps shall be manned any time bypass pumping system is in operation. If bypass pumping is continued 24 hours a day during any part of the project, pumps shall be manned 24 hours a day. Cellular alarms may be allowed if response time is less than 30 minutes. Contractor is responsible for overflows resulting in failed alarms, in accordance with paragraph 3.01.

### 3.04 FIELD QUALITY CONTROL

- A. Hydrostatic Pressure Test for Pump Bypass System:
1. Prior to operation, test each section of discharge piping with maximum pressure equal to 1.5 times the maximum operating pressure of system.
  2. Pressure test for a minimum of 1 hour. Any visible leakage or pressure drop will be considered a failure of the pressure test. Upon determination of failure, the operation of the bypass system will be immediately ceased, the leak will be addressed, and the pressure test will be conducted again until there are no failures.
  3. Notify Engineer 24 hours prior to testing.
- B. Dynamic Leakage Test: After successful completion of hydrostatic pressure test, Contractor will test operation of bypass pumping system for a minimum of 1 hour and will visibly check entire bypass pipe setup for leakage, including all connections to pump and at discharge. Any visible leakage will be considered a failure of the test. Upon determination of failure, the operation of the bypass system will be immediately ceased, the leak will be addressed, and the pressure test will be conducted again until there are no failures.

## TEMPORARY SANITARY SEWER BY-PASS

### 3.05 CLEANING

- A. Before bypass pumping system is broken down and moved to next section or removed at the completion of the Work, discharge sewage remaining in bypass discharge pipeline and pumping equipment to working sewer.
- B. Disturbed Areas: Upon completion of bypass pumping operation, clean disturbed areas, restore to condition, including pavement restoration, at least equal to that which existed prior to start of the Work.

**END OF SECTION**

## **SECTION 15860 EXHAUST FANS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. The General Mechanical Provisions, Section 15050, are included as part of this Section as though written in this document.

#### **1.02 SCOPE**

- A. Furnish and install exhaust fans as hereinafter specified and at locations indicated on the drawings. Fans shall be of the centrifugal type and shall be complete with motor, drive, vibration isolation, bird guard, backdraft dampers, disconnect switch, solid state speed controller and non-overloading wheel. Exhaust fans shall have capacity not less than that indicated on the drawings. Fan rating to be certified by AMCA for capacity and sound.

### **PART 2 PRODUCTS**

#### **2.01 DIRECT DRIVE CENTRIFUGAL WALL EXHAUSTERS**

- A. Wall exhaust fans shall be of the centrifugal, direct-drive type. Construction of the fan housing shall be of heavy gauge aluminum.
- B. All spun parts shall have a rolled bead for added rigidity and shall be specially spun so as to seal the pores of the aluminum providing greater resistance against oxidation and deterioration.
- C. The fan wheel shall be all aluminum of the centrifugal blower type, featuring backward inclined blades and a tapered inlet shroud. Wheels shall be statically and dynamically balanced. Inlet cone shall be aluminum and of the centrifugal blower type. Motors shall be of the heavy duty, permanently lubricated, sealed ball bearing type. Fan shaft shall be of steel construction, turned, ground and polished to precise tolerances in relationship to the hub and bearings. Bearings shall be flanged and of the permanently lubricated, permanently sealed, ball bearing type capable of over 200,000 hours bearing life. The drive assembly and wheel shall be removable, as a complete unit, from the support structure without disassembling the external fan housing. The complete drive assembly shall be mounted on rubber vibration isolation.
- D. Type A construction shall include a five (5) year warranty. Fans shall be licensed to bear the AMCA rating seal for air and sound performance.

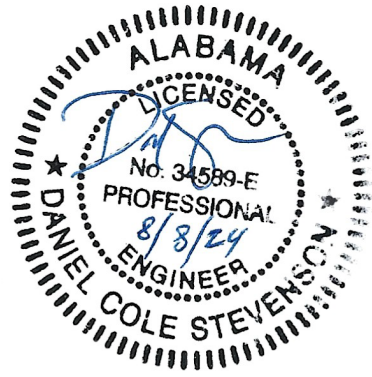
- E. The fan shall be manufactured by ACME, Cook, or Green Heck.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install the fan securely to the wall structure as shown in the detail on the plan.
- B. Install the back draft dampers and check to make sure that they are free to open and close.
- C. Check the power and rotation of the fan.

**END OF SECTION**



Dauphin Island Water & Sewer Authority  
Aloe Bay Water Quality Enhancement  
Wastewater Treatment Facility

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**SECTION 16010**  
**BASIC ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.

1.2 SCOPE

- A. This scope covers the furnishing, installation, testing, adjusting and placing in operation all electrical equipment, devices, facilities, materials, and auxiliary items necessary for the complete and successful operation of all electrical equipment as herein described, shown on the plans, or deemed necessary for the completion of the electrical portion of the project. It is the intent of DIVISION 16 to outline the electrical requirements of the contract in order to provide the information necessary for the construction of a fully operational system as shown on the plans and as herein described. A comprehensive electrical scope of work is as follows:
  - 1. Power/Electrical system
  - 2. Lighting system
  - 3. Control system
  - 4. Utility work
  - 5. Connection of electrically powered mechanical equipment
  - 6. Temporary construction power
  - 7. All incidentals necessary for a complete and fully operational electrical system.

1.3 WORKING CLEARANCES

- A. Working clearances around equipment requiring electrical services shall be verified by Contractor to comply with Code requirements. Should there be apparent violations of clearances; the Contractor shall notify the Engineer before proceeding with connection or placing of equipment.
- B. In the case of panelboards, safety switches and other equipment requiring wire and cable terminations, the Contractor shall ascertain that lug sizes and wiring gutters or space allowed for proper accommodation and termination of the wires and cables are adequate.

1.4 WORKMANSHIP

- A. Workmanship under this Division shall be accomplished by persons skilled in the performance of the required task. All work shall be done in keeping with conventions of

## **BASIC ELECTRICAL REQUIREMENTS**

the trade. Work of this Division shall be closely coordinated with work of other trades to avoid conflict and interference.

### **1.5 PROTECTION OF ELECTRICAL EQUIPMENT**

- A. Electrical equipment shall be protected by the weather, especially from water dripping or splashing upon it, at all times during shipment, storage and after installation. Should any apparatus be subjected to possible injury by water, it shall be thoroughly dried out and put through a dielectric test, at the expense of the contractor, to ascertain the suitability of this apparatus. The results of the test shall be submitted to the Engineer and if the apparatus is found to be unsuitable, the contractor shall replace it without additional cost to the Owner.

### **1.6 UTILITIES**

- A. The electrical contractor shall install a fully operational electrical service as described in the plans.
- B. Arrange with the utility company for the services and install the services in accordance with their requirements, regulations, and recommendations.

### **1.7 GUARANTEE**

- A. Contractor shall guarantee all light bulbs. Fluorescent, HID, and LED lamps, starters, and ballasts shall be guaranteed for a period of one (1) year after the building is occupied. Incandescent bulbs shall be guaranteed for a period of 30 days after occupancy. Guarantee shall include material and labor for re-lamping.
- B. The Contractor shall guarantee all other electrical systems, materials and workmanship to be free from defects for a period of one (1) year from the date of final acceptance. He shall correct all defects arising within this period upon notification by the Owner or Engineer, without additional compensation.
- C. It is understood that the rights and benefits given the Owner by the guarantees found in the technical specifications are in addition to and not in derogation of any rights or benefits found in the special and general provisions of the contract.

### **1.8 TEMPORARY LIGHTS DURING CONSTRUCTION**

- A. It shall be the responsibility of the Contractor to provide and maintain adequate temporary lighting at all times during construction, so that the various other trades can accomplish their work in a flawless manner. Particular attention will be given to lighting for masonry, drywall, painting, tile work and any other finish work.

### **1.9 MATERIAL STANDARDS**

- A. Material shall be new and comply with standards of Underwriters' Laboratories, Inc., where standards have been established for the particular product and the various NEMA, ANSI, ASTM, IEEE, AEIC, IPCEA or other publications referenced.

## BASIC ELECTRICAL REQUIREMENTS

### 1.10 TEST EQUIPMENT

- A. The contractor shall provide all test equipment and supplies deemed necessary by the Engineer at no extra cost to the Owner. These supplies shall include but not be limited to the following: volt meters, amp meters, light meters, fuel, generator load banks, watt meters, harmonic distortion test equipment, thermal image camera, high pot test equipment, power quality analyzers, and oscilloscopes.

### 1.11 REFERENCES

- A. ANSI/NFPA 70 – National Electrical Code.
- B. ANSIC2 – National Electrical Safety Code.
- C. NEMA – National Electrical Manufacturer's Assoc.
- D. UL – Underwriters Laboratories
- E. NFPA – National Fire Protection Assoc.
- F. IEEE – The Institute of Electrical and Electronics Engineers
- G. IESNA – The Illuminating Engineering Society of North America
- H. NETA – International Electrical Testing Association
- I. Recommended Standards for Water Works and Wastewater Facilities as published by Great Lakes – Upper Mississippi River Board of State Public Health and Environmental Managers.

### 1.12 SUBMITTAL

- A. Submit under provisions of the General Provisions.
  - 1. The Contractor installing all Electrical work shall review and approve all electrical shop drawings prior to submittal to the Engineer for review. As part of the review, the installer shall certify the following:
    - a. I hereby certify that the (equipment (material) (article) shown and marked in this submittal is in compliance with the contract drawing and specifications, can be installed in the allocated space, will be stored in accordance with the manufacturers recommendation, will be installed per NEC, and is submitted for approval.

Certified by: \_\_\_\_\_ Date: \_\_\_\_\_
- B. Submit shop drawings and product data grouped to include complete submittal of related systems, products, and accessories in a single submittal. No electrical work may be

## BASIC ELECTRICAL REQUIREMENTS

performed until shop drawings are approved. Submit Shop Drawings on the Following Systems as Grouped Below:

1. Power/Electrical System
  - a. Conduit and Conduit Fittings
  - b. Wire
  - c. Pull Boxes
  - d. Panelboards
  - e. Panelboard Layouts
  - f. Circuit Breakers
  - g. Disconnects
  - h. Fuses
  - i. Conduit Support Systems
  - j. Wiring Devices
  - k. Switchboards
  - l. Transformers
  - m. Surge Protection Equipment
  - n. Motor Control Centers (MCC)
  - o. Breaker Coordination Study
  - p. Variable Frequency Drives
  - q. Control Panels
2. Generator Equipment
  - a. Generator
  - b. Fuel System
  - c. Generator Enclosure
  - d. Automatic Transfer Switch
3. Site Lighting
  - a. All light fixtures
    - a) Computer printout of lighting layout
    - b) Sample fixtures
    - c) IES photometric files
4. Control System
  - a. PLC
  - b. I/O Racks
  - c. Field Instruments
  - d. HMI Software
5. Miscellaneous Electrical Equipment
  - a. Miscellaneous Electrical Parts
6. Drawings
  - a. Coordination drawing of All Electrical Rooms/Equipment Racks
  - b. Conduit layout drawings
  - c. Duct drawings
  - d. As-Built Drawings

C. Mark dimensions and values in units to match those specified.

## **BASIC ELECTRICAL REQUIREMENTS**

### **1.13 REGULATORY REQUIREMENTS**

- A. Conform to applicable sections of the Building Code and all local rules, regulations and ordinances.
- B. Electrical: Conform to NFPA 70 & National Electric Safety Code
- C. Obtain permits, and request inspections from authority having jurisdiction.
- D. References listed in Paragraph 1.11, this section.

### **1.14 FINAL INSPECTION AND TESTING**

- A. After the electrical installation is complete, the Contractor shall deliver to the Engineer the following information with his request for final inspection.
  - 1. One set of contract drawings marked to show all significant changes in equipment ratings and locations, alterations in locations of conduit runs, or of any data differing from the contract drawings. This shall include revised or changed panelboard, motor control center, and switchgear schedules.
  - 2. Certificates of final inspection from local authority.
  - 3. A tabulation of all motors listing their respective manufacturer, horsepower, nameplate voltage and current, actual running current after installation and overload heater rating.
- B. The electrical work shall be thoroughly tested to demonstrate that the entire system is in proper working order and in accordance with the plans and specifications. Each motor with its control shall be run as nearly as possible under operating conditions for a sufficient length of time to demonstrate correct alignment, wiring capacity, speed and satisfactory operation. All main switches and circuit breakers shall be operated, but not necessarily at full load. Contractor may be required during final inspection, at the request of the Engineer to furnish test instruments for use during the testing.
- C. All wiring shall be given a megger test using a 1000 Volt megger. This test shall be performed after conductors are pulled, but before final connections are made. The Engineer shall be given two (2) days' written notice of the anticipated test date so that he may witness the test if so desired. In any event, the Contractor shall record the circuit designation and the megger reading on each phase. This written record shall be submitted to the Engineer. The cost of this test or any retest caused by insufficient megger readings shall be the responsibility of the Contractor (All tests shall be done in accordance with NETA Standards).

### **1.15 STAFFING**

- A. The electrical contractor shall provide a "Master Electrician" who has been deemed a "Master Electrician" by exam through the State associated with the project location, or any other County in the State Permitting Authority as the Electrical Superintendent for

## **BASIC ELECTRICAL REQUIREMENTS**

the project. The Electrical Superintendent shall be on the project site any time any electrical work is performed by the contractor.

- B. In addition, the contractor shall provide one Journeyman electrician for every four electrical helpers used on the project site.

### **1.16 PROCESS EQUIPMENT**

- A. The electrical contractor is required and expected to read all other equipment specifications contained in these documents and provide all required power and control conductors required by said equipment to allow them to function as described.
- B. All equipment for which power is not specifically indicated on the plans shall be provided with power per the NEC to the nearest panelboard, MCC, or switchboard with adequate capacity to serve said equipment as calculated by the NEC.

### **1.17 AS-BUILT DRAWINGS**

- A. The contractor shall provide detailed as-built drawings for the project indicating all power wiring. (All Drawings shall be delivered to the Owner in an AutoCAD 2013 Format.)
- B. The As-Built drawings shall include detailed drawings of all duct banks, underground conduit, above ground conduit, motor control centers, PLC control panels, control drawings. These drawings shall indicate exact location of all underground electrical wiring and fiber optic cable.
- C. The Engineer shall provide electronic copies of all drawings in the bid plans set for use by the contractor.

**END OF SECTION**

**SECTION 16055**  
**OVERCURRENT PROTECTIVE DEVICE COORDINATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. All new overcurrent protection devices installed in the plant facility shall be selectively coordinated.
- B. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.
  - 1. Coordination of series-rated devices is permitted where indicated on Drawings.

**1.3 SUBMITTALS**

- A. Qualification Data: For coordination-study specialist.
- B. Submittals: Submittals shall be in paper and electronic forms.
  - 1. Coordination-study input data, including completed computer program input data sheets.
  - 2. Study and Equipment Evaluation Reports.
  - 3. Coordination-Study Report (breaker curves in color).
  - 4. Provide Electronic Study for Engineer Review.

**1.4 QUALITY ASSURANCE**

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

## **OVERCURRENT PROTECTIVE DEVICE COORDINATION**

- C. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- D. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- E. Comply with IEEE 399 for general study procedures.

### **PART 2 - PRODUCTS**

#### **2.1 COMPUTER SOFTWARE**

- A. Product:
  - 1. SKM Systems Analysis, Inc.
  - 2. Easy Power
  - 3. Engineer Approved Equal

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.
  - 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

#### **3.2 POWER SYSTEM DATA**

- A. Gather and tabulate the following input data to support coordination study:
  - 1. Product Data for overcurrent protective devices specified in other Division 16 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  - 2. Impedance of utility service entrance.



## OVERCURRENT PROTECTIVE DEVICE COORDINATION

3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
  - a. Circuit-breaker and fuse-current ratings and types.
  - b. Relays and associated power and current transformer ratings and ratios.
  - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
  - d. Generator kilovolt amperes, size, voltage, and source impedance.
  - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
  - f. Busway ampacity and impedance.
  - g. Motor horsepower and code letter designation according to NEMA MG 1.
4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
  - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
  - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
  - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
  - d. Generator thermal-damage curve.
  - e. Ratings, types, and settings of utility company's overcurrent protective devices.
  - f. Special overcurrent protective device settings or types stipulated by utility company.
  - g. Time-current-characteristic curves of devices indicated to be coordinated.
  - h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
  - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
  - j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

## OVERCURRENT PROTECTIVE DEVICE COORDINATION

### 3.3 FAULT-CURRENT STUDY

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
  - 1. Motor-control center.
  - 2. Distribution panelboard.
  - 3. Branch circuit panelboard.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141 and IEEE 242.
  - 1. Transformers:
    - a. ANSI C57.12.10.
    - b. ANSI C57.12.22.
    - c. ANSI C57.12.40.
    - d. IEEE C57.12.00.
    - e. IEEE C57.96.
  - 2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
  - 3. Low-Voltage Fuses: IEEE C37.46.
- E. Study Report:
  - 1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
  - 2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium- and high-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.
- F. Equipment Evaluation Report:
  - 1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

## OVERCURRENT PROTECTIVE DEVICE COORDINATION

2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

### 3.4 COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
  1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
  2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
  3. Calculate the maximum and minimum ground-fault currents.
- B. Comply with IEEE 141 and IEEE 242 recommendations for fault currents and time intervals. (Comply with NEC for selective coordination NFPA 70; 240.12, 700.27, 701.18)
- C. Transformer Primary Overcurrent Protective Devices:
  1. Device shall not operate in response to the following:
    - a. Inrush current when first energized.
    - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
    - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
  2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

## OVERCURRENT PROTECTIVE DEVICE COORDINATION

- E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
    - a. Device tag.
    - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
    - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
    - d. Fuse-current rating and type.
    - e. Ground-fault relay-pickup and time-delay settings.
  2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
    - a. Device tag.
    - b. Voltage and current ratio for curves.
    - c. Three-phase and single-phase damage points for each transformer.
    - d. No damage, melting, and clearing curves for fuses.
    - e. Cable damage curves.
    - f. Transformer inrush points.
    - g. Maximum fault-current cutoff point.
- F. Completed data sheets for setting of overcurrent protective devices bound in a 3 ring binder.

**END OF SECTION**

**SECTION 16060**  
**GROUNDING AND BONDING**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
  - 1. Underground distribution grounding.
  - 2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
  - 1. Ground rods.
  - 2. Ground rings.
  - 3. Grounding arrangements and connections for separately derived systems.
  - 4. Grounding for sensitive electronic equipment.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
  - 1. Instructions for periodic testing and inspection of grounding features at ground rings grounding connections for separately derived systems based on NFPA 70.
    - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    - b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### PART 2 - PRODUCTS

#### 2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

#### 2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

#### 2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type, 1 inch in diameter (length as required to achieve resistance to ground as specified in 3.5, B).

### PART 3 - EXECUTION

#### 3.1 APPLICATIONS

- A. Conductors: All conductors shall be stranded.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
  - 1. Bury at least 24 inches below grade.

## GROUNDING AND BONDING

- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus
- E. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

## GROUNDING AND BONDING

- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.



## GROUNDING AND BONDING

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building area or item indicated.
1. Install copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
  2. Bury ground ring not less than 24 inches from building foundation.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.

## **GROUNDING AND BONDING**

- a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.
  2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm.
  5. Substations and Pad-Mounted Equipment: 5 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

**END OF SECTION**

**SECTION 16073**  
**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. IMC: Intermediate metal conduit.
- B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
  - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze hangers. Include Product Data for components.
  - 2. Steel slotted channel systems. Include Product Data for components.
  - 3. Nonmetallic slotted channel systems. Include Product Data for components.
  - 4. Equipment supports.

## HANGERS AND SUPPORTS

### 1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.

### 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Stainless Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper B-Line, Inc.; a division of Cooper Industries.
    - b. Thomas & Betts Corporation.
    - c. Unistrut; Tyco International, Ltd.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper B-Line, Inc.; a division of Cooper Industries.
    - b. Unistrut; Tyco International, Ltd.
  - 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  - 3. Fitting and Accessory Materials: Same as channels and angles, except metal items shall be stainless steel.
  - 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Stainless Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of

## HANGERS AND SUPPORTS

conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-stainless steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Hilti Inc.
- 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- 3) MKT Fastening, LLC.
- 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Cooper B-Line, Inc.; a division of Cooper Industries.
- 2) Hilti Inc.
- 3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- 4) MKT Fastening, LLC.

3. Clamps for Attachment to Steel Structural Elements: Stainless Steel, type suitable for attached structural element.

4. Through Bolts: Stainless Steel Structural type, hex head, and high strength.

5. Hanger Rods: Threaded stainless steel.

### 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-stainless steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## PART 3 - EXECUTION

### 3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for conduit per NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

## HANGERS AND SUPPORTS

- C. Multiple Raceways or Cables (**All spaces except chemical feed areas**): Install trapeze-type supports fabricated with stainless steel slotted system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps
- D. Multiple Raceways or Cables (**All chemical feed areas**): Install trapeze-type supports fabricated with slotted nonmetallic system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt nonmetallic conduit clamps

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To New Concrete: Expansion anchor fasteners.
  - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 3. To Existing Concrete: Expansion anchor fasteners.
  - 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

## HANGERS AND SUPPORTS

- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete".
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Comply with requirements in Division 9 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

**END OF SECTION**

**SECTION 16075**  
**ELECTRICAL IDENTIFICATION**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Identification for raceway and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1, ANSI C2, and ANSI Z635.4.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.



## **ELECTRICAL IDENTIFICATION**

- D. Install identifying devices before installing acoustical ceilings and similar concealment.
- E. Install all signs and labels horizontal (level) and consistent for similar equipment and panels.

### **PART 2 - PRODUCTS**

#### **2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use

#### **2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS**

- A. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

#### **2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

### **PART 3 - EXECUTION**

#### **3.1 APPLICATION**

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with snap-around label.

## ELECTRICAL IDENTIFICATION

1. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, snap-around, color-coding bands:
  1. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
  2. Fire Alarm System: Red.
  3. Fire-Suppression Supervisory and Control System: Red and yellow.
  4. Combined Fire Alarm and Security System: Red and blue.
  5. Security System: Blue and yellow.
  6. Mechanical and Electrical Supervisory System: Green and blue.
  7. Telecommunication System: Green and yellow.
  8. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
  1. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
  1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
  1. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
  2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

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4. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway. During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches above duct. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
1. Description:
    - a. Permanent, bright-colored, continuous-printed, polyethylene tape.
    - b. Not less than 6 inches wide by 4 mils thick.
    - c. Compounded for permanent direct-burial service.
    - d. Embedded continuous metallic strip or core.
    - e. Printed legend shall indicate type of underground line.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
  2. Comply with NFPA 70 and 29 CFR 1910.145.
  3. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
  4. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
  5. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
  6. Warning label and sign shall include, but are not limited to, the following legends:
    - a. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
    - b. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## ELECTRICAL IDENTIFICATION

### I. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with ENGINEER/OWNER APPROVED instructions where needed for system or equipment operation. Instructions are needed for all equipment unless otherwise noted.
  - a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - b. The engraved legend shall be ½ “ White letters on Brown face, and punched or drilled for mechanical fasteners.
  - c. The signs shall be installed with stainless hardware.
2. Emergency Operating Instructions: Install emergency operating instruction signs at equipment used for power transfer, safety shutdown, or any other locations requiring operation in an emergency.
  - a. Signs shall be engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - b. The engraved legend shall be ½ “ White letters on Red face, and punched or drilled for mechanical fasteners.
  - c. The signs shall be installed with stainless hardware.

### J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

#### 1. Labeling Instructions:

- a. Indoor and Outdoor Equipment: Use engraved, laminated acrylic or melamine labels, punched or drilled for screw mounting. Identification labels shall have white letters on a dark-gray background. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high. Mount labels with stainless hardware.
- b. Elevated Components: Increase the size of the labels and letters to those appropriate for viewing from the floor.

#### 2. Equipment to Be Labeled:

- a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
- b. Panelboards, electrical cabinets, and enclosures.
- c. Access doors and panels for concealed electrical items.
- d. Electrical switchgear and switchboards.
- e. Transformers.
- f. Electrical substations.

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- g. Emergency system boxes and enclosures.
- h. Motor-control centers.
- i. Disconnect switches.
- j. Enclosed circuit breakers.
- k. Motor starters.
- l. Push-button stations.
- m. Power transfer equipment.
- n. Contactors.
- o. Battery inverter units.
- p. Battery racks.
- q. Power-generating units.
- r. Voice and data cable terminal equipment.
- s. Television/audio components, racks, and controls.
- t. Fire-alarm control panel and annunciators.
- u. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
- v. Monitoring and control equipment.
- w. Uninterruptible power supply equipment.
- x. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
- y. Control systems
- z. Field mounted control devices
- aa. Field mounted instruments

### 3.2 INSTALLATION PRACTICES

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- D. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes LARGER than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.

## **ELECTRICAL IDENTIFICATION**

- 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- E. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- F. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

**END OF SECTION**

## **SECTION 16120 CONDUCTORS AND CABLES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Wires and cables rated 600 V and less.
  - 2. Connectors and terminations rated 600 V and less.
  - 3. Sleeves and sleeve seals for cables.
- B. Restrictions
  - 1. All wire/cable runs of any type must be continuous. Splices are expressly prohibited.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

#### **1.5 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

#### **1.6 COORDINATION**

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

**PART 2 - PRODUCTS**

**2.1 CONDUCTORS AND CABLES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. American Insulated Wire Corp.; a Leviton Company.
  - 3. Beldon CDT Inc.
  - 4. General Cable Corporation.
  - 5. Senator Wire & Cable Company.
  - 6. Southwire Company.
- C. Copper Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types XHHW and SO.
- E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC and Type SO with ground wire.

**2.2 CONNECTORS AND SPLICES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

**2.3 SLEEVES FOR CABLES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.



## CONDUCTORS AND CABLES

- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

### 2.4 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper, stranded.
- B. Branch Circuits: Copper, stranded.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type XHHW-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type XHHW-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type XHHW-2, single conductors in raceway.
- F. Feeders in Cable Tray: Type XHHW-2, single conductors in raceway.
- G. Exposed Branch Circuits, Including in Crawlspace: Type XHHW-2, single conductors in raceway.

## CONDUCTORS AND CABLES

- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type XHHW-2, single conductors in raceway.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Metal-clad cable, Type MC.
- K. Branch Circuits in Cable Tray: Type TC.
- L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- M. All control cables between the PLCs / MMCs and field instruments: 2 # 18 AWG, twisted shielded pair, UL Instrument Cable, XLPE conductor insulation, PVC outer jacket.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

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- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to local codes and the manufacturer's written instructions.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to local codes and the manufacturer's written instructions.
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal

## CONDUCTORS AND CABLES

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to local codes and the manufacturer's written instructions.

### 3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
    - a. All Process Equipment.
    - b. Panels/Switchboards/Transformers/Transfer Switches
    - c. Pumps
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. All megger readings using a 1000 V dc megger shall be greater than 50 mega ohms.
  - 4. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION**

## **SECTION 16130 RACEWAYS AND BOXES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following: 16135

#### **1.3 DEFINITIONS**

- A. FMC: Flexible metal conduit.
- B. IMC: Intermediate metal conduit.
- C. LFNC: Liquidtight flexible nonmetallic conduit.
- D. RNC: Rigid nonmetallic conduit.

#### **1.4 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. For handholes and boxes for underground wiring, including the following:
    - a. Duct entry provisions, including locations and duct sizes.
    - b. Frame and cover design.
    - c. Grounding details.
    - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    - e. Joint details.
- C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members in the paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and other features in the paths of conduit groups with common supports.

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- D. Source quality-control test reports.

**1.5 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. For each type of conduit, all fittings shall be of one manufacturer.

**PART 2 - PRODUCTS**

**2.1 METAL CONDUIT AND TUBING**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. Electri-Flex Co.
  - 6. Manhattan/CDT/Cole-Flex.
  - 7. Maverick Tube Corporation.
  - 8. O-Z Gedney; a unit of General Signal.
  - 9. Wheatland Tube Company.
- B. Aluminum Rigid Conduit: ANSI C80.5.
- C. FMC: aluminum: **NOT ALLOWED**
- D. EMT: **NOT ALLOWED**
- E. Fittings for Conduit and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.

**2.2 NONMETALLIC CONDUIT AND TUBING**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arnco Corporation.
  - 4. CANTEX Inc.
  - 5. CertainTeed Corp.; Pipe & Plastics Group.
  - 6. Condux International, Inc.

## RACEWAYS AND BOXES

7. ElecSYS, Inc.
  8. Electri-Flex Co.
  9. Lamson & Sessions; Carlon Electrical Products.
  10. Manhattan/CDT/Cole-Flex.
  11. RACO; a Hubbell Company.
  12. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

### 2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Aruco Corporation.
  2. Endot Industries Inc.
  3. IPEX Inc.
  4. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Comply with UL 2024; flexible type, approved for general-use installation.

### 2.4 NONMETALLIC WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman.
  2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

### 2.5 SURFACE RACEWAYS

- A. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Engineer from manufacturer's standard colors.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Butler Manufacturing Company; Walker Division.
  - b. Enduro Systems, Inc.; Composite Products Division.
  - c. Hubbell Incorporated; Wiring Device-Kellems Division.
  - d. Lamson & Sessions; Carlon Electrical Products.
  - e. Panduit Corp.
  - f. Walker Systems, Inc.; Wiremold Company (The).
  - g. Wiremold Company (The); Electrical Sales Division.

### 2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  2. EGS/Appleton Electric.
  3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.
  8. Robroy Industries, Inc.; Enclosure Division.
  9. Scott Fetzer Co.; Adalet Division.
  10. Spring City Electrical Manufacturing Company.
  11. Thomas & Betts Corporation.
  12. Walker Systems, Inc.; Wiremold Company (The).
  13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Cabinets:
  1. NEMA 250, Type 1, stainless-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.

### 2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.



## RACEWAYS AND BOXES

1. Color of Frame and Cover: Gray.
  2. Configuration: Units shall be designed for flush burial and have open bottoms with 8" of gravel fill below the bottom of the box.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, as indicated for each service.
  6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with the entering ducts for secure, fixed installation in enclosure wall.
  7. Handholes 24 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. Hubble Power Systems, Quazite

### 2.8 SLEEVES FOR RACEWAYS

- A. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

### 2.9 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
  2. Calpico, Inc.
  3. Metraflex Co.
  4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Pressure Plates: Stainless steel. Include two for each sealing element.

## RACEWAYS AND BOXES

2. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### 2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  1. Exposed Conduit, Non-Hazardous areas: Rigid aluminum conduit.
  2. Exposed Conduit, Hazardous locations: Stainless Steel
  3. Concealed Conduit, Aboveground: Rigid aluminum conduit.
  4. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
  6. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.
  7. Application of Handholes and Boxes for Underground Wiring:
    - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
- B. Comply with the following indoor applications, unless otherwise indicated:
  1. Chemical Feed Areas: EPC-40 PVC
  2. Exposed: Rigid aluminum conduit.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC
  4. Damp or Wet Locations: Rigid aluminum conduit.
  5. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway.
  6. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway.
  7. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: Plenum-type, optical fiber/communications cable raceway.
  8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

## RACEWAYS AND BOXES

- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Aluminum Conduit: Use threaded aluminum conduit fittings, unless otherwise indicated.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. All aluminum conduit installed in contact with concrete or earth shall be protected with two coats of 3M Scotchrap Pipe Primer and then wrapped with one layer of 3M "Scotchrap –All Weather Corrosion Protection Tape" per the manufacturers recommendations.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- F. Conceal conduit within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceways Embedded in Slabs:
  - 1. Run all conduits parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Change from Type EPC-40-PVC to rigid aluminum conduit, 3" before rising above the floor.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

## RACEWAYS AND BOXES

- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
  - 1. 3/4-Inch Trade Size: Install raceways in maximum lengths of 50 feet.
  - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
  - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
  - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- O. Use LFNC in damp or wet locations not subject to severe physical damage.

## RACEWAYS AND BOXES

- P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- S. The use of LFNC to accomplish bends, turns, or otherwise ease of installation, and not detailed in Section 3.1.A.4, 3.1.B.5, or 3.2.N is expressly prohibited. Any exceptions will be at the sole discretion of the engineer and must be a written request with full justification.
- T. All underground conduits shall be spaced three times the trade size diameter apart.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
  - 2. Install backfill as specified in Division 2 Section "Earthwork."
  - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
  - 4. Conduit shall be provided with premanufactured conduit spaces designed to provide 3" separation between conduits. Spaces shall be equal to Carlon Snap-Loc or approved equal.
  - 5. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
    - 1) Couple conduits to ducts with adapters designed for this purpose.
    - 2) For stub-ups at equipment mounted on outdoor concrete bases, extend conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
- B. Concrete Encased Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
  - 2. Install backfill as specified in Division 2 Section "Earthwork."
  - 3. Concrete shall be 3000 PSI, Fiber Reinforced with Red Dye added.
  - 4. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly

## RACEWAYS AND BOXES

hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."

5. Conduit shall be provided with pre manufactured conduit spaces designed to provide 3" separation between conduits. Spaces shall be equal to Carlon Snap-Loc or approved equal.
6. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
  - 1) Couple conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - 2) For stub-ups at equipment mounted on outdoor concrete bases, extend conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

## RACEWAYS AND BOXES

2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position the raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Through-Penetration Firestop Systems."

**3.8 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

**END OF SECTION**



**SECTION 16135**  
**UNDERGROUND DUCTS**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
  - 2. Handholes and boxes.
  - 3. Manholes.

1.3 DEFINITION

- A. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Duct-bank materials, including separators and miscellaneous components.
  - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
  - 3. Accessories for manholes, handholes, boxes, and other utility structures.
  - 4. Warning tape.
  - 5. Warning planks.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
  - 1. Duct entry provisions, including locations and duct sizes.
  - 2. Reinforcement details.

3. Frame and cover design and manhole frame support rings.
  4. Ladder/Step details.
  5. Grounding details.
  6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
  7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
1. Duct entry provisions, including locations and duct sizes.
  2. Cover design.
  3. Grounding details.
  4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
  2. Drawings shall be signed and sealed by a qualified professional engineer.
- E. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.
- F. Qualification Data: For professional engineer and testing agency.
- G. Source quality-control test reports.
- H. Field quality-control test reports.

**1.5 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

## UNDERGROUND DUCTS

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store non-metallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

### 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify the Engineer, Construction Manager, and Owner no fewer than 5 days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without the Engineer's written permission.

### 1.8 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Engineer.

### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 10% percent of quantity of each item installed.

## PART 2 - PRODUCTS

### 2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

**2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following, or approved equal:
  - 1. ARNCO Corp.
  - 2. Beck Manufacturing.
  - 3. Cantex, Inc.
  - 4. CertainTeed Corp.; Pipe & Plastics Group.
  - 5. Condux International, Inc.
  - 6. ElecSys, Inc.
  - 7. Electri-Flex Company.
  - 8. IPEX Inc.
  - 9. Lamson & Sessions; Carlon Electrical Products.
  - 10. Manhattan/CDT; a division of Cable Design Technologies.
  - 11. Spiraduct/AFC Cable Systems, Inc.
- D. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- E. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-60-PVC and Type DB-80-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- F. Duct Accessories:
  - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in Division 16 Section "Electrical Identification."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
  - a. Color: Red dye added to concrete during batching.
  - b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

**2.3 PRECAST CONCRETE HANDHOLES AND BOXES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
  1. Carder Concrete Products.
  2. Christy Concrete Products.
  3. Elmhurst-Chicago Stone Co.
  4. Oldcastle Precast Group.
  5. Riverton Concrete Products; a division of Cretex Companies, Inc.
  6. Utility Concrete Products, LLC.
  7. Utility Vault Co.
  8. Wausau Tile, Inc.
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
  1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
  2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
  3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
    - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    - b. Cover Handle: Recessed.

## UNDERGROUND DUCTS

4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
  - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
  - b. Cover Handle: Recessed.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRICAL." Or "CONTROL"
7. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
  - a. Extension shall provide increased depth of 12 inches.
  - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
  - a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
  - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
  - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
  - a. Type and size shall match fittings to duct or conduit to be terminated.
  - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
11. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

### 2.4 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Description: Comply with SCTE 77.
  1. Color: Gray.
  2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

## UNDERGROUND DUCTS

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, "ELECTRICAL." Or "CONTROL."
  6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
  7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following, or approved equal:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. NewBasis.
    - e. Quazite
- C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following, or approved equal:
    - a. Armorcast Products Company.

- b. Carson Industries LLC.
  - c. Christy Concrete Products.
  - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following, or approved equal:
    - a. Carson Industries LLC.
    - b. Christy Concrete Products.
    - c. Nordic Fiberglass, Inc.
- E. High-Density Plastic Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be plastic.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following, or approved equal:
    - a. Carson Industries LLC.
    - b. Nordic Fiberglass, Inc.
    - c. PenCell Plastics.

**2.5 PRECAST MANHOLES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
  - 1. Carder Concrete Products.
  - 2. Christy Concrete Products.



3. Oldcastle Precast Group.
  4. Riverton Concrete Products; a division of Cretex Companies, Inc.
  5. Utility Vault Co.
- C. Coordinate first paragraph below with Drawings.
- D. Comply with ASTM C 858[, and with interlocking mating sections, complete with accessories, hardware, and features.
1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
    - a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
    - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
    - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
  2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    - a. Type and size shall match fittings to duct or conduit to be terminated.
    - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.
- E. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.
- F. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

**2.6 CAST-IN-PLACE MANHOLES**

- A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.
- B. Materials: Comply with ASTM C 858 and with Division 3 Section "Cast-in Place Concrete."
- C. Structural Design Loading: As specified in Part 3 "Underground Enclosure Application" Article.

**2.7 UTILITY STRUCTURE ACCESSORIES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
  - 1. Bilco Company (The).
  - 2. Campbell Foundry Company.
  - 3. Carder Concrete Products.
  - 4. Christy Concrete Products.
  - 5. East Jordan Iron Works, Inc.
  - 6. Elmhurst-Chicago Stone Co.
  - 7. McKinley Iron Works, Inc.
  - 8. Neenah Foundry Company.
  - 9. NewBasis.
  - 10. Oldcastle Precast Group.
  - 11. Osburn Associates, Inc.
  - 12. Pennsylvania Insert Corporation.
  - 13. Riverton Concrete Products; a division of Cretex Companies, Inc..
  - 14. Strongwell Corporation; Lenoir City Division.
  - 15. Underground Devices, Inc.
  - 16. Utility Concrete Products, LLC.
  - 17. Utility Vault Co.
  - 18. Wausau Tile, Inc.
- C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
  - 1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches.
    - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

## UNDERGROUND DUCTS

- b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
- 2. Cover Legend: Cast in. Selected to suit system.
  - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
  - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
  - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
- 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
  - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.
- D. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.
- E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- diameter eye, and 1-by-4-inch bolt.
  - 1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.
- F. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- diameter eye, rated 2500-lbf minimum tension.
- G. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
  - 1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.
- H. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.
  - 1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
- I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
- J. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.
  - 1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
  - 2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.

3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- K. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.
  2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.
- L. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 degrees F. Capable of withstanding temperature of 300 degrees F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- M. Fixed Manhole Ladders: Arranged for attachment to wall, and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
- N. Portable Manhole Ladders: UL-listed, heavy-duty fiberglass specifically designed for portable use for access to electrical manholes. Minimum length shall be equal to distance from deepest manhole floor to grade plus 36 inches. One required.
- O. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

2.8 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by a independent testing agency.
  2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

**PART 3 - EXECUTION**

**3.1 UNDERGROUND DUCT APPLICATION**

- A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-80-PVC, in concrete-encased duct bank, unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- C. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80-PVC, in direct-buried duct bank, unless otherwise indicated.
- D. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- F. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC installed in direct-buried duct bank, unless otherwise indicated.
- G. Underground Ducts Crossing Paved Paths, Walks, and Driveways, Roadways, and Railroads: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

**3.2 UNDERGROUND ENCLOSURE APPLICATION**

- A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
  - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
  - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
  - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
  - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Manholes: Precast concrete.
  - 1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
  - 2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 2 Section "Earthwork," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Sections "Lawns and Grasses" and "Exterior Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 1 Section "Cutting and Patching."

3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
  - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
  - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Coordinate design of concrete-encased duct banks approaching building wall penetrations with building structural design to support ducts at wall, without reducing structural or watertight integrity of building. Do not use steel conduit in highly corrosive soils. Coordinate with Drawings.
- F. Sleeves and sleeve seals for conduits penetrating building walls below grade are specified in Division 16 Section "Basic Electrical Materials and Methods."
- G. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the

## UNDERGROUND DUCTS

building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 16 Section "Basic Electrical Materials and Methods."

- H. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- I. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- J. Concrete-Encased Ducts: Support ducts on duct separators.
  - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
  - 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
  - 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  - 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  - 6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
  - 7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.

## UNDERGROUND DUCTS

8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### K. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 2 Section "Earthwork" for pipes less than 6 inches in nominal diameter.
4. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
5. Delete subparagraph below if dimensioned duct sections are shown on Drawings.
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Requirements in first subparagraph below exceed NFPA 70. Retain for conservative design.



8. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
9. Set elevation of bottom of duct bank below the frost line.
10. Direct-buried, PVC duct elbows in first subparagraph below are particularly vulnerable to damage by pulling lines when cable pulling tensions are high. Rigid steel conduit elbows are sometimes specified for these stub-ups to prevent such damage. However, concrete encasement of PVC duct elbows, together with reduced pulling tensions, is also used in these situations. Pulling tensions can be reduced by making duct runs from the closest manhole or handhole as short as possible and arranging duct banks so stub-up elbows have the longest possible radius. 5-inch (125-mm) duct elbows are available in standard radii of 24, 36, 48, and 60 inches (300, 900, 1200, and 1500 mm) and greater. Coordinate with Drawings and see Editing Instruction No. 3 in the Evaluations.
11. Retain one of first two subparagraphs and associated subparagraphs below to specify type of stub-ups for direct-buried ducts in Project.
12. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
13. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
14. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

### 3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

#### A. Cast-in-Place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
3. Cast-in-place concrete, formwork, and reinforcement are specified in Division 3 Section "Cast-in-Place Concrete."

#### B. Precast Concrete Handhole and Manhole Installation:

## UNDERGROUND DUCTS

1. Comply with ASTM C 891, unless otherwise indicated.
  2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
  3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
  2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
  3. Install handholes with bottom below the frost line.
  4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
  5. Where indicated, cast handhole cover frame integrally with handhole structure.
- D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
- E. Manhole Access: Circular opening in manhole roof; sized to match cover size.
1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
  2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
- F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
- G. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 7 Section "Bituminous Dampproofing." After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
- H. Coordinate paragraph below with Drawings. Delete second option if nonmetallic cable racks are specified.
- I. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- J. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

## UNDERGROUND DUCTS

- K. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
- L. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

### 3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
  - 1. Concrete: 3000 psi, 28-day strength, complying with Division 3 Section "Cast-in-Place Concrete," with a troweled finish.
  - 2. Dimensions: 10 inches wide by 12 inches deep.

### 3.7 GROUNDING

- A. Ground underground ducts and utility structures according to Division 16 Section "Grounding and Bonding."

**3.8 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections and prepare test reports:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
  - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
  - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 16 Section "Grounding and Bonding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

**3.9 CLEANING**

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

**END OF SECTION**

## **SECTION 16139 CABLE TRAYS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes aluminum and stainless-steel cable trays and accessories.

#### **1.3 SUBMITTALS**

- A. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
  - 1. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
- C. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements. Show the following:
  - 1. Vertical and horizontal offsets and transitions.
  - 2. Clearances for access above and to side of cable trays.
  - 3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
- D. Field quality-control reports.

#### **1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

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- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Aluminum cable trays and stainless-steel cable trays may be stored outside without cover, but shall be loosely stacked, elevated off the ground, and ventilated to prevent staining during storage.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Chalfant Manufacturing Company.
  - 2. Cooper B-Line, Inc.
  - 3. Cope, T. J., Inc.; a subsidiary of Allied Tube & Conduit.
  - 4. GS Metals Corp.; GLOBETRAYS Products.
  - 5. MONO-SYSTEMS, Inc.
  - 6. MPHusky.
  - 7. PW Industries.

### 2.2 MATERIALS AND FINISHES

- A. Cable Trays, Fittings, and Accessories: Aluminum, complying with NEMA VE 1, Aluminum Association's Alloy 6063-T6 for rails, rungs, and cable trays, and Alloy 5052-H32 or Alloy 6061-T6 for fabricated parts; with Type 316 stainless-steel splice-plate fasteners, bolts, and screws
- B. Cable Trays, Fittings, and Accessories: Stainless steel, Type 316, complying with NEMA VE 1.

**2.3 CABLE TRAY ACCESSORIES**

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Covers: Solid type of same materials and finishes as cable tray.
- C. Barrier Strips: Same materials and finishes as cable tray.
- D. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

**2.4 WARNING SIGNS**

- A. Lettering: 1-1/2-inch- high, black letters on yellow background with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."
- B. Materials and fastening are specified in Division 16 Section "Electrical Identification."

**2.5 SOURCE QUALITY CONTROL**

- A. Perform design and production tests according to NEMA VE 1.

**PART 3 - EXECUTION**

**3.1 CABLE TRAY INSTALLATION**

- A. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.
- B. Remove burrs and sharp edges from cable trays.
- C. Fasten cable tray supports to building structure and install seismic restraints.
  - 1. Place supports so that spans do not exceed maximum spans on schedules.
  - 2. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
  - 3. Support bus assembly to prevent twisting from eccentric loading.
  - 4. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.

5. Locate and install supports according to NEMA VE 1.
- D. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.
- E. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA VE 1. Space connectors and set gaps according to applicable standard.
- F. Make changes in direction and elevation using standard fittings.
- G. Make cable tray connections using standard fittings.
- H. Seal penetrations through fire and smoke barriers according to Division 7.
- I. If cable trays are sized for future cables, specify provisions for penetrations with sleeves through fire-rated partitions or use "repairable" firestop-sealing material. Include specific firestopping requirements of this Section in a schedule developed in the Division 7 Section referenced in paragraph above.
- J. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- K. Workspace: Install cable trays with enough space to permit access for installing cables.
- L. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- M. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

### 3.2 CABLE INSTALLATION

- A. Install cables only when cable tray installation has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. On vertical runs, fasten cables to tray every 18 inches. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- D. In existing construction, remove inactive or dead cables from cable tray.



- E. Install covers after installation of cable is completed.

### 3.3 CONNECTIONS

- A. Ground cable trays according to manufacturer's written instructions.
- B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

### 3.4 FIELD QUALITY CONTROL

- A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:
  - 1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.
  - 2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.
  - 3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.
  - 4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.
  - 5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
  - 6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
  - 7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.
- B. Report results in writing.

**3.5 PROTECTION**

A. Protect installed cable trays.

1. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

**END OF SECTION**

**SECTION 16140**  
**WIRING DEVICES**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Twist-locking receptacles.
  - 3. Receptacles with integral surge suppression units.
  - 4. Isolated-ground receptacles.

1.3 DEFINITIONS

- A. Retain term and abbreviations that remain after this Section has been edited.
- B. EMI: Electromagnetic interference.
- C. GFCI: Ground-fault circuit interrupter.
- D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- E. RFI: Radio-frequency interference.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Retain first paragraph below if products have critical features needing hands-on appraisal.
- D. Field quality-control test reports.

## WIRING DEVICES

- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain all wiring devices and associated wall plates from a single manufacturer and one source. (No deviation without written permission from the owner and engineer.)
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

### 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Retain subparagraph below if cord and plug sets are specified in Part 2.
  - 2. Cord and Plug Sets: Match equipment requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5351 (single), 5352 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).

## WIRING DEVICES

- c. Leviton; 5891 (single), 5352 (duplex).
  - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; CR 5253IG.
    - b. Leviton; 5362-IG.
    - c. Pass & Seymour; IG6300.
  - 2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; TR8300.
    - b. Hubbell; HBL8300SG.
    - c. Leviton; 8300-SGG.
    - d. Pass & Seymour; 63H.
    - e. <Insert manufacturer's name; catalog number.>
  - 3. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

### 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Cooper; GF20.
  - 2. Pass & Seymour; 2084.

### 2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

## WIRING DEVICES

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

### B. Duplex TVSS Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; 5362BLS.
  - b. Hubbell; HBL5362SA.
  - c. Leviton; 5380.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

### C. Isolated-Ground, Duplex Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; IG5362BLS.
  - b. Hubbell; IG5362SA.
  - c. Leviton; 5380-IG.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

## 2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

### A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper Crouse-Hinds.
  - b. EGS/Appleton Electric.
  - c. Killark; a division of Hubbell Inc.

## 2.6 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

## WIRING DEVICES

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; L520R.
  - b. Hubbell; HBL2310.
  - c. Leviton; 2310.
  - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
  1. Products: Subject to compliance with requirements, provide one of the following:
  2. Hubbell; IG2310.
    - a. Leviton; 2310-IG.
  3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

### 2.7 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
  2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

### 2.8 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  1. Wiring Devices Connected to Normal Power System: As selected by Engineer, unless otherwise indicated or required by NFPA 70 or device listing.
  2. Wiring Devices Connected to Emergency Power System: Red.
  3. TVSS Devices: Blue.
  4. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtail existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.



## WIRING DEVICES

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Recommendation in subparagraph below is made in IEEE 602.

G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

H. Coordinate two paragraphs below with Drawings.

I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

J. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with [black] [white] [red]-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

**B. Tests for Convenience Receptacles:**

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

**END OF SECTION**

**SECTION 16289**  
**SURGE PROTECTION DEVICES**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes SPDs for low-voltage power, control, and communication equipment.
- B. Related Sections include the following:
  - 1. Division 16 Section "Wiring Devices" for devices with integral SPDs.

1.3 DEFINITIONS

- A. Retain abbreviations that remain after this Section has been edited.
- B. ATS: Acceptance Testing Specifications.
- C. SVR: Suppressed voltage rating.
- D. SPD: Surge Protection Device.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
  - 1. UL 1283.
  - 2. UL 1449.
- C. Coordinate paragraph below with qualification requirements in Division 1 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.

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- D. Retain first paragraph and subparagraphs below if Contractor is responsible for field quality-control testing.
- E. Field quality-control test reports, including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Failed test results and corrective action taken to achieve requirements.
- F. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- E. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- F. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

### 1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Engineer's written permission.

## TRANSIENT VOLTAGE SUPPRESSION

- B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
  - 2. Operating Temperature: 30 to 120 deg F.
  - 3. Humidity: 0 to 85 percent, noncondensing.
  - 4. Altitude: Less than 20,000 feet above sea level.

### 1.7 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.
- B. Coordinate surge protection devices with Division 16 Section "Electrical Power Monitoring and Control."

### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.

### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Replaceable Protection Modules: One of each size and type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products.
- B. Retain above for nonproprietary or below for semiproprietary specification. Refer to Division 1 Section "Product Requirements."
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Advanced Protection Technologies, Inc.
2. Current Technology, Inc.
3. Leviton Mfg. Company Inc.
4. Liebert Corporation; a division of Emerson.
5. Square D; Schneider Electric.
6. Surge Suppression Incorporated.
7. Cuttler-Hammer

### 2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
  2. Audible alarm, with silencing switch, to indicate when protection has failed.
  3. One set of dry contacts per phase rated at 5 A and 250-V ac, for remote monitoring of protection status. (Contacts shall be connected in either series or parallel as required to provide a single input to the plant control system.)
- B. Retain first option in first paragraph below for high exposure and cost, second option for medium exposure and cost, and third option for low exposure and cost.
- C. Peak Single-Impulse Surge Current Rating: 300 kA per phase.
- D. Connection Means: Permanently wired.
- E. Retain one of four paragraphs and associated subparagraphs below. Adjust clamping voltages to comply with Project conditions and verify compatibility of peak surge current rating and clamping voltage. Reference to UL 1449 is to the Second Edition.
- F. Protection modes and UL 1449 SVR for delta circuits with voltages of 480V, 3-phase, 3-wire circuits shall be as follows:
1. Line to Line: 1500 V for 480V.
  2. Line to Ground: 1000 V for 480V.

### 2.3 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.

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2. Audible alarm, with silencing switch, to indicate when protection has failed.
  3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Retain first option in paragraph below for high exposure and cost, second option for medium exposure and cost, and third option for low exposure and cost.
- C. Peak Single-Impulse Surge Current Rating: 50 kA per phase.
- D. Retain one of four paragraphs and associated subparagraphs below. Adjust clamping voltages to comply with Project conditions and verify compatibility of peak surge current rating and clamping voltage. Reference to UL 1449 is to the Second Edition.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120.
  2. Line to Ground: 400 V for 208Y/120.
  3. Neutral to Ground: 400 V for 208Y/120.
- F. Protection modes and UL 1449 SVR for delta circuits with voltages of 480V, 3-phase, 3-wire circuits shall be as follows:
1. Line to Line: 1500 V for 480V.
  2. Line to Ground: 800 V for 480V.

### 2.4 PLUG-IN SURGE SUPPRESSORS

- A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and accessories:
1. LED indicator lights for power and protection status.
  2. LED indicator lights for reverse polarity and open outlet ground.
  3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
- B. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
- C. Protection modes and UL 1449 SVR shall be as follows:
1. Line to Neutral: 475 V.
  2. Line to Ground: 475 V.
  3. Neutral to Ground: 475 V.

**2.5 ENCLOSURES**

- A. Interior enclosures to be NEMA 1.
- B. Exterior enclosures to be NEMA 4X, Stainless Steel.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF SURGE PROTECTION DEVICES**

- A. Install devices at each service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for each panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
  - 1. Comply with manufacturer's written recommendation for conductor and circuit-breaker size for connecting SPD devices to distribution system. Match circuit-breaker size to conductor size. Coordinate with Drawings.
  - 2. Provide multipole, circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

**3.2 PLACING SYSTEM INTO SERVICE**

- A. Do not energize or connect service entrance equipment, panelboards, control terminals, and data terminals to their sources until surge protection devices are installed and connected.

**3.3 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation, including connections, and to assist in field testing. Report results in writing.
  - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. Testing: Perform the following field tests and inspections and prepare test reports:
  - 1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.



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2. Complete startup checks according to manufacturer's written instructions.
  3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
- C. Remove and replace malfunctioning units and retest as specified above.

### **3.4 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 1 for training requirements.

**END OF SECTION**

**SECTION 16410**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Receptacle switches.
  - 4. Molded-case circuit breakers (MCCBs).
  - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. First two paragraphs below are defined in Division 1 Section "Submittal Procedures" as "Action Submittals."
- B. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Retain first subparagraph below if using series rating of overcurrent protective devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 6. Retain subparagraph below if final system short-circuit and coordination studies will be performed by the designer or will be assigned to an independent consultant. These curves are also beneficial to Owner for future additions or reevaluations of settings of overcurrent protective devices. Although some

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## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

manufacturers no longer offer curves on translucent graph paper, curves can normally be downloaded from manufacturers' Web sites or be obtained, in electronic form, from various coordination software vendors as part of a subscription service. Retain option in subparagraph below only if manufacturers selected offer curves on graph paper.

7. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
  - C. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
    1. Wiring Diagrams: For power, signal, and control wiring.
  - D. Remaining paragraphs are defined in Division 1 Section "Submittal Procedures" as "Informational Submittals."
  - E. Coordinate first paragraph below with qualification requirements in Division 1 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.
  - F. Retain first paragraph below if retaining "Manufacturer's Field Service" Paragraph in "Field Quality Control" Article. Consider manufacturer's field services especially when retaining zone-selective interlocking because setting it to operate properly requires factory-trained expertise.
  - G. Manufacturer's field service report.
  - H. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
    1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
- 1.5 Retain option in subparagraph below only if manufacturers selected offer curves on graph paper.

### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- D. Comply with NFPA 70.

### 1.7 PROJECT CONDITIONS

- A. Specify unusual environmental or service conditions in first paragraph below. For equipment installed outdoors, indicate maximum and minimum ambient temperature and expected humidity range. For additional ambient compensation requirements for fuses, see Editing Instruction No. 5 in the Evaluations.
- B. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
  - 2. Altitude: Not exceeding 6600 feet (2010 m).
- C. Retain paragraph below if interruption of existing electric service is required.
- D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Engineer no fewer than seven days in advance of proposed interruption of electric service.
  - 2. Indicate method of providing temporary electric service.
  - 3. Do not proceed with interruption of electric service without Engineer's written permission.
  - 4. Comply with NFPA 70E.

### 1.8 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### 1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Fuse Pullers: Two for each size and type.

## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 2 - PRODUCTS

#### 2.1 FUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Siemens
  - 2. Square D
  - 3. Allen-Bradley
  - 4. Cutler-Hammer
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  - 6. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 7. Lugs: Mechanical type, suitable for number, size, and conductor material.
  - 8. Service-Rated Switches: Labeled for use as service equipment.

## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### 2.2 NONFUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Siemens
  - 2. Square D
  - 3. Allen-Bradley
  - 4. Cutler-Hammer
- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.

- 2.3 Retain subparagraph below if retaining "Auxiliary Contact Kit" Subparagraph above and if remote-control power for remote indication is not specified in other Sections. See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. Integrally mounted control power is not available in safety switches.

### 2.4 RECEPTACLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. Hubble
  - B. Type 4, IP66 Rated, Twist lock, amp rated, combination safety switch and receptacle
  - C. Receptacle: Twist lock, three-phase, four-wire or five-wire receptacle (one wire connected to enclosure ground lug).
- 2.5 If more than one type or rating of receptacle-switch combination is required, consider showing location of each on Drawings and deleting subparagraph below; otherwise, insert required information.
- 2.6 MOLDED-CASE CIRCUIT BREAKERS.
- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following (all switches to be manufactured by the same manufacturer as the motor control centers used on the project):
    1. Cutler-Hammer
    2. Square D
    3. Engineer approved equal
  - B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
  - C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
    1. Instantaneous trip.
    2. Long- and short-time pickup levels.
    3. Long- and short-time time adjustments.
    4. Ground-fault pickup level, time delay, and  $I^2t$  response.
  - F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
  - G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
  - H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### I. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor. (Provide only when shown on the single line, or required by code)
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact. (Provide when indicated on drawing)
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay. (Provide when indicated on drawings)
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts. (Provide when indicated on drawing)
8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped. (Provide when indicated on drawing)
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position. (Provide when indicated on drawing)

### 2.7 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  2. Outdoor Locations: NEMA 250, Type 4X stainless steel.
  3. Corrosion Areas: NEMA 250, Type 4X fiberglass.
  4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X stainless steel.
  5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 4X stainless steel

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



## ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 16 Section "Electrical Identification."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

## **ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

- c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections..
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### **3.5 ADJUSTING**

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges to provide selective coordination above 0.1 seconds.

**END OF SECTION**

## **SECTION 16442 PANELBOARDS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Load centers.
  - 4. Electronic-grade panelboards.

#### **1.3 DEFINITIONS**

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.

## PANELBOARDS

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  6. Include wiring diagrams for power, signal, and control wiring.
  7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device (on project with emergency generators upstream of the panelboard, provide selective coordination for all panelboard circuit breakers).
- C. Field Quality-Control Reports:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

**1.7 PROJECT CONDITIONS**

- A. Environmental Limitations (NEMA 1 and NEMA 12 Panelboards Only):
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
    - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Engineer no fewer than two days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Engineer's written permission.
  - 3. Comply with NFPA 70E.

**1.8 COORDINATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

**1.9 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Per general conditions of the contract.

**1.10 EXTRA MATERIALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Two spares for each type of panelboard cabinet lock.
  - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
  - 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR PANELBOARDS**

- A. Enclosures: Flush- and surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250, Type 4X stainless steel.
    - c. Corrosion Areas: NEMA 250, Type 4X fiberglass.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4 stainless steel.
    - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
  - 3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  - 4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

5. Finishes:
    - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized for NEMA 1 and NEMA12. Stainless steel for NEMA 4X..
    - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
  6. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads (see Drawings for requirements).
  4. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Main and Neutral Lugs: Mechanical type.
  3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
  4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device (see Drawings for requirements).
  5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
  6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
  7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

## PANELBOARDS

- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

### 2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. Square D/Schneider Electric
  - 3. Siemens
  - 4. Engineer approved equal
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: See panelboard schedules on Drawings.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- G. Branch Overcurrent Protective Devices: Fused switches.
  - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

### 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. Square D/Schneider Electric
  - 3. Siemens



- 4. Engineer approved equal
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: See panelboard schedules on Drawings.
- D. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.
  - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. Square D/Schneider Electric
  - 3. Siemens
  - 4. Engineer approved equal
- B. Coordinate two paragraphs below with Drawings. See the "Disconnecting and Overcurrent Protective Devices" Article in the Evaluations for guidance on making selections.
- C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

## PANELBOARDS

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
  - a. Standard frame sizes, trip ratings, and number of poles.
  - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
  - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
  - f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
  - g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
  - h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
  - i. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
  - j. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

### 2.5 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Current Technology; a subsidiary of Danahar Corporation.
  2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  3. Liebert Corporation.
  4. Engineer approved equal

- B. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
1. Accessories:
    - a. LED indicator lights for power and protection status.
    - b. Audible alarm, with silencing switch, to indicate when protection has failed.
    - c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
  2. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.
  3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
    - a. Line to Neutral: 70,000.
    - b. Line to Ground: 70,000.
    - c. Neutral to Ground: 50,000.
  4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
  5. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 and 208Y/120-V, three-phase, four-wire circuits shall be as follows:
    - a. Line to Neutral: 800 V for 480Y/277 or 400 V for 208Y/120.
    - b. Line to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.
    - c. Neutral to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.

## 2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 3 Section "Cast-in-Place Concrete."
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
  - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to panelboards.
  - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.
- H. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- J. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 16 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.

## PANELBOARDS

- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 16 Section "Overcurrent Protective Device Coordination."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

### 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

**END OF SECTION**

**SECTION 16443**  
**MOTOR CONTROL CENTERS**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes motor-control centers for use on ac circuits rated 600 V and less.
- B. Related Sections include the following:
  - 1. Division 16 Section

1.3 SUBMITTALS

- A. Product Data: For each type of controller and each type of motor-control center. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each motor-control center.
  - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.
    - c. Short-circuit current ratings of buses and installed units.
    - d. Vertical and horizontal bus capacities.
    - e. Retain first subparagraph below if series rating of overcurrent protective devices is used or if combination controllers are used.
    - f. Features, characteristics, ratings, and factory settings of each motor-control center unit.
    - g. Harmonic correction calculations.
    - h. Cable Terminations
    - i. Busway connections
    - j. Listing of overcurrent device coordination

## MOTOR CONTROL CENTERS

2. Wiring Diagrams: Power, signal, and control wiring for class and type of motor-control center. Provide schematic wiring diagram for each type of controller.
- C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around motor-control centers where pipe and ducts are prohibited. Show motor-control center layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Qualification Data: For manufacturer.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For motor-control centers, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1.
  1. Routine maintenance requirements for motor-control centers and all installed components.
  2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- G. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain motor-control centers and controllers of a single type through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.
- E. Motor control centers are to be built to the latest NEMA standards.
- F. The motor control center shall be designed, manufactured and tested in facilities registered to the ISO 9001 standard.



## MOTOR CONTROL CENTERS

- G. Product Selection for Restricted Space: Drawings indicate maximum dimensions for motor-control centers, including clearances between motor-control centers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver motor-control centers in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.
- B. Handle motor-control centers according to the following:
  - 1. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
  - 2. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."

### 1.6 COORDINATION

- A. Coordinate layout and installation of motor-control centers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place" Concrete."
- C. Coordinate features of motor-control centers, installed units, and accessory devices with pilot devices and control circuits to which they connect.
- D. Coordinate features, accessories, and functions of each motor-control center, each controller, and each installed unit with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.
- E. Provide selective coordination of all overcurrent devices including: circuit breakers, fuses, overload relays, and motor circuit protectors. The selective coordination shall be from the generator circuit breaker, through the low voltage transfer switch, through the MCC, to the motors/low voltage panelboard breakers.

**1.7 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Spare Fuses: Furnish one spare for every five installed, but no less than one set of three of each type and rating.
  - 2. Indicating Lights: Two of each type installed.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D / Schneider Electric
  - 2. Eaton/Cutler Hammer
  - 3. Allen-Bradley
  - 4. Siemens

**2.2 MOTOR-CONTROL CENTERS**

- A. Wiring: NEMA ICS 3, Class I, Type B.
- B. Enclosures: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
  - 1. Outdoor Locations: NEMA 250, Type 4X Stainless Steel.
  - 2. Compartments: Modular; individual doors with concealed hinges and quick-captive screw fasteners (The captive screw fasteners shall be equipped with springs that allow the door to partially open in the event of an ARC Fault to vent the gasses without the door completely opening.). Interlocks on combination controller units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.
  - 3. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in motor-control center; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.

## MOTOR CONTROL CENTERS

4. Wiring Spaces: Wiring channel in each vertical section for vertical and horizontal wiring to each unit compartment; supports to hold wiring in place.
  5. Provide a barrier between the wiring spaces and the MCC buckets to prevent inadvertent contact with energized parts.
- C. Short-Circuit Current Rating for Each Section: Equal to or greater than indicated available fault current in symmetrical amperes at motor-control center location.
- D. Each MCC bucket shall have the ground connection made before the power connections are made.

### 2.3 BUSES

- A. Material: Plated hard-drawn copper, 98 percent conductivity.
- B. Ampacity Ratings: As indicated for horizontal and vertical main buses.
- C. Neutral Buses: Full size.
- D. Equipment Ground Bus: Noninsulated, horizontal configuration; adequate for equipment ground conductors; bonded to enclosure.
- E. Horizontal Bus Arrangement: Main phase, neutral and ground buses extended with same capacity the entire length of motor-control center, with provision for future extension at both ends by bolt holes and captive bus splice sections or equivalent.
- F. Short-Circuit Withstand Rating: Same as short-circuit current rating of section.

### 2.4 FUNCTIONAL FEATURES

- A. Description: Modular arrangement of controllers, control devices, overcurrent protective devices, transformers, panelboards, instruments, indicating panels, blank panels, and other items mounted in compartments of motor-control center.
- B. Controller Units: Combination controller units of types and with features, ratings, and circuit assignments indicated.
1. Install units up to and including Size 3 on draw-out mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
  2. Provide units with short-circuit current ratings equal to or greater than short-circuit current rating of motor-control center section.

## MOTOR CONTROL CENTERS

3. Equip units in Type B and Type C motor-control centers with pull-apart terminal strips or draw-out terminal boards for external control connections.
4. Controller Disconnecting Means: Factory-assembled combination disconnect and controller (see single line for type).
  - a. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by an NRTL.
  - b. Non-fusible Disconnecting Means: NEMA KS 1, heavy-duty, non-fusible switch.
  - c. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- C. Overcurrent Protective Devices: Individual feeder-tap units through 225-A rating shall have draw-out mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
- D. Retain paragraph below if suppressors are required. Suppressors are specified in Division 16 Section "Transient Voltage Suppression."
- E. Transient Voltage Surge Suppressors (TVSS): Connect to motor-control center bus. Provide TVSS protection for all MCC equipment, VFDs, and Soft Starts.
- F. Coordinate two paragraphs below with Drawings. Indicate, in schedule, sizes of future controllers to be accommodated.
- G. Spaces and Blank Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of draw-out units.
- H. Spare Units: Type, sizes, and ratings indicated; installed in compartments indicated "spare."
- I. Cubicles for motor starters with exhaust fans shall have an adjustable thermostat in parallel with a set of running contacts from the motor starter to allow the exhaust fans to operate only when the load is operational or if the temperature exceeds a desired level. The thermostats shall be initially set to 80 degrees.
- J. Motor heater circuits shall be provided for all motor load cubicles. A 120Vac branch circuit from the cubicle's control transformer shall be fused and controlled through a set of contacts from the associated starter. The contacts shall open whenever the associated starter is running and close whenever the starter is off to provide power to the associated motor heater.

### 2.5 ACROSS-THE-LINE CONTROLLERS

- A. Manual Controller: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.
- B. Magnetic Controller: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, unless otherwise indicated.
  - 1. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
  - 2. Overload Relay: See Section 2.9 for overload relay requirements.

### 2.6 REDUCED-VOLTAGE CONTROLLERS

- A. Solid-State, Reduced-Voltage Controller (see drawing for requirements): NEMA ICS 2, suitable for use with NEMA MG 1, Design B, polyphase, induction motors.
  - 1. Adjustable acceleration rate control utilizing voltage or current ramp, and adjustable starting torque control with up to 500 percent current limitation for 20 seconds.
  - 2. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
  - 3. LED indicators showing motor and control status, including the following conditions:
    - a. Control power available.
    - b. Controller on.
    - c. Overload trip.
    - d. Loss of phase.
    - e. Shorted silicon-controlled rectifier.
  - 4. Motor running contactor operating automatically when full voltage is applied to motor.
  - 5. Communication interface to plant control system PLC which will allow for remote control, reset, programming, and viewing of the starter data from the HMI interface and the plant control system.

2.7 VARIABLE FREQUENCY DRIVES (VFD)

- A. Description: NEMA ICS 2, pulse-width-modulated, variable frequency controller; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency.
  - 1. Provide unit suitable for operation of premium-efficiency motor as defined by NEMA MG 1.
- B. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- C. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
- D. Unit Operating Requirements:
  - 1. Input ac voltage tolerance of 380 to 500 V, plus or minus 10 percent.
  - 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
  - 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
  - 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
  - 5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
  - 6. Starting Torque: 100 percent of rated torque or as indicated.
  - 7. Speed Regulation: Plus or minus 1 percent.
  - 8. Ambient Temperature: 0 to 40 deg C.
- E. Isolated control interface allows controller to follow control signal over an 11:1 speed range.
  - 1. Electrical Signal: 4 to 20 mA at 24 V.
- F. Internal Adjustability Capabilities:
  - 1. Minimum Speed: 5 to 25 percent of maximum rpm.
  - 2. Maximum Speed: 80 to 100 percent of maximum rpm.
  - 3. Acceleration: 2 to a minimum of 22 seconds.
  - 4. Deceleration: 2 to minimum of 22 seconds.
  - 5. Current Limit: 50 to a minimum of 110 percent of maximum rating.
- G. Self-Protection and Reliability Features:
  - 1. Input transient protection by means of surge suppressors.
  - 2. Under- and overvoltage trips; inverter over-temperature, overload, and overcurrent trips.

## MOTOR CONTROL CENTERS

3. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10, 20, or 30 performance.
  4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
  5. Instantaneous line-to-line and line-to-ground overcurrent trips.
  6. Loss-of-phase protection.
  7. Reverse-phase protection.
  8. Short-circuit protection.
  9. Motor over-temperature fault.
- H. Each VFD shall be equipped with a communication interface to plant control system PLC which will allow for remote control, reset, programming, and viewing of all VFD data from the HMI interface and the plant control system.
- I. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Restarting during deceleration shall not damage controller, motor, or load.
- J. Power-Interruption Protection: Prevents motor from re-energizing after a power interruption until motor has stopped.
- K. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
1. Power on.
  2. Run.
  3. Overvoltage.
  4. Line fault.
  5. Overcurrent.
  6. External fault.
- L. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
- M. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate controller output current, voltage, and frequency.
- N. Bypass Controller (provide bypass controller when shown on single line diagram): NEMA ICS 2, full-voltage, non-reversing enclosed controller with across-the-line starting capability in manual-bypass mode or soft starts based on what is shown. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability in either mode.
- O. Integral Disconnecting Means: NEMA AB 1, molded-case switch with lockable handle.

- P. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- Q. Provide a HAND-OFF-AUTO three-position selector switch and manual speed pot on the door of each VFD enclosure to facilitate in manual operation.
- R. Provide 5% input line reactors and output reactors for each VFD supplied.

## 2.8 FEEDER OVERCURRENT PROTECTION

- A. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 2. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 4. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
  - 5. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
  - 6. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 7. Ground-Fault Protection (provide when shown on single line diagram): Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 8. Communication Capability (provide when required by control system): Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system.
  - 9. Shunt Trip (provide when required by control system): 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.



10. Auxiliary Switch (provide when required by control system): One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts; "b" contacts operate in reverse of circuit-breaker contacts.
- B. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses with lockable handle.

## 2.9 ACCESSORIES

- A. All motor control centers starters (full voltage & reduced voltage) to be provided with the motor control center manufacturer's standard electronic overload relays capable of the following:
  1. Motor Overload / Underload Protection
  2. Phase Loss / Phase Imbalance
  3. Ground Fault
  4. Stall (high current during start)
  5. Jam (high current during run)
  6. Overload Time-to-trip, Overload time-to-reset
  7. Percent thermal capacity utilized
  8. Power Information
    - a. KW
    - b. KVAR
    - c. PF
  9. Welded contactor alarm
  10. Loss of communication alarm
  11. Motor Thermistor input
  12. 4 digital inputs
  13. 2 relay outputs
  14. Remote reset capability from the local HMI or over the plant control network
  15. Communication capability to the plant control system
- B. All soft starts and variable frequency drives shall be provided with Ethernet communication interface modules to allow communication to the plant control system for monitoring and control. The operator shall be able to download configuration data, view status and alarm data of each device from the plant control system HMI.
- C. The control system shall store and trend all information available from the electronic overloads, VFDs, & soft starts. Trend intervals shall be as directed by the Engineer. All trend data shall be stored in a historical database.
- D. The system HMI shall provide the following information for maintenance purposes:

## MOTOR CONTROL CENTERS

1. The HMI shall be capable of providing detailed drawings for each motor control center bucket. The drawings shall show all internal and external wiring.
  2. The HMI shall be capable of providing detailed parts list for each component contained within each MCC bucket.
  3. The HMI shall be interfaced with the plant's spare parts inventory management system to allow the maintenance staff to know if a desired spare part is available on site.
  4. The HMI shall have a visual representation of the MCC as one of its maintenance screens. By allowing the operator to select a specific bucket, soft start, or variable frequency drive; the HMI shall display real time data as follows:
    - a. Amps each phase
    - b. Voltage each phase
    - c. Current Prior to Last Trip
    - d. Average Current Each Phase
    - e. Current Each Phase at Last Calibration
    - f. Starter Status
    - g. Ground Fault Status
    - h. Status of each I/O in the bucket
    - i. Soft Starts
      - 1) configuration data
      - 2) most recent faults
      - 3) amps
      - 4) volts
      - 5) overload condition
      - 6) fault history with the last 10 events (date/time stamp)
      - 7) remote fault resets
    - j. VFDs
      - 1) configuration data
      - 2) speed
      - 3) frequency
      - 4) fault history with the last 10 events (date/time stamp)
      - 5) amps
      - 6) volts
      - 7) overload conditions
      - 8) remote fault resets
- E. Electronic Overload Relay Power Sources: All electronic relays not powered from the individual starter buckets shall be provided with redundant power supplies on the buss.

## MOTOR CONTROL CENTERS

- F. In the event of a component failure the Motor Control Center shall alarm the operator of the failed components. Upon installation of the new equipment, the Control System shall notify the operator of the newly located device. The Control System shall automatically re-address and configure the newly installed device with failed devices address and latest configuration parameter settings. The operator shall not be required to manually enter the device configuration parameters for the new device. The Control System shall be responsible for recording and storing all system configuration parameters, such that the Operators are not required to maintain separate configuration files or records for each device installed in the system.
- G. The Motor Control Center shall be provided with automatic vertical bus shutters.
- H. Control power shall be provided by individual unit control power transformers located in each individual MCC cubicle, as required for control circuit power. The control power transformer shall be de-energized upon power being disengaged from the associated cubicle.

### 2.10 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and factory-tested, motor-control centers before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and surfaces to receive motor-control centers for compliance with requirements, installation tolerances, and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATIONS

- A. Select features of each controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

**3.3 INSTALLATION**

- A. Install motor-control centers on concrete bases.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

**3.4 CONCRETE BASES**

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

**3.5 IDENTIFICATION**

- A. Identify motor-control center, motor-control center components, and control wiring according to Division 16 Section "Electrical Identification."
- B. Operating Instructions: Frame printed operating instructions for motor-control centers, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of motor-control centers.

**3.6 CONTROL WIRING INSTALLATION**

- A. Install wiring between motor-control devices according to Division 16 Section "Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

**3.7 CONNECTIONS**

- A. Conduit installation requirements are specified in other Division 16 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 16 Section "Grounding and Bonding."

**3.8 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each motor-control center element, bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
  - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
  - 2. Report results in writing.
- C. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each electrical test and visual and mechanical inspection, except for optional tests, stated in NETA ATS "Motor Control Centers." Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

**3.9 ADJUSTING**

- A. Set field-adjustable switches and circuit-breaker trip ranges based on overcurrent device coordination study.

**3.10 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain components of motor-control centers including solid-state controllers. Refer to Division 1.

**END OF SECTION**

**SECTION 16461**  
**LOW-VOLTAGE TRANSFORMERS**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
  - 1. Distribution transformers.
  - 2. Buck-boost transformers.

1.3 SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- C. Qualification Data: For testing agency.
- D. Source quality-control test reports.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. If an independent testing agency is required, see Division 1 Section "Quality Requirements" for general testing and inspecting agency qualification requirements. If additional control is

## LOW VOLTAGE TRANSFORMERS

needed, retain one of first two paragraphs below to specify 29 CFR 1910.7 or other more specific criteria (e.g., NETA). 29 CFR 1910.7 defines a nationally recognized testing laboratory as it applies to testing and inspecting for safety, and lists, labels, or accepts equipment and materials that meet certain OSHA criteria.

- B. Retain first paragraph and subparagraph below if Contractor selects testing agency.
- C. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

### 1.6 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Products.
  - 2. Square D; Schneider Electric.
  - 3. Siemens

### 2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Copper.

### 2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Interior Noncorrosive Area Enclosures: Ventilated, NEMA 250, Type 2.
  - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Exterior/Interior Corrosive Area Enclosures: Totally enclosed, nonventilated, NEMA 250, Type 4X, stainless steel.
  - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
  - 1. Finish Color: ANSI 49 gray.
- F. Taps for Transformers Smaller Than 3 kVA: None.
- G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- J. Energy Efficiency for Transformers Rated 15 kVA and Larger:
  - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
  - 2. Tested according to NEMA TP 2.
- K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.



## LOW VOLTAGE TRANSFORMERS

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

L. Wall Brackets: Manufacturer's standard brackets.

M. Fungus Proofing: Permanent fungicidal treatment for coil and core.

N. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

### 2.4 BUCK-BOOST TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.

B. Enclosure: Ventilated, NEMA 250, Type 2.

1. Finish Color: ANSI 49 gray.

### 2.5 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Electrical Identification."

### 2.6 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

## LOW VOLTAGE TRANSFORMERS

- D. Verify that ground connections are in place and requirements in Division 16 Section "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

### 3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
  - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - 2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
  - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

## LOW VOLTAGE TRANSFORMERS

### 3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

### 3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

**END OF SECTION**

## **SECTION 16491 FUSES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers, and motor-control centers.
  - 2. Spare-fuse cabinets.

#### **1.3 SUBMITTALS**

- A. First paragraph below is defined in Division 1 Section "Submittal Procedures" as an "Action Submittal."
- B. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
  - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
    - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
  - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 3. Current-limitation curves for fuses with current-limiting characteristics.
  - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

5. Coordination charts and tables and related data.
  6. Fuse sizes for elevator feeders and elevator disconnect switches.
- C. Paragraph below is defined in Division 1 Section "Submittal Procedures" as an "Informational Submittal."
- D. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
1. Ambient temperature adjustment information.
  2. Current-limitation curves for fuses with current-limiting characteristics.
  3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
  4. Coordination charts and tables and related data.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

#### 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

#### 1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

**1.7 EXTRA MATERIALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Edison Fuse, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Littelfuse, Inc.

**2.2 CARTRIDGE FUSES**

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

**2.3 SPARE-FUSE CABINET**

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull. (Install in the Admin. Building as directed)
  - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
  - 4. Fuse Pullers: For each size of fuse, where applicable, from fuse manufacturer.
  - 5. Include in the cabinet a complete list of fuses used in the facility. (include: size, type, model, rating, quantity, and location)

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 FUSE APPLICATIONS**

- A. Cartridge Fuses (provide fuse type indicated below unless otherwise shown on Drawings or required by breaker coordination study):
  - 1. Service Entrance: Class T, fast acting.
  - 2. Feeders: Class RK1, time delay.
  - 3. Motor Branch Circuits: Class RK5, time delay.
  - 4. Other Branch Circuits: Class RK5, time delay.
  - 5. Control Circuits: Class CC, fast acting.

**3.3 INSTALLATION**

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

**3.4 IDENTIFICATION**

- A. Install labels complying with requirements for identification specified in Division 16 Section "Electrical Identification" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

**END OF SECTION**

**SECTION 16622**  
**STANDBY EMERGENCY GENERATOR**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. This is a performance specification for a Standby Emergency Generator Power System. No used equipment will be allowed.
- B. This section includes the performance specification for providing the standby power generation and includes, but is not limited to, a packaged engine generator system, weatherproof housing, exhaust silencer and fittings, fuel system, control panel, battery and charger, automatic transfer switch, and appurtenances, connections, and supplies required to provide a fully functioning system.
- C. The following references shall be followed for the design of the emergency power generation system.
  - 1. ANSI/NEMA 250: Enclosures for electrical equipment (1,000 volts maximum).
  - 2. ANSI/NEMA MG 1: Motors and generators.
  - 3. ANSI/NFPA: National electrical code.
  - 4. NFPA 110 Level 1.
  - 5. ANSI/NFPA 99: Health care facilities.
  - 6. ANSI/NEMA AB 1: Molded case circuit breakers.
  - 7. NEMA ICS 1: General Standards for industrial Control and Systems.
  - 8. NEMA ICS 2: Standards for Industrial Control Devices, Controllers, and Assemblies.
  - 9. NEMA ICS 6: Enclosures for Industrial Controls and Systems.
- D. The following documents are required before the Owner will accept the system for ownership and maintenance:
  - 1. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion requirements, and electrical diagrams including schematic and interconnection diagrams.
  - 2. Submit product data showing dimensions, weights ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibrator isolators, fuel system, radiator, and remote annunciator.



## **STANDBY EMERGENCY GENERATOR**

3. Submit record of system load test.
4. Accurately record location of engine generator and mechanical and electrical connections.
5. Submit 5 copies for each segment, per size, operation and maintenance data upon delivery of the emergency generator.
6. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and fuel system, oil sampling and analysis for engine wear, and emergency maintenance procedures.
7. Provide a full five-year warranty for engine and alternator against wear and defects from date of startup or three months after delivery, whichever occurs first, including the generator and transfer switch.
8. Furnish service and maintenance of emergency generator system for two years every four months from date of startup or three months after delivery, whichever occurs first.
9. Provide two additional sets of each fluid (except fuel), oil, and air filter element require for the engine generator system.
10. Furnish one set of tools for each segment (3 total) for preventive maintenance of the engine generator system. Package tools in an adequately sized metal box that is fitted for padlock and turned over to the Owner.
11. List of special tools, maintenance materials, and replacement parts.

## **PART 2 - PRODUCTS**

### **2.1 GENERATOR**

- A. The generator shall be one of the following power systems. All control panels, breakers, transfer switches, and other appurtenances shall be provided by the same manufacturer or authorized distributor and will be guaranteed to operate with the system. All parts of the system shall be covered under a single warranty by the generator manufacturer. The accepted generator manufacturer shall have a facility authorized service center within 150 miles of the project site.
- B. Approved generator manufacturers are:
  1. Caterpillar
  2. Cummings
  3. Kohner
  4. Generac
  5. Or Engineer Approved Equal

## STANDBY EMERGENCY GENERATOR

- C. Approved automatic transfer switch manufacturers are:
  - 1. Caterpillar
  - 2. Cummings
  - 3. Kohler
  - 4. Generac
  - 5. ASCO
  - 6. Zenith
  - 7. Or Engineer Approved Equal
- D. 480 volt, 3-Phase, diesel fuel operated generator will be provided.
  - 1. Note: The size as indicated on the plans is based on minimum kW requirements. If the manufacturer does not have the size shown, the next available size shall be used.
- E. Qualifications:
  - 1. Manufacturer: company specializing in packaged engine generator system with minimum ten years experience.
  - 2. Supplier: authorized distributor of engine generator manufacturer with service facilities within 150 miles of the project site. The service facility must be staffed with a minimum of 4 technicians capable of providing warranty service on the proposed equipment (generator and ATS).
  - 3. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24 hours and 95% within 48 hours. 80% of the spare parts inventory necessary to provide service or repairs for each size (as a group) generator set being provided.

### 2.2 ENGINE

- A. Type: Water-cooled inline or V-type, diesel engine, operating at no more than 1800 rpm. Shall be provided with a skid-mounted double wall fuel storage tank. Sized as required to operate all loads shown on the drawings.
- B. The engine shall have a rating sufficient to operate at 100 percent load for duration of the power outage specified elevation and ambient temperature limits. The unit has been sized to start all motors at each location.
- C. The engine shall have an electronic governor.
- D. The generator shall be capable of delivering full load amps with up to 5% total harmonic distortion.

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- E. Safety devices: engine shutdown on high water temperature, low oil pressure, over-speed, and engine over-crank. Limits as determined by manufacturer.
- F. Engine Accessories: lube oil filter, intake air filter, lube oil cooler, gear-drive water pump. Include water temperature gage, and lube oil pressure gage on engine-generator control panel. For diesel fuel units, include fuel filter, fuel pumps, fuel priming pumps, fuel primer gage, as required.
- G. Engine starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.
- H. Engine Jacket Heater: thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C), and suitable for operation on 208 or 120 volts AC.
- I. Radiator: radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F (43 degrees C). Radiator air flow restriction: 0.5 inches of water (9.34 mm of mercury), maximum.

### 2.3 GENERATOR

- A. Generator: ANSI/NEMA MG 1; three phase, four-pole, re-connectable brushless synchronous generator with brushless exciter.
- B. Insulation: ANSI/NEMA MG1, Class F.
- C. Temperature Rise: 130 degrees C standby.
- D. Enclosure: ANSI/NEMA MG1; open drip proof.

### 2.4 AUTOMATIC TRANSFER SWITCH (ATS)

- A. Provide an automatic transfer switch that is recommended by the manufacturer of the generator set. The ATS shall be rated as UL 1008. For corrosive and/or outdoor corrosive environments the switch shall be housed in a NEMA 4X stainless steel enclosure. For indoor non-corrosive environments the switch shall be housed in a NEMA 12 enclosure.
- B. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.
- C. Test Switch: Required.
- D. Return To Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
- E. Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.

## STANDBY EMERGENCY GENERATOR

- F. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal voltage.
- G. Provide adjustable time delay on transfer and re-transfer.
- H. The ATS shall be supplied with surge protection.

### 2.5 ACCESSORIES

- A. Diesel Fuel System: The fuel storage tank's volume shall be large enough to hold enough fuel to run the generator for 48 hours at full load. Tank shall be double walled painted steel fuel tank used as the base of the generator with fuel gauge, overfill protection, stage II vapor recovery, audible leak detectors, per DEP and EPA requirements. All joints shall be fully welded before preparation and painting. Provide low-level fuel indicator. The painting shall be 100% shop applied as follows:
  - 1. Organic Zinc-rich/Urethane/Urethane Coating System
    - a. Surface Preparation: SSPC-SP6 Commercial Blasting Cleaning
    - b. Prime Coat: Series 90-97 Tnemac-Zinc at 2.5 to 3.5 mils DFT
    - c. Intermediate and Finish: Series 1075 Endura-Shield-Color at 2.0 to 3.0 mils DFT each coat
    - d. Minimum Total DFT: 7.0 mils
  - 2. The bottom of the fuel tank shall be coated with 8 mil coal tar epoxy.
  - 3. In addition, the fuel tank will be manufactured so the bottom of the tank will not come in full contact with the concrete slab.
  - 4. The fuel level shall be monitored by the site control system. The level shall be transmitted to the control system through a transducer with a 4-20mA output.
- B. Batteries: Heavy duty, diesel starting type lead-acid storage batteries. Match battery voltage to starting system. Include necessary cables and clamps.
- C. Battery charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection. Full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide enclosure to meet ANSI/NEMA 250, Type 1 requirements, and unit to be mounted inside of generator enclosure.
- D. Generator Enclosure:
  - 1. Standard: Enclosures shall be painted steel, 14-gauge construction, with stainless steel hardware. Doors shall be keyed and padlockable.
  - 2. Sound Attenuated: Enclosures shall be painted steel, 14-guage construction, with stainless steel hardware. Doors shall be weather-protective seals; keyed and padlockable. Non-hydroscopic sound-insulating materials. The maximum "dB" rating shall be 80 dB. The panel openings shall be designed so as not to allow wind-driven rain to enter the

## STANDBY EMERGENCY GENERATOR

enclosure and cause damage to the unit while in operation. The enclosure shall be designed to withstand 110 mph wind speed.

3. High Wind Enclosures: Enclosure designed to withstand 130 mph wind speed, Exposure C, Importance Factor 1.15, partially enclosed condition in accordance with methodology contained in ASCE 7-98. Provide sealed shop drawings by an Engineer licensed in the State of Florida. All other conditions of E.2 above and Generator Tabulation Form apply.
- E. Enclosure shall also be designed with removal louvers for servicing generator. Generator enclosure to house battery tray, battery charger, generator circuit breakers. All electrical controls shall be contained within the enclosures.
- F. Exhaust Silencer: For standard enclosures the silencer may be mounted outside the unit. On sound attenuated enclosures the silencer shall be mounted inside the unit. Along with the exhaust silencer, additional exhaust piping shall be provided (along with necessary mounting hardware) to route the exhaust from underneath the 1<sup>st</sup> floor installation location (as shown on the project plans) to a safe area outside of the building.
- G. Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
  1. All indications for protection and diagnostics according to NFPA 110 Level 1, including remote and local annunciation.
  2. Frequency Meter: 45-65 Hz range, 3-1/2 inch (89 mm) dial.
  3. AC Output Voltmeter: 3-1/2 inch (89 mm) dial, 2 percent accuracy, with phase selector switch.
  4. AC Outlet Ammeter: 3-1/2 inch (89 mm) dial, 2 percent accuracy, with phase selector switch.
  5. Output voltage adjustment.
  6. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
  7. Engine start/stop selector switch.
  8. Engine running time meter.
  9. Oil pressure and water temperature gages.
  10. Auxiliary Relay: 3 PDT, operates when engine runs, with contact terminals pre-wired to terminal strip.
  11. Provision for regularly scheduled starting and operation of engine generator for maintenance purposes.
- H. Generator circuit breaker: Each generator shall be supplied with a unit mounted circuit breaker rated for the capacity of the generator and coordinated with the ATS.

## **STANDBY EMERGENCY GENERATOR**

### **2.6 REMOTE COMMUNICATIONS**

- A. Remote Alarm Contacts: Pre-wire SPCT contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99. The generator control panel shall provide dry contacts for the following signals at a minimum:
  - 1. Generator Running
  - 2. Generator Common Fault
  - 3. Low Fuel
- B. All alarm conditions shall be made available for connection to control unit at the generator site for transmission to a central communication facility. Additionally, all level monitored by the microprocessor shall also be made available through 4-20 ma signals or other compatible method.
- C. The supplier of the generator set is responsible for labeling where these signals are available, but not for connecting them to the local monitoring system.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation of the generator will be performed by the electrical contractor under the supervision of the general contractor.

### **3.2 TESTING**

- A. The contractor shall provide the first tank of fuel in addition to the fuel required to perform the load bank test.
- B. Provide full load test utilizing portable test bank, for four (4) hours minimum.
- C. During test, record the following at 20 minute intervals:
  - 1. Kilowatts
  - 2. Amperes
  - 3. Voltage
  - 4. Coolant temperature
  - 5. Ambient temperature
  - 6. Frequency
  - 7. Oil pressure
- D. Test alarm and shutdown circuits by simulating conditions.

## **STANDBY EMERGENCY GENERATOR**

- E. Manufacturer's representative should be present to prepare, start, test, and adjust systems. Adjust generator output voltage and engine speed.

**END OF SECTION**

**SECTION 16905**  
**PROCESS LOOP DESCRIPTION**

**PART 1        GENERAL**

**1.01    SCOPE**

The Project consists of the following major components:

Operations Building

Master Lift Station

Two (2) BNR process basins

Two (2) secondary clarifiers

Tertiary filtration systems

Aeration systems

Pumping systems

Solids handling facility & screw press

UV disinfection system and redundant chlorine contact basin

SCADA control system

**PART 2        GENERAL**

**2.01    GENERAL SYSTEM DESCRIPTION**

- A.    This project includes the following: process treatment equipment, power distribution, motor controls, field instrumentation, Application Software, HMI servers, HMI clients, Operator workstation, Operator Interfaces, and a PLC based control system.
- B.    The Control System shall allow the operator to monitor the operating status of all equipment located on the plant that is connected to the Plant Monitoring and Control System (PMCS).
- C.    The PMCS shall allow the operator to manually operate any piece of equipment from any of the clients, servers, or operator interfaces connected to the plant control system network on the plant site.
- D.    The PMCS shall allow the operator to easily change the operating setpoints of any piece of equipment that is automatically operated by the PMCS. The setpoint ranges shall be hard coded such that the operator may not be allowed to enter a setpoint that allows the equipment to operate out of the range or limits set forth by the equipment manufacturer. In addition, the PMCS shall have a configuration screen that allows an operator with proper security privileges to reset each of the setpoints to the default values originally programmed in the system.
- E.    The PMCS shall alarm the system operator when any equipment that was called to run fails to start or unexpectedly stops running for any reason.
- F.    The PMCS shall alarm the system operator whenever an alarm condition is present on any piece of equipment connected to the PMCS. The System



Integrator shall coordinate with the Owner to determine the desired priority level for all alarms as well as call-out scheduling and sequencing.

- G. Overall requirements of the system operation and control system operation are as described in the loop descriptions below and as defined elsewhere in the contract drawings.

## 2.02 ALARM CONDITIONS

- A. All alarm conditions for the proposed equipment shall:
  1. Provide audible and visual notification via the PMCS HMI with all of the associated alarm details.
  2. Provide remote notification via email or text to the “on-call” operator in the event that the alarm is not acknowledged within a period of time to be determined by the Owner. In the event the “on-call” operator does not acknowledge or clear the fault, the PMCS shall continue attempting to notify the operators (on the configured call-out list) until the alarm is acknowledged or cleared.

## 2.03 DATA ARCHIVAL

- A. The PMCS shall record each operation of every piece of equipment connected to the control system (i.e. pump operations, valve operations, etc.).
- B. The PMCS shall record the value of each analog input to allow the operator to trend the plant process data.
- C. The PCMS shall be provided and configured with a long term data archival procedure such that all PCMS data is automatically logged to the PMCS database along with system images of each server for disaster recovery purposes.

# PART 3 LOOP DESCRIPTIONS

## 3.01 TYPICAL CONTROL LOOPS

- A. Typical Motor Status Monitoring
  1. Constant Speed Motors: The following status shall be indicated by the control system.
    - a. Motor run
    - b. Motor failure
    - c. Daily and Continuous Total Runtime shall be indicated and archived on the PMCS. It shall be able to reset the Continuous Runtime via the PMCS.
    - d. Daily Cycles (starts) shall be indicated and archived on the PMCS.
    - e. Where UNIT IN AUTO is required for a control loop, the HAND-OFF-AUTO switch shall provide a form ‘C’ contact wired back to the PCMS to indicate that the system has been placed in AUTO
  2. Reduced Voltage Starters: The following status shall be indicated by the control system.

- a. Motor run
  - b. Motor failure
  - c. Daily and Continuous Total Runtime shall be indicated and archived on the PMCS. It shall be able to reset the Continuous Runtime via the PMCS.
  - d. Daily Cycles (starts) shall be indicated and archived on the PMCS.
  - e. Where UNIT IN AUTO is required for a control loop, the HAND-OFF-AUTO switch shall provide a form 'C' contact wired back to the PCMS to indicate that the system has been placed in AUTO
3. Variable Frequency Drives: The following status shall be indicated by the control system
  - a. Motor Run
  - b. Motor failure
  - c. Motor Mode Status
  - d. Daily and Continuous Total Runtime shall be indicated and archived on the control system. It shall be able to reset the Continuous Runtime via the PMCS.
  - e. Motor Speed Control (desired speed) and Speed Indication shall be indicated and recorded by the control system.
  - f. Daily Cycles (starts) shall be indicated and archived on the PMCS.
4. HAND-OFF-AUTO
  - a. When the HAND-OFF-AUTO switch is in the HAND mode, the equipment will run continuously regardless of the automatic control logic. In the HAND mode, personnel protective and equipment protective interlocks shall be enabled to shut down the equipment. In the HAND mode, the equipment will run even in the event of PLC or control system failure.
  - b. When the HAND-OFF-AUTO switch is in the OFF mode, the equipment will not run under any circumstances.
  - c. When the HAND-OFF-AUTO switch is in the AUTO mode, the equipment will run in response to a single automatic contact from PLC or hardwired logic functions.
  - d. Where UNIT IN AUTO is required for a control loop, the HAND-OFF-AUTO switch shall provide a form 'C' contact wired back to the PCMS to indicate that the system has been placed in AUTO.
5. HAND-OFF-REMOTE
  - a. When the HAND-OFF-REMOTE switch is in the HAND mode, the equipment will run continuously regardless of the remote control logic. In the HAND mode, personnel protective and equipment protective interlocks shall be enabled to shut down the equipment. In the HAND mode, the equipment will run even in the event of PLC or control system failure.

- b. When the HAND-OFF-REMOTE switch is in the OFF mode, the equipment will not run under any circumstances.
  - c. When the HAND-OFF-REMOTE switch is in the REMOTE mode, the equipment will run in response to a single remote contact from PLC or hardwired logic functions.
  - d. Where UNIT IN AUTO is required for a control loop, the HAND-OFF-AUTO switch shall provide a form 'C' contact wired back to the PCMS to indicate that the system has been placed in AUTO.
- B. Software Control Switches
  - 1. MANUAL-AUTO Switch
    - a. Where an automatic control strategy is implemented in software and it is necessary to disable the automatic operation, a software MANUAL-AUTO switch may be provided on the P&IDs. In the AUTO mode the automatic control logic operates the control system equipment. In the MANUAL mode the control system equipment is controlled by Operator selection on the PMCS HMI graphics
  - 2. ENABLE-OFF Switch
    - a. Where no automatic control strategy is implemented in software, but it is necessary to disable the automatic operation elsewhere, a software ENABLE-OFF switch may be provided. In the OFF mode, the output contact from the control system remains open. In the ENABLE mode, the control system equipment is controlled by the control system
  - 3. OPEN-CLOSE Switch
    - a. A software OPEN-CLOSE switch is typically designated HS and annotated OPENCLOSE. The control system shall provide one normally open contact which closes when the control system logic calls for the valve to open. When the contact opens the valve closes.
    - b. When the valve is fully closed the valve closed indicator in the PCMS System, ZIC, shall be on. When the valve is fully open or traveling, the valve closed indicator in the control system, ZIC shall be off.
    - c. When the valve is fully open the valve open indicator in the PCMS System, ZIO, shall be on. When the valve is fully closed or traveling, the valve open indicator in the control system, ZIO, shall be off.
- C. Typical Equipment Protection: Equipment protection circuits shall be fail-safe; the circuit shall open to stop equipment. All motor control logic in the PMCS System shall include:
  - 1. Motor Control Command Disagreement Alarm
    - a. "Failed to Run" is when a motor is called to run by the PMCS and no run feedback is received by the PMCS within a preset, adjustable period of time. This shall only be applied to those motors which have signal feedback to the PMCS.

2. Valve Control Command Disagreement Alarms
  - a. "Failed to Open" is when a valve is called to open by the PMCS and the open feedback is not received by the PMCS within a preset, adjustable period of time.
  - b. "Failed to Close" is when a valve is called to close by the PMCS and the closed feedback is not received by the PMCS within a preset, adjustable period of time.
- D. Analog Loop Control and Alarm
  1. All software PID (Proportional, Integral, and Derivative) controllers must show set-point, process variable, and allow limited access to tuning parameters from the operator interface software package. Any software controller shall have the capability of being placed in MANUAL mode and have the capability of manually adjusting the output in MANUAL mode from the operator interface software package. Indicator readouts for software PID controllers shall conform to the requirements given in the Typical Analog Loop -Indication and Alarm description above.
  2. Required software alarm functions (designated LALL, LAH TAH, AAL, AAH, etc.) derived from analog variables shall be configure and the ranges shall be fully adjustable through the PCMS.
  3. Manual Analog Control Setting shall be configurable for each device allowing manual control and the ranges shall be fully adjustable through the PCMS
  4. Timer Control: A software time control function is shown, or described within the specifications. Where times are used for cycle/duration control logic, the controlled unit will remain off for a pre-set, adjustable cycle time. At the end of the cycle time, the controlled unit will turn on for an adjustable duration time. At the end of the duration time, the cycle timer resets and starts again.
- E. Software Alarm
  1. All analog inputs to the PMCS shall have the capability for low and high software alarms. Where low and/or high software alarms are not specified elsewhere in this document, they shall initially be turned off or set for 0% (low alarm) and 100% (high alarm) of the signal range. This will help eliminate nuisance alarms during checkout and start-up. All software alarms shall be reviewed with the plant superintendent, or his designee, during programming or panel checkout and again during field checkout or start-up. For critical alarms, the System Integrator shall configure the associated graphic symbol to flash or change color when in an alarm condition.

### 3.02 PROCESS LOOP DESCRIPTIONS

## A. Influent Pump Station

## 1. Description

- a. The influent pump station shall be powered and controlled via the Motor Control Center (MCC) and the Main Control Panel (MCP). The control panel shall facilitate three (3) modes of operation: automatic (level transducer) based control, backup (float) control, and manual operation.

- 1) In the automatic mode of operation:

- a) The pumps shall be given assignments (lead, 1<sup>st</sup> lag, 2<sup>nd</sup> lag, 3<sup>rd</sup> lag) based on the availability of the pumps. A pump shall be available for assignment when it is in 'Auto' and none of the manufacturer required interlocks are energized.
- b) The control system shall utilize the pump station's level transducer as the primary means of control and to energize the associated outputs.
- c) The control system shall start and stop pumps based on operator entered levels (in the plant HMI application) associated with the pump assignments (lead, 1<sup>st</sup> lag, 2<sup>nd</sup> lag, 3<sup>rd</sup> lag). Separate levels shall be available for both the on and off setpoints for each assignment to provide the operator maximum flexibility. When the level reaches an on level setpoint for the pump assignment(s) the control system shall call the desired pump(s) to run.
- d) The control system shall modulate the speed of the pumps (through a PID controller) based upon the level in the wetwell and an operator adjustable setpoint.
- e) When a pumping cycle has been completed or a fault occurs the pump assignments shall be rotated.
- f) In the event of a power failure (or other event) that could potentially cause all of the pumps to start simultaneously, the control system shall stagger starting of the pumps.

- 2) In the backup mode of operation:

- a) The wet well shall contain a set of backup floats to be used in the event of a level transducer/PLC failure. The floats along with intrinsically safe barrier relays, an alternator, and time delay relays shall start, stop and alternate the pumps until the PLC and/or transducer become functional once again. The floats shall be positioned in the wet well so that they don't interfere with the typical operating range utilized by

the transducer.

- b) The status of the floats and backup mode operation shall be reported to the PLC.
- c) All circuitry shall be contained in a separate MCC cubicle to isolate the controls from the main control panel.
- 3) In the manual mode of operation:
  - a) The pumps shall be started and stopped when their associated Hand-Off-Auto switch is placed in Hand mode.
  - b) The speed of each VFD shall be modulated through associated speed potentiometers located on the MCC.
  - c) All manufacturer required interlocks shall be hardwired into the starting circuit to properly protect the pump.
- b. All alarms from the pump station shall be displayed on the PMCS HMI application.

2. Signals

- a. Pump Running (typical of 4)
- b. VFD Fault (typical of 4)
- c. Pump HOA in Auto (typical of 4)
- d. Pump Seal Fail (typical of 4)
- e. Pump Thermal Fault (typical of 4)
- f. Pump Run Command (typical of 4)
- g. Desired Speed (typical of 4)
- h. Current Speed (typical of 4)
- i. Off Float
- j. Lead Float
- k. 1<sup>st</sup> Lag Float
- l. 2<sup>nd</sup> Lag Float
- m. 3<sup>rd</sup> Lag Float
- n. Current Level
- o. Flow
- p. Pressure

B. Odor Control

1. Description

- a. The control system for the Odor Control system shall be supplied as part of a complete package as provided by the manufacturer.
- b. The system control package shall be pre-engineered and configured for the operation of the package.
- c. The PMCS shall interface with the packaged control system via hardwired conductors and a network connection to allow the operator to monitor and control the associated system.
- d. System network connectivity of the packaged system shall be coordinated with/by the system integrator.
- e. All alarms from the packaged control system shall be displayed both locally (if applicable) and in the PMCS HMI application.
- f. All manufacturer required interlocks shall be observed and adhered to for operation of equipment.

2. Signals

- a. System Running
- b. System Common Fault

C. Headworks Screening Equipment

1. Description

- a. The headworks screens shall be provided as a self-contained packaged system. Operation of the screens and their associated solenoids shall be controlled via a local control panel provided as part of the screening system.
- b. The headworks screening equipment conveyor shall be powered and controlled via the Motor Control Center (MCC) and the Main Control Panel (MCP). The MCC cubicle shall provide the ability to manually and automatically control the conveyor while adhering to all of the associated protective signals - motor thermal, conveyor E-Stop, and operational limit switch.

2. Signals

- a. Screen Conveyor Running
- b. Screen Conveyor E-Stop
- c. Screen Conveyor Motor Thermal
- d. Screen Conveyor Limit
- e. Screen Conveyor in Auto
- f. Screen Conveyor Run Command

D. Headworks Grit Equipment

1. Description

- a. The control system for the Grit Equipment shall be supplied as part of a complete package as provided by the manufacturer.
- b. The system control package shall be pre-engineered and configured for the operation of the package.
- c. The PMCS shall interface with the packaged control system via hardwired conductors to allow the operator to monitor and control the associated system.
- d. All alarms from the packaged control system shall be displayed both locally (if applicable) and in the PMCS HMI application.
- e. All manufacturer required interlocks shall be observed and adhered to for operation of equipment.

2. Signals

- a. Underflow valve open
- b. Underflow valve closed
- c. Underflow valve fault
- d. System in auto
- e. Fludizing valve open

E. BNR Process Basin Mixing Pumps & NRCY Pumps

1. Description

- a. The BNR Process Basin Mixing and NRCY pumps station shall be powered and controlled via the Motor Control Center (MCC) and the Main Control Panel (MCP). The MCC and MCP shall facilitate two modes of operation: automatic and manual operation.
  - 1) In the automatic mode of operation:
    - a) The pump shall run either continuously or on a cyclic (timed) interval. Operators shall be able to select desired mode of control as well as adjust the time durations from the PMCS HMI.
    - b) The pumps shall be started and stopped when their associated Hand-Off-Auto switch is placed in Auto position.
    - c) All manufacturer required interlocks shall be hardwired into the starting circuit to properly protect



the pump.

2) In the manual mode of operation:

- a) The pumps shall be started and stopped when their associated Hand-Off-Auto switch is placed in Hand mode.
- b) All manufacturer required interlocks shall be hardwired into the starting circuit to properly protect the pump.

- b. All alarms from the pump station shall be displayed on the PMCS HMI application.

2. Signals

- a. Motor Running (typical of 4)
- b. Motor Thermal Fault (typical of 4)
- c. Motor HOA in Auto (typical of 4)
- d. Motor Run Command (typical of 4)
- e. NRCY Flow (typical of 2)

F. Clarifiers

1. Description

- a. The Clarifiers shall be powered and controlled via the Motor Control Center (MCC) and the Main Control Panel (MCP). The MCC and MCP shall facilitate two modes of operation: automatic and manual operation.

1) In the automatic mode of operation:

- a) The associated clarifier shall run continuously whenever the operator enables it from the PMCS HMI.
- b) The clarifiers shall be started and stopped when their associated Hand-Off-Auto switch is placed in Auto position.
- c) All manufacturer required interlocks shall be hardwired into the starting circuit to properly protect the clarifier. High torque conditions shall trigger a warning in the PMCS. High High Torque and Motor thermal conditions shall shutdown the clarifier and trigger alarms in the PMCS.
- d) While running automatically, the clarifier's spray solenoid shall be engaged on a cyclic basis. The on/off time durations shall be accessible to plant personnel via the PMCS HMI.

- 2) In the manual mode of operation:
  - a) The clarifiers shall be started and stopped when their associated Hand-Off-Auto switch is placed in Hand mode.
  - b) All manufacturer required interlocks shall be hardwired into the starting circuit to properly protect the clarifiers.

2. Signals

- a. Running (typical of 2)
- b. Motor Thermal Fault (typical of 2)
- c. High Torque (typical of 2)
- d. High High Torque (typical of 2)
- e. Clarifier Start/Stop (typical of 2)
- f. Clarifier Spray Solenoid Open/Close (typical of 2)

G. BNR Process Basin RAS Pumps

1. Description

- a. The BNR Basin RAS pumps shall be powered and controlled via the Motor Control Center (MCC) and the Main Control Panel (MCP). The MCC and MCP shall facilitate three (3) modes of operation: automatic flow control, automatic constant speed, and manual control.
  - 1) In the automatic flow control mode of operation:
    - a) The RAS pumps shall be started, stopped, and have their speed modulated to meet an operator desired flow setpoint.
    - b) Modulation of the speed shall be achieved via a PID loop in the MCP PLC. The PID's process variable (PV) shall be the flow as measured by the RAS flow meter.
    - c) The RAS pump's HOA switch must be in Auto and none of the manufacturer required interlocks shall be triggered to run in the automatic flow mode.
  - 2) In the automatic constant speed mode of operation:
    - a) Operators shall have the ability to set a constant speed setpoint for the associated RAS pump. The RAS pump shall maintain the desired speed throughout the time period while running.
    - b) The RAS pump's HOA switch must be in Auto and none of the manufacturer required interlocks shall be triggered to run in the automatic flow mode.

- 3) In the manual mode of operation:
  - a) The pumps shall be started and stopped when their associated Hand-Off-Auto switch is placed in Hand mode.
  - b) The speed of each VFD shall be modulated through associated speed potentiometers located on the MCC.
  - c) All manufacturer required interlocks shall be hardwired into the starting circuit to properly protect the pump.
- b. All alarms from the pumps shall be displayed on the PMCS HMI application.

2. Signals

- a. Pump Running (typical of 2)
- b. Pump HOA in Auto (typical of 2)
- c. Starter Fault (typical of 2)
- d. Pump Thermal Fault (typical of 2)
- e. Run Command (typical of 2)
- f. Current Pump Speed (typical of 3)
- g. Desired Pump Speed (typical of 3)

H. Filter

1. Description

- a. The control system for the Filter shall be supplied as part of a complete package as provided by the manufacturer.
- b. The system control package shall be pre-engineered and configured for the operation of the package.
- c. The PMCS shall interface with the packaged control system via a network connection to allow the operator to monitor and control the associated system.
- d. System network connectivity of the packaged system shall be coordinated with/by the system integrator.
- e. All alarms from the packaged control system shall be displayed both locally (if applicable) and in the PMCS HMI application.
- f. All manufacturer required interlocks shall be observed and adhered to for operation of equipment.

2. Signals
  - a. Disk motor running
  - b. Backwash pump running
  - c. Disk motor fault
  - d. Backwash pump fault
  - e. System running
  - f. System in auto
  - g. System common fault

I. UV System

1. Description
  - a. The control system for the UV system shall be supplied as part of a complete package as provided by the manufacturer.
  - b. The system control package shall be pre-engineered and configured for the operation of the package.
  - c. The PMCS shall interface with the packaged control system via a network connection to allow the operator to monitor and control the associated system.
  - d. System network connectivity of the packaged system shall be coordinated with/by the system integrator.
  - e. All alarms from the packaged control system shall be displayed both locally (if applicable) and in the PMCS HMI application.
  - f. All manufacturer required interlocks shall be observed and adhered to for operation of equipment.
  - g. In conjunction with the UV system, a plant water solenoid shall be controlled via the MCP to provide water whenever the effluent flow rate drops below 50 GPM.
2. Signals
  - a. Common Trip
  - b. Common Warning
  - c. UV Dose Fail
  - d. Wiper Fail
  - e. Lamp Fail
  - f. Water Leak
  - g. System Ready

- h. Start/Stop
- i. Clear Message
- j. Remote Wipe
- k. Set High Power
- l. UV Dose
- m. Ballast Power
- n. Plant Water Solenoid Open/Close

J. W3 Plant Water System

1. Description

- a. The control system for the W3 system shall be supplied as part of a complete package as provided by the manufacturer.
- b. The system control package shall be pre-engineered and configured for the operation of the package.
- c. The PMCS shall interface with the packaged control system via hardwired conductors to allow the operator to monitor and control the associated system.
- d. All alarms from the packaged control system shall be displayed both locally (if applicable) and in the PMCS HMI application.
- e. All manufacturer required interlocks shall be observed and adhered to for operation of equipment.

2. Signals

- a. Pump Running (typical of 2)
- b. Pump HOA in Auto (typical of 2)
- c. Pump Fault (typical of 2)
- d. System Pressure
- e. Desired Pressure

K. Blowers

1. Description

- a. The blowers will provide air to the BNR Process Basins as well as the digesters. The plant design includes three (3) blowers – one for each SBR process basin and one for the digesters.
- b. Each blower shall be provided with an integral control panel (supplied as part of the complete package) containing all necessary

motor controls and circuitry to run the associated blower. Each blower control panel shall interface with the PMCS (via hardwired conductors) to provide air for the associated plant process.

- c. The PMCS/MCP shall facilitate two (2) modes of operation for the BNR process basin blowers: automatic DO control and automatic constant speed control.
  - 1) In the automatic DO control mode of operation:
    - a) The blower associated with each process basin shall be started, stopped, and have their speed modulated to meet an operator desired DO setpoint.
    - b) Modulation of the speed shall be achieved via a PID loop in the MCP PLC. The PID's process variable (PV) shall be the basin's DO.
    - c) The Blower must be in Auto and none of the manufacturer required interlocks shall be triggered to run.
  - 2) In the automatic constant speed mode of operation:
    - a) Operators shall have the ability to set a constant speed setpoint for the associated Blower. The Blower shall maintain the desired speed throughout the time period while running.
    - b) The Blower must be in Auto and none of the manufacturer required interlocks shall be triggered to run.
  - 3) All manual control of the blowers shall be performed at each individual blower control panel.
- d. The PMCS/MCP shall facilitate one mode of operation for the digester blower: automatic constant speed control.
  - 1) In the automatic constant speed mode of operation:
    - a) Operators shall have the ability to set a constant speed setpoint for the associated Blower. The Blower shall maintain the desired speed throughout the time period while running.
    - b) The Blower must be in Auto and none of the manufacturer required interlocks shall be triggered to run.
- e. The PMCS shall allow operators to start and stop the blowers manually as long as all of the manufacturer required interlocks are observed. In the event of a fault or failure the PMCS shall shut down the blower and alert plant personnel.

## 2. Signals

- a. Blower Thermal Fault (typical of 3)
- b. Blower VFD Fault (typical of 3)
- c. Blower HOA in Auto (typical of 3)
- d. Blower Running (typical of 3)
- e. Blower Speed Feedback (typical of 3)
- f. Blower Start/Stop (typical of 3)
- g. Blower Desired Speed (typical of 3)
- h. SBR Basin Dissolved Oxygen (typical of 2)

L. Digesters

1. Description

- a. The plant digesters shall be aerated by the associated blowers as noted above. Provisions in the PMCS and MCP shall be made to monitor and alert in the event of a high level condition in either digester.

2. Signals

- a. Digester High Level (typical of 2)

M. Screw Press

1. Description

- a. The Screw Press shall be provided as a packaged system complete with a master control panel.
- b. The Screw Press control panel shall monitor and control the operation of the screw press, sludge feed pump, wash water pump, polymer feed system, compressor, and discharge conveyors .
- c. The PMCS shall monitor the status of the screw press package via a network connection. The system integrator shall work with the screw press manufacturer to coordinate network addresses for incorporation into the PMCS.

2. Signals

- a. Press Running
- b. Press in Auto
- c. Zero Speed
- d. E Stop
- e. Low Water Pressure
- f. Low Air Pressure

## PROCESS LOOP DESCRIPTION

- g. Rotary Drum Failure
- h. Screen Drive Failure
- i. Transfer Pump Failure
- j. High Discharge Pressure
- k. Poly Pump Failure
- l. Sludge Pump Failure

**END OF SECTION**



**SECTION 16910**  
**CONTROL PANEL CONSTRUCTION**

**PART 1 - GENERAL**

1.1 SCOPE

- A. The Supplier shall furnish, test, and startup all furnished electrical control panels and control system components related to their furnished equipment.
- B. Specifically included are the following control panels:
  - 1. All Process Equipment Control Panels
  - 2. Main Control Panel (MCP)

1.2 SUBMITTALS

- A. Product Data: For each type of product supplied. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- C. Additional Shop Drawing Requirements:
  - 1. Point - to - Point Wiring Drawings.
  - 2. Fabrication and nameplate legend drawings
  - 3. Internal wiring schematic and layout drawings
  - 4. Systems schematic drawings illustrating all components being supplied complete with electrical interconnections.

**PART 2 - PRODUCTS**

2.1 GENERAL REQUIREMENTS FOR CONTROL PANELS

- A. All control panes shall be constructed in accordance with the following standards: National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronics Engineers (IEEE), Underwriter Laboratories (UL), Nation Fire Protection Association (NFPA), and Instrumentation Systems and Automation Society (ISA)

## **CONTROL PANEL CONSTRUCTION**

- B. All control panels shall be constructed in a UL approved production facility and bear all applicable UL labels for panel construction (i.e. UL508A, etc.).
- C. The completed panel shall be factory tested prior to shipment. Field installation by the Contractor shall consist only of setting the panel in place and making necessary pneumatic and/or electrical connections.
- D. All control panels shall be designed to operate at the service voltage as indicated in the project plans.

### **2.2 CONTROL PANEL ENCLOSURES**

- A. Unless otherwise noted, all control panels shall be provided with a NEMA 4X, Stainless Steel enclosure packages as manufactured by Hoffman, or Engineer approved equal. The enclosure shall be constructed with a 3-point steel latching mechanism and padlocking stainless steel handles. Latch rods to have rollers for easier door closing.
- B. All control panels and associated hardware shall be constructed of 304 stainless-steel unless otherwise noted.
- C. All interior components shall be mounted with stainless steel hardware and shall be clearly identified with plastic identification nametags. The tags shall be white with black lettering.
- D. Door shall be provided with heavy gauge stainless steel hinges.
- E. All control panels shall be constructed of 14 gauge stainless steel. Control panels shall also include a 10 gauge mild steel sub-panel mounted on collar studs for equipment mounting.
- F. All control panel seams shall be continuously welded and ground smooth.
- G. Data pockets shall be provide on all interior panel doors. The equipment supplier shall provide laminated schematics in each pocket for the associated control panel.
- H. All cabinets shall be sized to accommodate the equipment required plus 25% spare space.

### **2.3 CONTROL PANEL COOLING REQUIREMENTS**

- A. Air conditioners and sun shields shall be supplied as required to keep the equipment mounted inside the control panels operating within the manufacturers operating temperature requirements. The air conditioner unit shall not exchange the air inside the control panel with the air outside the control panel. The unit shall be coated to provide environmental protection and maintain the enclosure rating it is mounted to/penetrating.
- B. The manufacturer of the control panels and cabinets shall provide all necessary cooling/heating equipment required to maintain temperature and humidity within the operating requirements of all equipment located within panels and cabinets. Coordination for electrical/mechanical connection is the responsibility of the Contractor. At the time of submittals, the Contractor shall submit calculations indicating that such requirements have been met.

## CONTROL PANEL CONSTRUCTION

- C. All exterior control panels designed for exterior mounting shall be provided with equipment rated for 60° Celsius or provided with air conditioners.

### 2.4 CONTROL PANEL WIRING

- A. Wiring, where required, shall be general-purpose open type, neatly bundled and laced or installed in plastic wiring troughs. Wire shall be stranded No. 16 AWG minimum, with thermoplastic insulation rated for 600V and 90 degrees C.
- B. All equipment mounting backboards shall be provided with nonmetallic slotted ducts. All nonmetallic slotted ducts shall have spare space equal to 40% of the depth of the duct.
- C. Wiring colors shall be as follows:
  - 1. All ungrounded AC conductors operating at the supply voltage shall be “Black”
  - 2. All ungrounded AC control conductors operating at a voltage less than or equal to the supply shall be “Red”
  - 3. All grounded AC current carrying conductors shall be “White”
  - 4. All ground conductors shall be “Green”
  - 5. All ungrounded DC control conductors shall be “Orange”
  - 6. All grounded DC control conductors shall be “Brown”
  - 7. All intrinsically safe circuits shall be “Blue”
  - 8. A wiring color code legend shall be mounted inside the control panel door.
- D. All wires entering and leaving all panels shall be terminated at barrier type terminal strips. All terminals shall be identified and labeled per the Owner’s standard naming conventions. It shall be the Supplier’s responsibility to coordinate with the Engineer for the Owner’s accepted naming conventions. (All terminal strips shall be designed for #12 AWG, XHHW-2, 90 degree C field wiring for terminations.)
- E. No terminal strip may be located closer than 8” from any side or bottom of the control panel. This is designed to allow for adequate wire bending radius for field terminations.
- F. All wiring shall be clearly marked with an identification number consistent with the wiring schematic.
- G. Devices mounted on the enclosure door or interior dead front panel shall be run in spiral wrap to avoid pinch points when opening and closing the enclosure door(s) or interior panels

## CONTROL PANEL CONSTRUCTION

### 2.5 PANEL MOUNTED DEVICES

- A. Indicating lights to be heavy duty, push-to-test type, oil tight, industrial type with integral transformer for 120 VAC applications. Lenses shall be colored as noted on drawings or as required by the equipment manufacturers if not specified on the drawings. Legend plates shall be factory engraved as required. Lights shall be 30mm Square D 9001 Series, Allen Bradley 800T or approved equal.
- B. Momentary pushbuttons to be heavy duty, oil tight, industrial type with full guard and momentary contact rated at 10 Amps continuous at 120 VAC. Legend plates shall be factory engraved as required. Pushbutton shall be 30mm Square D 9001 Series, Allen Bradley 800T or approved equal.
- C. Selector switches, on/off and H.O.A. to be heavy duty, oil tight, industrial type with contact rated at 120 VAC, 10 amps continuous service. Legend plates shall be factory engraved as required. Switches shall be 30mm Square D 9001 Series, Allen Bradley 800T or approved equal.
- D. Current to voltage converters, 4-20mAdc to 1-5Vdc shall be as manufactured by Phoenix Contact or Engineer approved equal.
- E. D.C. power supplies shall be as manufactured by PLC Manufacturer, PULS, Phoenix Contact, or approved equal and shall be sized for 1.5 times the application requirements. (No open power supplies will be allowed.)
- F. All relays shall be 3PDT Potter Brumfield KRPA series based on the application requirements for switching and ampacity. Units shall incorporate a lamp in parallel with relay coil.
- G. All circuit breakers shall be of the same AIC rating as the panel or MCC to which they are connected, and shall be required to selectively coordinate above 0.1 seconds.
- H. All motor starters shall be manufactured by Square D, Allen Bradley or engineer approved equal. All starters shall be NEMA rated (no IEC devices). All motor speed controllers shall have the following capabilities: remote start/stop, status output, running output, and remote speed.
- I. All reduced voltage starters shall be manufactured by Square D (Altistart), Allen Bradley (SMC Flex) or engineer approved equal.
- J. All variable frequency drives shall be manufactured by Square D (Altivar 630), Allen Bradley (PowerFlex 753) or engineer approved equal. Each variable frequency drive shall be supplied with an Ethernet communication module for the control and monitoring of the associated device.
- K. H-O-A selector switches are required for each motor starter contained within a control panel. All adjustable speed controllers (VFDs) shall be provided with manual speed adjustment devices (separate from any HMI or Operator Interface Panel), which may be located on the face of the enclosure. H-O-A selector switches and manual speed switches shall allow the operator to control all motors and valves manually in the event of a PLC failure.

## CONTROL PANEL CONSTRUCTION

- L. Runtimes for each motor starter located in the control panel shall be tracked with elapsed time meters mounted on the enclosure.
- M. Power distribution blocks shall be block style distribution blocks manufactured by Square D, Mersen or Engineer approved equal. All distribution blocks shall be provided with polycarbonate safety covers to provide dead front protection. The safety cover shall have a test prod hole for testing purposes
- N. Fuse blocks/holders shall be UL style fuse blocks manufactured by Bussmann, Mersen or Engineer approved equal.
- O. General purpose fuses shall be Bussmann, Mersen, or Engineer approved equal. Unless otherwise noted the fuse rating and type shall be determined based on the equipment (which the fuse is protecting) manufacturer's recommendations for overcurrent protection.
- P. Semiconductor fuses shall be Mersen Amp Trap series fuses or Engineer approved equal. Unless otherwise noted the fuse rating and type shall be determined based on the equipment (which the fuse is protecting) manufacturer's recommendations for overcurrent protection.
- Q. All control transformers shall be sized to provide 25% spare capacity. The transformer connections shall be provided with protective covers to guard against accidental contact, and the transformer shall be provided with primary and secondary fusing per the manufacturer's recommendations.
- R. Each control panel shall be provided with a ground fault duplex service receptacle that is accessible from the interior dead-front panel. The service receptacle shall be capable of providing 15A at 125VAC.
- S. All intrinsically safe barrier relays shall be UL listed and shall be manufactured by Phoenix Contact or Engineer approved equal.
- T. All circuit breakers shall be manufactured by Square D, Eaton Cutler Hammer, or Engineer approved equal. A main circuit breaker shall be provided for each control panel.
- U. Pilot lights shall be provided for each starter located inside the control panel. The lights shall be as follows: Green (Run), Red (Alarm/Fault), Amber (Warning).
- V. Control power transformers shall be provided in each control panel with a supply voltage other than 120V or 120/208V. Control power transformers shall be manufactured by Square D, Allen Bradley or engineer approved equal and provided with both primary and secondary fuses per the NEC.

### 2.6 MISCELLANEOUS

- A. Engraved laminated plastic nameplates shall be furnished for each front panel mounted instrument. The Contractor shall coordinate with the Owner for nameplate color and naming conventions. All instruments and components shall be tagged on rear with embossed plastic tape labels.

## **CONTROL PANEL CONSTRUCTION**

- B. No pneumatic tubing shall be installed inside the control panels.

### **PART 3 - EXECUTION**

#### **3.1 CONTRACTOR'S RESPONSIBILITY**

- A. The Contractor shall coordinate the work of the service personnel during construction, testing, and acceptance of the work.
- B. The Contractor shall receive final approval on all panel, enclosure, and equipment layouts by the Engineer prior to fabrication or installation.

#### **3.2 QUALITY ASSURANCE**

- A. All control panels shall be factory tested and certified prior to releasing for shipment. The testing shall consist of but not limited to the following:
  - 1. Point to point testing of all wiring prior to application of power
  - 2. The intended supply voltage shall be applied to the control panel and all components shall be tested for proper operation and calibration.
  - 3. The programmable logic controller and operator interface code shall be loaded, and each shall be tested for functionality.
  - 4. All components shall be checked to confirm that each device has been installed per the plans and specifications as well as the Manufacturer's recommendations.
  - 5. The enclosure shall be inspected for defects and shall be repaired or replaced if necessary.
  - 6. All labeling and identification tags shall be verified and be clean and visible.
- B. The control panel manufacturer shall be required to test and provide the test results of all control panels supplied for the project. The documentation shall contain the results of the tests listed above as well as any rework items and subsequent repairs that were required prior to shipment. In addition, the manufacturer must certify this document prior to the release for shipment. Prior to shipment one copy of the applicable documentation shall be placed in the drawing pocket of each enclosure, and three copies shall be sent to the Engineer.

#### **3.3 INSTALLATION**

- A. All equipment and devices for the work shall be installed in the locations shown on the drawings, in accordance with the manufacturer's recommendations, and in compliance with the requirements of these specifications.

## **CONTROL PANEL CONSTRUCTION**

- B. The Contractor shall be responsible for coordinating the installation of all equipment in the proposed locations with all other trades performing work on the project that may be affected.

### **3.4 FINAL INSPECTION**

- A. Include all changes and/or alterations in the control panels prior to final inspection and acceptance by the owner.
- B. Any changes and/or alterations in the Control Panels shall be reflected/updated in all Control Panel Schematics prior to acceptance by the Owner. This includes all electronic copies delivered to the Owner.

**END OF SECTION**

**SECTION 16950**  
**FIELD INSTRUMENTS**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Submersible Pressure (Level) Transducers
  - 2. Float Switches
  - 3. Electromagnetic Flow Meters
  - 4. Pressure Transducers
  - 5. Pressure Gauges
  - 6. Refrigerated Sampler
- B. Related Sections: Division 16.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on sea-level conditions.
- B. Operating Temperature: 35 degrees F to 100 degrees F.
- C. Environment: Wastewater.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data including rated capacities of each unit, weights (shipping, installed, and operating), furnished specialties, accessories, and the following:
  - 1. Sensor housing, NEMA rating.
  - 2. Power requirements.



- 3. Sensitivity ranges.
- 4. Mounting requirements.
- C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connections.
- D. Coordination Drawings, including plumbing/connection plans and sections drawn accurately to scale. Submit with Shop Drawings. Show layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.
- E. Wiring diagrams detailing wiring for power and control systems and differentiating clearly between manufacturer-installed and field-installed wiring.
- F. Maintenance data for units to include in the operation and maintenance manual specified in Division 1 and in Division 15 Section "Basic mechanical Requirements".
- G. Schedule of Operator training.

**1.5 QUALITY ASSURANCE**

- A. Electrical Component Standard: provide components that comply with NFPA 70 and that are listed and labeled by UL where available.
- B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver units as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Lift and support units with the manufacturer's designated lifting and covering.

**1.7 PROJECT CONDITIONS**

- A. Field Measurements: Verify dimensions by field measurements. Verify clearances for installation.

**1.8 COORDINATION AND SCHEDULING**

- A. Coordinate with the Owner for the location of mounting areas.
- B. Coordinate the Dissolved Oxygen System with process equipment manufacturer for exact placement.

**1.9 EXTRA MATERIALS**

- A. Furnish any spare parts that are expected to be replaced within a 1-year period in sufficient quantity to keep monitoring equipment operating for a minimum period of one year.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS & SUPPLIERS**

- A. Manufacturer's: Subject to compliance with requirements list in the project specifications.
- B. Supplier's: Suppliers shall be located within a 100-mile radius of the project.

**2.2 SUBMERSIBLE PRESSURE (LEVEL) TRANSMITTERS**

Manufacturer:	Endress & Hauser
Transducer Model:	Waterpilot FMX21
Range:	1.5 psi to 300 psi
Temperature Range:	-40 to 80 degrees Celsius
Material:	Ceramic sensor with 316L stainless steel cage
Transmitter Model:	RIA 452
Transmitter Supply Voltage:	90 to 250VAC
Signal Output:	4 to 20 mA with HART
Relay Outputs:	6 SPDT (can be inverted)
Applications:	Level
Housing:	NEMA 4X
Options:	Provide 316L stainless steel mounting clamp
Location(s) (Quantity):	Influent Pump Station (1)

**2.3 FLOAT SWITCHES**

Manufacturer:	Anchor Scientific
Sensor Model No:	ROTO-FLOAT-SST
Description:	Teflon coated Stainless Steel direct-acting float switch
Signal Output:	1 N.O. & 1 N.C. contacts
Cable Length:	As required by application
Accessories:	Stainless Steel mounting hardware; pipe Clamps
Location(s) (Quantity):	Influent Pump Station (5), Digesters (2), Reuse System (3)

**2.4 ELECTROMAGNETIC FLOW METER**

Manufacturer:	Endress & Hauser
Model No:	Endress & Hauser Promag W 400
Measured Error:	+/- 0.2%

## FIELD INSTRUMENTS

Temp Range:	-5 to 50 degrees Celsius
Size:	As shown on mechanical drawings
Liner:	Hard Rubber
Pressure Class:	ANSI B 16.5 Class 150
Display Range:	5 digits with sign and units
Housing:	Remote NEMA 4X Compact Aluminum
Display:	LC, Backlit, 4 lines, 16 characters each
Cable:	Length as required
Power Supply:	85 to 260 Vac
Accessories:	Grounding rings; Sunshield for the remote mount controller
Location(s) (Quantity):	Influent Pump Station (1), RAS (2), NRCY (2), Effluent (1)

### 2.5 PRESSURE TRANSMITTERS

Manufacturer:	Endress & Hauser
Model No:	Endress & Hauser Cerabar S PMC71
Measured Error:	+/- 0.2%
Temp Range:	-40 to 85 degrees Celsius
Display Range:	5 digits with sign and units
Signal Output:	4 to 20 mA
Display:	Provide local display
Pressure Range:	Equal to 1.5 times shutoff head of pumps supplying system, but not greater than 3.0 times shutoff head.
Environment:	Unclassified
Options:	Provide a SS diaphragm/snubber as well as block and bleed valves for each pressure transmitter
Location(s) (Quantity):	Influent Pump Station (1)

### 2.6 PRESSURE GAUGES

Manufacturer:	Ashcroft
Model No:	Type 1009, Grade 1A
Type:	Liquid Filled
Display:	4 1/2"
Housing:	Stainless Steel
Pressure Range:	Equal to 1.5 times shutoff head of pumps supplying system, but not greater than 3.0 times shutoff head.

### 2.7 REFRIGERATED SAMPLERS (see Section 11811)

### 2.8 ANALYZER FOR DO PROBES (2 total)

- A. The Analyzer shall be a microprocessor based instrument. Connections between the probe sensor and the controller shall be "plug-and-play" without requiring extensive programming or

## FIELD INSTRUMENTS

configuration. The system shall be able to perform automatic calibration of the dissolved oxygen monitoring system.

- B. The controller shall have wireless downloading capability through an IR port located on the controller unit to download and print real time data, calibration history and current set points in a CSV format.
- C. The controller unit shall allow control of the sensor and interface functions using menu driven software. The interface unit shall have a built-in data logger with the capacity to store data on 15-minute intervals for up to 6 months. The display for the unit shall be a graphic dot matrix LCD display, 128 x 64 pixels with LED backlighting. All user settings for the controller shall be retained indefinitely in non-volatile memory (EEPROM)
- D. The controller unit shall include two analog 4 to 20mA output signals proportional to dissolved oxygen and temperature, and shall include two independent PID control functions including high/low phasing, setpoints, dead bands, off delay and on delay.
- E. The unit shall include three (3) SPDT, user configurable Form 'C' alarm contacts, rated at 100 to 230 volts AC, 5 amp resistive maximum. The unit shall be capable of providing the following alarm conditions: low alarm setpoint, low alarm point dead band, high alarm setpoint, high alarm point dead band, off delay and on delay.
- F. The controller unit shall be housed in a NEMA 4X enclosure with a corrosion resistant finish. The AC power supply to the unit shall be housed in the interface unit and shall automatically accept input in the range of 100 to 230 volts AC, single phase, 60 Hz. The interface unit shall be supplied with a sun shield. The unit shall be capable of exterior mounting, vertically on the handrail. Shall be provided with all necessary mounting hardware and a sunshield for each controller.
- G. The Controller shall be HACH Model SC4500 Controller as manufactured by the Hach Company.

### 2.9 DISSOLVED OXYGEN PROBES (2 total, 1 per train)

- A. The Dissolved Oxygen (D.O.) Probe shall be a continuous reading probe that utilizes luminescent sensor technology.
- B. The probe material shall be foamed Noryl® and Type 316 stainless steel. All parts of the probe shall be corrosion resistant and fully immersible. The D.O. sensor material shall be polybutyl methoacrylate.
- C. The measurement range of the probe shall be 0.00 to 20.00 mg/L dissolved oxygen and 32.0 to 212.0° F (0.0 to 100.0° C) temperature. The operation of the probe/analyzer shall not be affected by H<sub>2</sub>S, pH, metals and salts normally found in domestic wastewater. The probe shall provide for electrolyte-free operation without the requirements of sample conditioning.
- D. The probe shall not require periodic membrane changing. The sensor cap shall be easily replaceable and cleaning accomplished by periodically wiping the sensor with a clean rag. The accuracy of the sensor shall be ±0.1 mg/L for levels less than 1.0 mg/L and ±0.2 mg/L for D.O.

## FIELD INSTRUMENTS

levels greater than 1.0 mg/L. The sensitivity of the probe shall be  $\pm 0.5\%$  of the span and the repeatability of the probe shall be  $\pm 0.5\%$  of the span. The response time of the probe shall be 1 to 60 seconds to 90 percent of the value upon a step change in D.O.

- E. The probe shall be mounted with a float mount boom assembly supplied by the probe manufacturer.
- F. The D.O. probe shall be the HACH LDO 2 Probe for dissolved oxygen and temperature measurement as manufactured by the Hach Company.

### 2.10 WARRANTY

- A. The equipment shall be warranted for a period of one year after the installation.
- B. Components failing to perform as specified by the engineers, or as represented by the manufacture, or proven defective in service during the warranty period, shall be replaced, repaired or satisfactorily modified by the manufacture without cost to the Owner when returned to the manufacture.

### 2.11 WORKMANSHIP

- A. All materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer to conform with the contract documents. The installation shall be accomplished by workmen skilled in this type of work.

### 2.12 LIGHTNING PROTECTION

- A. Each electronic transmitter shall be provided with a Phoenix PLUGTRAB TVSS device for both the power and the 4-20 mA signal in a NEMA 4X stainless steel hinged junction box adjacent to the transmitters.

## PART 3 - EXECUTION

### 3.1 DEMONSTRATION

- A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance.
- B. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout".
- C. Demonstrate operation of products specified in this Section. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each product.

**3.2 INSTALLATION**

- A. Install according to manufacturer's written instructions.
- B. Install units with clearances for service and maintenance.
- C. Contractor shall install required electric conduit and cables for all field instruments. Each electric field instrument shall be supplied with 3#12 in a 1" C to the nearest power panelboard unless otherwise indicated on the project drawings. In addition, 2-2#18 AWG shield pairs of signal wire in a 1" C shall be provided to the nearest PLC plant control panel unless otherwise shown on the project drawings.
- D. Each pump shall be provided with a discharge pressure gauge. The discharge pressure gauge shall be connected to the piping system prior to the pump check valve. Each pressure gauge shall be supplied with a stainless steel isolation valve and pipe nipple for connection to the tapped pipe.
- E. All pressure transmitters shall be installed using a stainless steel isolation valve and stainless steel pipe nipple.
- F. All transmitters shall be provided with sun/rain hoods.

**3.3 CONNECTIONS**

- A. Electrical: Conform to applicable requirements in Division 16 Sections.
- B. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

**3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly of components and installation and electrical connections, and to report results in writing.
- B. Contractor shall install all equipment and related accessories before having the manufacturer's field service. If additional trips are required due to incorrect installation, Contractor shall pay for the costs for the field services.

**END OF SECTION**



# Mims Engineering Inc.

112 Southside Square, Suite B Huntsville, AL 35801 Phone: (256)881-4126 Fax: (256)880-6743



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**SECTION 220500**  
**PLUMBING GENERAL PROVISIONS**

**PART 1        GENERAL**

**1.01    DESCRIPTION**

- A.    The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.
- B.    The word "Contractor" used within this Specification Division shall apply to the Mechanical or Plumbing Contractor.

**1.02    SCOPE OF WORK**

- A.    The Work shall include the furnishings of systems, equipment, and materials specified in this Division and as required by Contract Documents to include: supervision, operation, methods, and labor for the fabrication, installation, start-up, and tests for the complete Plumbing installation.
- B.    Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as pipe fittings, access panels, and sleeves may not be shown. This Contractor shall be responsible for confirming the fixtures, piping and equipment to fit the space provided. The location and sizes for pipe fittings, sleeves, inserts, and other basic items required by code and other sections shall be coordinated and included for the proper installation of the work.
- C.    Fixture and Equipment Specification may not deal individually with minute items required such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for in the Contract Documents.
- D.    Where the words "provide", "furnish", "include", or "install" are used in the Specification or on the Drawings, it shall mean to furnish, install, and test complete and ready for operation, the items mentioned. If an item is indicated in the Contract Documents, it shall be considered sufficient for including same in the work.
- E.    Where noted on the Drawings or where called for in other Sections of the Project Manual, the Contractor for this Division shall install equipment furnished by Others and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.
- F.    Coordinate with all trades in submittal of shop drawings. Shop drawings shall be prepared clearly indicating all applicable components. Space conditions shall be detailed to the satisfaction of all concerned trades, subject to review and final acceptance by the Engineer. In the event that the Contractor installs his work before

## PLUMBING GENERAL PROVISIONS

coordinating with other trades or so as to cause any interference with work of other trades, the necessary changes shall be made in the work to correct the condition, at no additional cost to the Owner.

- G. Contractor must provide a payment and performance bond for their portion of the work. The payment and performance bond shall be 100% of the total bid price of the Mechanical, Plumbing and / or Fire Protection Contractor. The Contractor's portion of work includes all equipment, devices, materials, labor, etc. in regard to this Contractor's discipline. This Contractor shall purchase all equipment, devices, materials, etc. applicable to the discipline in which the Contractor will be providing work.

- H. COMMISSIONING

1. The purpose of this paragraph is to alert Division 22 to their responsibilities in the commissioning process.
2. The systems to be commissioned are listed in Section 01 91 13.
3. Commissioning requires the participation of Division 22 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 13. Division 22 shall be familiar with all parts of Section 01 91 13 and the commissioning plan issued by the CxA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

### 1.03 CODES AND STANDARDS

- A. Conform to latest edition of governing codes, ordinances, or regulations of city, county, state, or utility company having jurisdiction. Where local codes are not applicable, conform to Standard Plumbing Code; Standard Mechanical Code; Standard Fire Prevention Code and National Electrical Code.

### 1.04 CONTRACTOR'S QUALIFICATIONS

- A. The Contractor's qualifications listed herein are an extension to any Pre-Qualification approval received by a Contractor. The qualifications of the Contractor for this project shall be as follows s:
  1. The Contractor shall have been in the contracting business for the last five (5) consecutive years and under their current corporation name with 75% of the same corporate officers.
  2. The Contractor shall have successfully completed at least two projects of comparable size and scope within the past five (5) years.
  3. The Contractor's main office shall be located within 100 miles driving distance of the project. If the Contractor's office is located more than 100 miles from job site, the Contractor shall submit for approval, 10 working days prior to bidding the job, the name of the service company within a 100 mile radius of the job site, who will be responsible for any/all service

## PLUMBING GENERAL PROVISIONS

required during the warranty period. In either case, the Contractor shall be responsible for having a qualified technician on the job site within 4 hours after receiving a service call.

4. Contractor must provide a payment and performance bond for their portion of the work. The payment and performance bond shall be 100% of the total bid price of the Mechanical, Plumbing and / or Fire Protection Contractor. The Contractor's portion of work includes all equipment, devices, materials, labor, etc. regarding this Contractor's discipline. This Contractor shall purchase all equipment, devices, materials, etc. applicable to the discipline in which the Contractor will be providing work
5. When requested, the Contractor shall provide substantiating proof of these requirements.

### 1.05 FEES, PERMITS, AND INSPECTIONS

- A. Secure all permits and pay all fees required, including aid to construction, in connection with the Work.
- B. Coordinate and provide such inspections as are required by the Authorities with jurisdiction over the site.
- C. Where applications are required for procuring of services to the building, prepare and file such application with the Utility Company. Furnish all information required in connection with the application in the form required by the Utility Company.

### 1.06 ACTIVE SERVICES

- A. Existing active services: water, gas, sewer, electric, are to be located and shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities with jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

### 1.07 SITE INSPECTION

- A. Contractor shall inspect the site to familiarize himself with conditions of the site which will affect his work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.
- B. Extra payment will not be allowed for changes in the Work required because of Contractor's failure to make this inspection.

### 1.08 OPENINGS, CUTTING, AND PATCHING

- A. Coordinate the placing of openings in the new structure as required for the installation of the Plumbing Work.

## PLUMBING GENERAL PROVISIONS

- B. When additional patching is required due to failure to inspect work; then provide the patching required to properly close the openings, to include patch painting.
- C. When cutting and patching of the structure is made necessary due to failure to install piping, sleeves, or equipment on schedule, or due to failure to furnish, on schedule, the information required for the leaving of openings, then provide the cutting and patching as required.

### 1.09 WIRING FOR PLUMBING EQUIPMENT

- A. Division 26 shall provide power services for motors and equipment furnished by this Contractor to include safety disconnect switches, starters and final connections.
- B. Division 22 shall provide all motors and contactors for equipment furnished under this Division, except where they are an integral part of a motor control center which is provided under another Division.
- C. Provide internal wiring, alarm wiring including for fire protection and/or security, control wiring, and interlock wiring for equipment furnished, to include temperature control wiring.
- D. Coordinate with Division 26 all motors and other mechanical equipment which require electrical services. Provide schedule which shall include the exact location for rough-in, electrical load, size, and electrical characteristics for all services required.
- E. Where motors or equipment furnished require larger services or services of different electrical characteristics than those called for on the Electrical Drawings, this contractor shall coordinate with the electrical contractor and the Electrical Engineer to provide a larger service as required, the cost of which shall be the responsibility of this contractor.
- F. Electrical work provided under Division 22 shall conform to the requirements of Division 26.

### 1.10 SUBSTITUTIONS

- A. Any equipment submitted as "equal" to the basis of design shall be accompanied with a comparison letter from the vender stating any differences from the equipment being submitted and the basis of design. A letter is also to be submitted from the vender, on the vender's letterhead, stating that the vender has received a copy of the job specifications, all addendums and any necessary drawings. For any type of "Country of Origin", ARRA, etc. requirement projects, compliance letters from the manufacturer shall be obtained ten working days prior to the bid.
- B. Substitutions for the scheduled and specified equipment shall only be done with the prior approval of the engineer and shall be obtained in writing. Prior approvals shall be obtained no less than one week prior to the bid date. Prior approval shall not relieve the contractor of supplying equipment that meets the specifications, capacities, efficiencies, physical dimensions, etc.

## PLUMBING GENERAL PROVISIONS

### 1.11 PROTECTION

- A. Special care shall be taken for the protection of equipment furnished. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
- B. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled, or otherwise damaged during such work. Contractor shall arrange with the other Contractors for repairing and refinishing of such areas which may be damaged.
- C. When welding is required inside building, provide one man for a fire watch. Fire watch shall require adequate protection of existing surfaces and observance of lower floors where penetrations exist.

### 1.12 SUBMITTALS

- A. General
  - 1. Submit to Engineer shop drawings and product data required by the drawings and specifications.
  - 2. Contractor shall compile all data including but not limited to ductwork materials and construction details, ductwork layout, manufacturers catalog and product data, controls wiring diagrams and material data, piping, insulation, water treatment, and test and balance.
  - 3. Submit a minimum of 7 copies of data, more if required by the Architect.
- B. Submittal Requirements
  - 1. Prepare submittals compiled in a 3-ring, hard bound, loose leaf binder. The face of the binder shall be clearly marked with the project title and number, the name of the Owner, Architect, Engineer, General Contractor and this contractor.
  - 2. The first page inside the binder shall provide an index, numerically indicating all sections applicable to this submittal.
  - 3. Separate binders shall be provided for HVAC, plumbing and fire protection trades.
  - 4. Provide tab dividers for each section submitted. In the event an item appears on the drawings not specifically covered by the specifications, provide an additional numeric tab at the end of the index detailing the item and include the submittal data in the binder.
  - 5. All equipment included on the submittal sheets shall be marked to indicate the "Tag" name or number of the equipment as shown on the drawings. The equipment shall be high-lighted, where necessary, to clarify which items are being submitted.

## PLUMBING GENERAL PROVISIONS

6. For the piping submittals, when required, the contractor will be provided with an electronic copy of the plumbing floor plans. Piping layout submittals shall consist of one copy on a reproducible medium such as mylar. The drawings shall be on standard size sheets of 24" x 36" or 30" x 42". The reproducible copy shall be returned to the contractor with the engineers' approval stamp and comments.
7. Submit only complete project submittals. Partial submittals or submittals not complying with the above requirements shall be returned to the contractor un-marked and rejected.
8. In the interest of project expediency, the contractor may pre-submit long lead items for pre-approval. However, the contractor shall not be relieved of including the same data as required by submittal binder and shall be included therein.
9. The Contractor may turn in submittals without control drawings if they require a longer production time. All other items shall be included.
10. Provide a tab for items not included and include an explanation of why item is not included in the submittal and the expected submittal date.
11. Review shop drawings and product data prior to submission to Engineer.
12. Verify field measurements, field construction criteria, catalog numbers, and similar data.
13. Coordinate each submittal with work of the project and Contract Documents.
14. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Engineer's review of submittals unless Engineer gives written acceptance of specific deviations.
15. Notify Engineer in writing of deviations from requirements of Contract Documents at time submittals are made. A "deviation" shall be construed to mean a minor change to the sequence indicated on drawings or specification. A "deviation" is not intended to allow substitutions or product options.
16. Do not begin work which requires submittals until submittals have been returned with Engineer's stamp and initials or signature indicating review and approval. Materials and equipment that were installed prior to being not approved shall be removed and replaced with approved items at no additional cost to other parties.
17. Shop Drawings and/or submittals requiring resubmission to the Engineer due to non-compliance with the Contract Documents and/or incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Engineer for review. The Contractor shall ensure the completeness and compliance of the submittal materials and shall reimburse

## PLUMBING GENERAL PROVISIONS

the Engineer at their standard hourly billing rates for review of submittals/shop drawings beyond the second submission.

18. Attention is directed to the fact that Engineer's review is only to check for general conformance with the design concept of the project and general compliance with Contract Documents. No responsibility is assumed by Engineer for correctness of dimensions, details, quantities, procedures shown on shop drawings or submittals.
19. Omission in shop drawings of any materials indicated in Contract Drawings, mentioned in Specifications, or required for proper execution and completion of Work, does not relieve the Contractor from responsibility for providing such materials.
20. Approval of a separate or specified item does not necessarily constitute approval of an assembly in which item functions.

### 1.13 OPERATING AND MAINTENANCE MANUALS

#### A. General

1. Provide searchable CD in PDF format of all product data, and other information described in this Section for use in compiling operating and maintenance manuals.

#### B. Compilation

1. The Contractor will receive shop drawings, brochures, materials list, technical data of all types, warranties, guarantees, and other pertinent information and will assemble, catalog, and file information in searchable PDF format on CD.
2. Submittal Format: (Provide each of the following items, as applicable, for each required item or system. Requirements will vary, depending on the equipment. Refer to specific Specification section requirements.)
  - a. Item: (Use appropriate Section title.)
  - b. System Description: (Provide a detailed narrative description of each system, describing function, components, capacities, controls and other data specified, and including the following:
    - (1.) Number of.
    - (2.) Sizes.
    - (3.) Type of operation.
    - (4.) Detailed operating instructions, including start-up and shut-down of each system, with indications for position of all controls, as applicable.

## PLUMBING GENERAL PROVISIONS

- (5.) Wiring Diagrams: (Complete wiring diagrams for internally wired components including controls.)
- (6.) Operating Sequence: (Describe in detail.)
- (7.) Manufacturers Data: (Provide catalog data sheets, specifications, nameplate data and parts list.)
- (8.) Preventative Maintenance: (Provide manufacturer's detailed maintenance recommendations.)
- (9.) Trouble Shooting: (Provide manufacturer's sequence for trouble-shooting procedures for operational problems.)
- (10.) Extra Parts: (Provide a listing of extra stock parts furnished as part of the Contract.)
- (11.) Warranties: (Provide specific manufacturer's warranty. List each component and control covered, with day and date warranty begins, date of expiration, and name, address, and telephone number of people to contact regarding problems during warranty period.)
- (12.) Directory: (Provide names, addresses and telephone numbers of Contractor, its subcontractors, suppliers, installers and authorized service and parts suppliers. Format as follows:)

Contractor:

Address:

Telephone No.:

Person to Contact:

Subcontractor:

Address:

Telephone No.:

Person to Contact:

Installer:

Address:

Telephone No.:

Person to Contact:

Manufacturer:



## PLUMBING GENERAL PROVISIONS

Address:

Telephone No.:

Person to Contact:

Local Service Representative:

Address:

Telephone No.:

Person to Contact:

### 1.14 RECORD DRAWINGS

#### A. Detailed Requirements for Record Drawings

1. During the progress of the work, the Contractor shall require the job superintendent for the plumbing subcontractors to record on their field sets of drawings the exact locations, as installed, of all conduits and pipes, whether concealed or exposed which were not installed exactly as shown on the contract drawings.
2. The Contractor shall submit redline as-built drawings to the Engineer for review.
3. The Engineer shall authorize the Contractor to produce and distribute the redline as-built drawings in PDF format as follows:
  - a. One (1) disc to the Engineer.
  - b. One (1) disc to the Architect.
  - c. One (1) hard copy to owner
  - d. Two (2) disc to the Owner. (PDF must be searchable)

### 1.15 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
- B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with specifications.
- C. For products specified by naming several products or manufacturers and stating "or equivalent", "or equal", or "or Engineer approved equivalent", or similar wording, submit a request for proposed substitutions for any product or manufacturer which is not specifically named; for review and approval by the Engineer.
- D. For products specified by naming only one product and manufacturer, there may be an option of an Engineer approval of a product of equal or greater quality or size.

## PLUMBING GENERAL PROVISIONS

### 1.16 SUBSTITUTION SUBMISSIONS

- A. Contractor's Base Bid shall be per contract documents.
- B. Submit separate request for each substitution. Support each request with:
  - 1. Complete data substantiating compliance of proposed substitution with requirements stated in contract documents:
    - a. Product identification, including manufacturer's name and address.
    - b. Manufacturer's literature; identify:
      - (1.) Product description.
      - (2.) Reference standards.
      - (3.) Performance and test data.
    - c. Name and address of at least two similar projects on which product has been used, and date of each installation.
    - d. Itemized comparison of the proposed substitution with product specified; list significant variations.
    - e. Data relating to changes in construction schedule.
    - f. Any effect of substitution on separate contracts.
    - g. List of changes required in other work or products.
    - h. Designation of availability of maintenance services, sources of replacement materials.
    - i. Provide certification of product compatibility with adjacent materials.
- C. Substitutions will not be considered for acceptance when:
  - 1. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor or his supplier prior to bid.
  - 2. Acceptance will require substantial revision of contract documents.
  - 3. In judgement of Engineer, do not include adequate information necessary for a complete evaluation.
  - 4. Substitute products shall not be ordered or installed without written acceptance of Engineer.
  - 5. Engineer will determine acceptability of proposed substitutions.

### 1.17 CONTRACTOR'S SUBSTITUTION RESPONSIBILITIES

- A. In making formal request for substitution, Contractor represents that:
  - 1. He has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.

## PLUMBING GENERAL PROVISIONS

2. He will provide same warranties or bonds for substitution as for product specified.
  3. He will coordinate installation of accepted substitution into the work, and will make such changes as may be required for the work to be complete in all respects. This includes revisions due to changes in electrical characteristics, physical size and weight, service requirements, service clearances, etc.
  4. He waives claims for additional costs caused by substitution which may subsequently become apparent.
- B. The contractor shall have included all costs associated with the substitution for the specified products or materials, and that no additional cost will be incurred by any other party in order to fully incorporate the substituted item(s).
- C. The contractor agrees to reimburse the Architect/Engineer for any architectural or engineering re-design that is required by the substitution to be fully incorporated. The reimbursement shall be at the Architect/Engineer's standard billing rate.

### 1.18 ENGINEER DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

### 1.19 CONTRACTOR OBSERVATION DUTIES

- A. When the Contractor schedules an observation for the Engineer, all work for that observation, i.e., underground, above ceiling, or in walls prior to gypsum board installation, shall be completed. If the work is not complete and not ready for inspection, the Engineer will notify the Contractor that the inspection was not performed. The Contractor shall complete the work, and then re-schedule the inspection for the Engineer, for which the Contractor shall reimburse the Engineer at their normal hourly billing rates.
- B. Minimum Required inspections by Engineer:
1. Underground utilities with appropriate test prior to covering pipe.
  2. In walls prior to gypsum board installation.
  3. Above ceiling: Prior to ceiling installation.
  4. Piping systems testing: When performed in smaller sections, the entire system will be required to be retested.

### 1.20 FINISHING

- A. General: Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.
- B. Cleaning: At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the mechanical construction. All closed off spaces shall be cleaned of all packing boxes,

## PLUMBING GENERAL PROVISIONS

wood frame members, and other waste materials used in the mechanical construction.

- C. The entire system of piping and equipment shall be cleaned internally. The Contractor shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris.
- D. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.
- E. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.). All equipment shall have affixed adjacent to the permanent nameplate, the unit identification on an engraved label with permanent adhesive.
- F. Plumbing fixtures, equipment, tanks, pumps, etc., shall be thoroughly cleaned.

### 1.21 TEST AND DEMONSTRATIONS

- A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.
- B. Prior to acceptance of the mechanical installation, demonstrate to the Owner or his designated representatives all essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The contract shall allow for five (5) working days to perform the demonstrations.
- C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.
- D. Provide video/Audio DVD of demonstrations in close out documents.
- E. Dates and times for performing the demonstrations shall be coordinated with the Owner.
- F. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall bear signatures of contractor and owner.

### 1.22 PAINTING AND IDENTIFICATION

- A. Touch-up paint where damaged on equipment furnished with factory applied finish, to match original finish.
- B. Provide engraved, laminated plastic tags for all equipment. Tags shall be attached with permanent adhesive.

## PLUMBING GENERAL PROVISIONS

### 1.23 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Provide excavation necessary for underground water piping, etc., and backfill such trenches and excavations after work has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe and utility laying, than that which is authorized.
- B. Trenches for piping and utilities located inside foundation walls and to point five (5) feet outside of the wall shall be not less than sixteen (16) inches nor more than twenty-four (24) inches wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five (5) feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.
- C. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the barrel will be supported on compacted fill. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell but shall be no larger than necessary for proper jointing. All sewers and piping required for the structure shall be excavated to at least (6) inches below pipe invert.
- D. Immediately after testing and/or inspection, the trench shall be carefully backfilled 6" above pipe, and sloped as specified. Backfill shall be No. 57 crushed stone. Interior backfill of #57 stone shall be full depth from top of bedding to bottom of slab. Exterior bedding #57 stone, free from clods, brick, etc., to a depth one-half the pipe diameter and then firmly puddled and tamped in such a manner as not to disturb the alignment or joints of the pipe. Thereafter, the backfill shall be earth, free from clods, brick, etc., puddled and tamped every vertical foot

### 1.24 CONCRETE WORK

- A. Provide concrete bases and housekeeping pads for all equipment installed at finish floor level. Concrete work shall be as specified in the applicable Civil/Site and Structural Sections. Vibration pads, equipment bases, pipe supports and thrust blocks shall be provided by this Contractor.
- B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

### 1.25 ACCESS PANELS

- A. Provide access panels where required and not shown on the drawings for installation by the drywall or masonry Contractor. Access panels shall be as specified in the applicable architectural section. All access panel locations which allow access to equipment shall be approved by the Architect/Engineer.

## PLUMBING GENERAL PROVISIONS

### 1.26 SLEEVES

- A. Sleeves passing through non-fire rated walls and partitions shall be Schedule 10 black steel.
- B. Sleeves passing through load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 galvanized steel pipe or cast-iron pipe.
- C. Sleeves passing through non-load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 PVC or cast iron.
- D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.
- E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.
- F. Pipe to wall penetration closures for underground pipe penetrations of walls shall be "Link-Seal" as manufactured by Thunderline Corporation, or equal.

### 1.27 ESCUTCHEONS

- A. Provide chrome plated escutcheons at each sleeved opening into finished and exposed exterior spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve but not to insulation with set screws or other approved devices.

### 1.28 INSULATION PROTECTION

- A. Where exposed insulated piping extends to floor, provide sheet metal guard around insulation.

### 1.29 ANCHORING OF EQUIPMENT

- A. All equipment located on floor slab, that is not mounted on wheels shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficient size to prevent equipment from overturning.

### 1.30 ISOLATION OF EQUIPMENT

- A. All equipment shall be installed with isolating service valves. Unions or flange fittings shall be provided for removal of the isolated equipment.

### 1.31 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Water or waste & vent piping shall not be installed in electrical rooms, communication rooms or directly above electrical equipment.

## PLUMBING GENERAL PROVISIONS

### 1.32 CONNECTIONS FOR FIXTURES AND EQUIPMENT UNDER ANOTHER SECTION OR BY OWNER

- A. Rough all equipment requiring connection to systems provided under this Division. Verify requirements and current locations before proceeding with work.
- B. Make all connections to equipment furnished under another Section or by owner as required to obtain complete and working systems.

### 1.33 SYSTEM GUARANTEE

- A. Work required under this Division shall include one-year guarantee. Guarantee by Contractor to Owner is to replace for Owner any defective workmanship or material which has been furnished under contract at no cost to the Owner for a period of one year from date of substantial completion. Guarantee shall also include all reasonable adjustments of system required for proper operation during guarantee period. Guarantee shall not include normal preventative maintenance services or filters.
- B. At "Demonstration", one-year guarantee provision by Contractor shall be explained to Owner.
- C. All sealed hermetic refrigeration systems shall be provided with five-year factory warranty from date of substantial completion.

### 1.34 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. In paragraph below, delete appliances not included in this Section.
- C. Operate and adjust disposers, hot-water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- D. Delete fixture types in first paragraph below not in Project.
- E. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- F. Replace washers and seals of leaking and dripping faucets and stops.
- G. Install fresh batteries in sensor-operated mechanisms.

### 1.35 CLEANING

- A. At completion of all work, fixtures, exposed materials, and equipment shall be cleaned with manufacturers' recommended cleaning methods and materials. Do the following:  
  
Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.  
  
Remove sediment and debris from drains.

## PLUMBING GENERAL PROVISIONS

After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### 1.36 FINAL ACCEPTANCE

- A. Provide protective covering for installed fixtures and fittings, including but NOT limited to bathtub semi-flexible high impact plastic protective covers with deep fluted sidewalls with non-skid foam pas to absorb shock and prevent scratches.

Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test, sterilization compliance and backflow devices certificates.

**END OF SECTION**



**SECTION 220532**  
**PLUMBING SUPPORTS AND ANCHORS**

**PART 1 GENERAL**

**1.01 WORK INCLUDED**

- A. Pipe, duct, and equipment hangers, supports, and associated anchors.
- B. Equipment bases and supports.
- C. Sleeves and seals.
- D. Flashing and sealing equipment and pipe stacks.

**1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS**

- A. Furnish hanger and support inserts sleeves for placement into formwork.

**1.03 SUBMITTALS**

- A. Submit shop drawings and product data for all items listed under this section.
- B. Indicate hanger and support framing and attachment methods.

**PART 2 PRODUCTS**

**2.01 PIPE HANGERS AND SUPPORTS**

- A. Hangers for Pipe Sizes 1/2 to 4 inches: Carbon steel, adjustable, clevis.
- B. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.
- C. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- D. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast-iron roll for hot pipe sizes 6 inches and over.
- E. Vertical Support: Steel riser clamp.
- F. Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe  
Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- G. Un-insulated Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- H. Shield for Insulated Piping 1 1/4 Inches and Smaller: 16 gage galvanized steel saddle over insulation in 180-degree segments, minimum 16 inches long per pipe support.
- I. Shield for Insulated Water Piping 1 1/2 Inches and Larger: Rigid non-conducting blocking in 180-degree segments, 16-inch minimum length with block thickness the same as insulation thickness and with an inner contour of the supporting pipe. Install with 18 gage galvanized steel saddle per pipe support.

## PLUMBING SUPPORTS AND ANCHORS

- K. Shields for Vertical Copper Pipe Risers: Sheet lead.

### 2.02 HANGER RODS

- A. Steel Hanger Rods: Galvanized threaded both ends, threaded one end, or continuously threaded.

### 2.03 FLASHING

- A. Metal Flashing: galvanized steel.
- B. Lead Flashing: 5 lb/sq ft sheet lead for waterproofing; one lb/sq ft sheet lead for soundproofing.
- C. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- D. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

### 2.04 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with Schedule 10 black steel pipe.
- B. Sleeves for Pipes Through Non-fire Rated Walls, Footings, and Potentially Wet Floors: Form with schedule 10 steel pipe.
- C. Sleeves through beams shall be Schedule 40 steel; only in locations approved by the Structural Engineer.
- D. Sleeves through beams shall be Schedule 40 steel; only in locations approved by the Structural Engineer.
- E. Sleeves for floor or wall penetrations at rated assemblies shall conform to Specifications Section 220560.

### 2.05 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.

### 2.06 FINISH

- A. Prime coat steel hangers and supports.

## PART 3 EXECUTION

### 3.01 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as follows:

## PLUMBING SUPPORTS AND ANCHORS

PIPE SUPPORT SCHEDULE					
Pipe Size	Support Spacing				Hanger Rod Diameter
	Sched 40 Black Steel	Copper	PVC	Cast Iron Soil Pipe	
1/2"	-	5'-0"	4'-0"	-	3/8"
3/4"	7'-0"	5'-0"	4'-0"	-	3/8"
1"	7'-0"	6'-0"	4'-0"	-	3/8"
1-1/4"	7'-0"	7'-0"	4'-0"	-	3/8"
1-1/2"	9'-0"	8'-0"	4'-0"	-	3/8"
2"	10'-0"	8'-0"	4'-0"	5'-0"	3/8"
2-1/2"	10'-0"	9'-0"	4'-0"	5'-0"	1/2"
3"	10'-0"	10'-0"	4'-0"	5'-0"	1/2"
4"	10'-0"	10'-0"	4'-0"	5'-0"	1/2"
6"	10'-0"	10'-0"	4'-0"	5'-0"	5/8"
8"	10'-0"	10'-0"	4'-0"	5'-0"	3/4"
10"	10'-0"	10'-0"	4'-0"	5'-0"	7/8"

Note: Rods may be reduced one size for double rod hangers, with 3/8" being the

- B. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2-inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. All hangers, hanger rods, supports, etc. shall be double-nutted.

### 3.02 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete type.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

## PLUMBING SUPPORTS AND ANCHORS

### 3.03 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36-inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, and mop sink drains watertight to adjacent materials.
- E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

### 3.04 SLEEVES

- A. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water. Caulk sleeves full depth and provide floor plate.
- B. Install chrome plated steel escutcheons at finished surfaces
- C. Install stainless steel escutcheons at exterior surfaces.

**END OF SECTION**

**SECTION 220533**  
**DOMESTIC HOT WATER TEMPERATURE MAINTENANCE**

**PART 1 GENERAL**

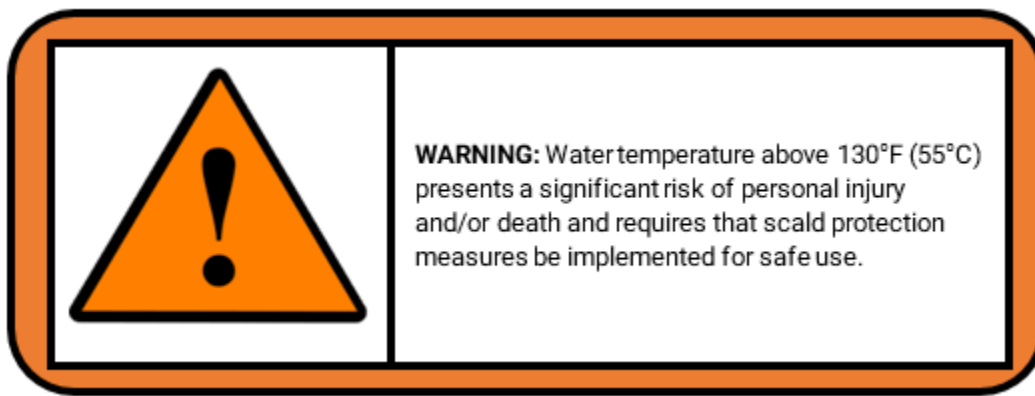
**1.1. SUMMARY**

- A. The system complies with California Title 24 energy requirements.
- B. Section includes a UL Listed, CSA Certified, or FM Approved temperature maintenance heat tracing system of domestic hot water supply consisting of self-regulating trace heater, connection kits, and energy efficient time-based control.
- C. Related Requirements
  - 1. Section 22 07 10 – Insulation for Plumbing Systems

**1.2. REFERENCES**

- A. Reference Standards
  - 1. UL515 – Electrical Resistance Heat Tracing for Commercial Applications
  - 2. IEEE 515.1-2012 Standard for the Testing, Design, Installation & Maintenance of Electric Resistance Trace Heating for Commercial Applications
  - 3. CSA Standard C22.2 No. 130-03 Requirements for Electrical Resistance Heating Cables & Heating Device Sets
  - 4. NFPA 70 - National Electrical Code
  - 5. CSA Standard C22.1 – Canadian Electrical Code
  - 6. ANSI/ASHRAE Standard 188-2018 - Legionellosis: Risk Management for Building Water Systems
  - 7. CIBSE TM13-2013 Minimizing the Risk of Legionnaires Disease

**1.3. SCALDING WARNING**



1.4. SYSTEM DESCRIPTION

- A. NVENT RAYCHEM ACS-30: System for temperature maintenance of domestic hot water supply systems with energy efficient time-based control, multi-point monitoring, integrated ground-fault circuit protection and Building Management System (BMS) communication capabilities.

1.5. ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

A. Product Data

1. Heating cable data sheet
2. UL, CSA, FM approval certificates for hot water temperature maintenance system components
3. Hot water temperature maintenance design guide
4. System installation and operation manual
5. System installation details
6. Connection kits and accessories data sheet
7. Controller data sheet
8. Controller wiring diagram

B. Shop Drawings

1. Provide engineered isometric heat tracing circuit layout drawings indicating power connections, tees, end seals, cable length and circuit cable length.

1.6. QUALITY ASSURANCE

- A. Source Limitations: All system components shall be sourced from a single manufacturer, under no circumstances shall any components be installed other than those supplied by the cable manufacturer, to ensure system integrity and to meet warranty requirements.

B. Qualifications

1. Manufacturers
  - a. Manufacturer to show minimum of 40 years of experience in manufacturing electric self-regulating heating cables.
  - b. Manufacturer will be ISO-9001 registered.
  - c. Manufacturer to provide products consistent with IEEE 515.1 and CSA 22.2 No. 130-03 requirements.

## DOMESTIC HOT WATER TEMPERATURE MAINTENANCE

- d. The self-regulating temperature maintenance cable shall be qualified and tested to demonstrate a useful lifetime in excess of 40 years.
- 2. Installers
  - a. System installer shall have complete understanding of product and product literature from manufacturer or authorized representative prior to installation. A licensed electrician shall perform all electrical connections.
- 3. Electrical Components, Devices, and Accessories: Listed and labelled as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Laboratory (NRTL), and marked for intended use.
- C. Certifications
  - 1. The system (heating cable, connection kits, and controller) shall be UL Listed, CSA Certified, or FM Approved for hot water temperature maintenance.
- 1.7. DELIVERY, STORAGE, AND HANDLING
  - A. Delivery and Acceptance Requirements
    - 1. Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels identifying the following:
      - a. Product and Manufacturer
      - b. Length/Quantity
      - c. Lot Number
      - d. Installation and Operation Manual
      - e. MSDS (if applicable)
  - B. Storage And Handling Requirements
    - 1. Store the heating cable in a clean, dry location with a temperature range 0°F (-18°C) to 140°F (60°C).
    - 2. Protect the heating cable from mechanical damage
- 1.8. WARRANTY
  - A. Manufacturer Warranty
    - 1. nVent warrants all goods listed below for 2 years from date of purchase against faulty workmanship and use of defective materials when such goods are properly installed, operated, and maintained according to product documentation. See Limited Product Warranty H57396 at [nventthermal.com](http://nventthermal.com) for details.

## DOMESTIC HOT WATER TEMPERATURE MAINTENANCE

- a. Heating cables, connection kits, and accessories
  - b. Thermostats, controllers, panels contactors, sensors, and accessories
- B. Extended Warranty –
- 1. Contractor shall provide the owner an extended product warranty. The contractor must complete and forward to owner the Installation, Inspection or Commissioning Record(s) located in the back of installation manual for the heat trace system being installed, and complete the online warranty registration form at [nventthermal.com/support/warranty](http://nventthermal.com/support/warranty) within 30 days from the date of installation, otherwise only standard limited warranty applies. See Limited Product Warranty Extension H57397 at [nventthermal.com](http://nventthermal.com) for details.
    - a. Provide Extended Warranty for heating cable and components shall be 10 years from date of purchase.

## PART 2 PRODUCTS

### 2.1. HEAT TRACING SYSTEM

- A. Manufacturers
  - 1. Basis of Design Manufacturer: Subject to the compliance with requirements, provide nVent RAYCHEM heat tracing products of nVent Thermal, LLC or approved equal.
- B. Materials
  - 1. Heating cables shall be nVent RAYCHEM HWAT-R2, self-regulating temperature maintenance heating cables specifically designed for this application, tested and approved to IEEE 515.1 and CSA 22.2 No 130-03.
    - a. The construction of the self-regulating temperature maintenance heating cable shall consist of a continuous core of conductive polymer that is radiation crosslinked, extruded between two 16 AWG nickel-plated copper bus wires that varies its power output in response to pipe temperature changes.
    - b. The heating cable shall have a modified polyolefin inner jacket for dielectric integrity and long-life expectancy.
    - c. The heating cable shall have a laminated aluminum foil layer (Mylar wrap) for additional mechanical protection and shall act as a plasticizer diffusion shield.
    - d. The heating cable shall have a thicker gauge (5/24) tinned copper braid with minimum 70% coverage for ground path and mechanical ruggedness.
    - e. The heating cable shall have a POLYOLEFIN outer jacket printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).



## DOMESTIC HOT WATER TEMPERATURE MAINTENANCE

- f. The heating cable shall have a self-regulating factor of at least 70 percent for HWAT-R2. The self-regulating factor is defined as the percent reduction of the heating cable power output going from a 40°F (5°C) pipe temperature to 150°F (65°C) pipe temperature.
- g. The heating cable shall operate online voltages of 277 without the use of transformers. Coordinate with Electrical Contractor PRIOR to shop drawing submittals and purchasing.
- h. The heating cable shall be UL Listed, CSA Certified, and FM Approved system.
- i. Constant wattage cables are not acceptable.

### 2. Heating Cable Connection Kits

- a. Heating cable connection kits shall be nVent RAYCHEM RayClic Connection Kits.
- b. Contractor shall provide power connections, splices/tees, and end seal kits to properly connect and terminate the heating cable.
- c. All splices, tees and crosses shall be installed underneath the pipe insulation with service loops installed to allow for future service of the piping.
- d. Connection kits shall be rated Type 4X to prevent water ingress and corrosion. All components shall be UV stabilized and shall not require the installing contractor to cut into the heating-cable core to expose the bus wires.
- e. Connection kits shall be UL Listed, CSA Certified, and FM approved.

### 3. Attachment of Heating Cable

- a. Attachment method of heating cable to the piping shall be either
  - 1. nVent RAYCHEM GT-66 – general purpose, high temperature, glass filament tape for installation @ 40°F (5°C) and above. Contractor to affix the heating cable to the pipe every 12" by wrapping the GT-66 tape around the pipe and over the heating cable.
  - 2. nVent RAYCHEM AT-180 – aluminum tape, high temperature for all plastic piping for installations @ 32°F (0°C) and above. Tape is installed lengthwise over the heating cable.
- b. Metal cable ties are not permitted.

### 4. Identification of Heating Cable System

- a. Contractor shall provide and install nVent RAYCHEM ETL "Electric Heat Traced" labels on exterior of pipe insulation every 10 feet on opposite sides of the pipe for the entire length of heat traced piping.

## DOMESTIC HOT WATER TEMPERATURE MAINTENANCE

- b. In addition, all splices, tees, crosses and power connections shall be labeled on the exterior of the pipe insulation indicating the presence of a connection kit.

### 5. Energy Efficient Control System

#### a. Single Circuit Local Digital Controller

1. All self-regulating temperature maintenance cable shall be controlled via an energy saving, programmable single circuit controller to provide adjustable maintained temperatures in the range of 105°F to 140°F, known as nVent RAYCHEM HWAT-ECO-GF, manufactured by nVent.
2. Digital controller shall operate on 277 V.
3. Pre-programmed duty cycles based on ambient temperature ranging from 60°F to 80°F.
4. The pre-programmed duty cycles shall be based on HWAT-R2 heating cables only. No other heating cables may be used with the HWAT-ECO-GF controller.
5. Flexible temperature control from 105°F to 140°F.
6. Three programmable temperature set points for maximum energy efficiency: Maintain, Economy, Off.
7. Controller shall have heat cycle setting.
8. The controller shall have a USB port to allow for quick and easy software update.
9. Digital controller shall have an integrated GFPD (30 mA).
10. Heating cable manufacturer shall provide a local digital controller with 24/7 pre-programmed time-based profiles specific to the selected heating cable application such as schools, hospitals and prisons.
11. Controller shall have remote alarming capability to a BMS interface.
12. Controller shall have a pipe temperature sensor, low/high pipe temperatures alarms and high temperature cut-out to maximize the energy efficiency of the nVent RAYCHEM HWAT system by verifying that the hot water pipe temperature is at or above the programmed minimum temperature (low temperature set point); and to monitor and alarm if the pipe temperature is higher than the maximum programmed temperature (high temperature set point and cut-out).
13. Controller shall have an optional boiler temperature sensor, low/high boiler temperatures alarms and high temperature cut-out to maximize the energy efficiency of the HWAT system by verifying that the boiler temperature is at or above the correct minimum temperature (low temperature set point); and to monitor and alarm if the pipe temperature is higher than the maximum programmed temperature (high temperature set point and cut-out).

## DOMESTIC HOT WATER TEMPERATURE MAINTENANCE

14. Controller shall have 30 A switching capacity rating.
  15. Enclosure type shall be Type 12 (Polycarbonate).
  16. Controller shall have NO/NC alarm contacts. Controller shall alarm on:
    - a. Loss of power
    - b. Controller reinitialized
    - c. Pipe temperature above high set point\
    - d. Pipe temperature below low set point
    - e. Boiler temperature above high set point
    - f. Boiler temperature below low set point
  17. Digital controller shall have c-UL-us approvals specifically for use with the HWAT-R2 heating cable.
6. Thermal Pipe Insulation
- a. Pipes must be thermally insulated in accordance with the HWAT Design Guide H57510 requirements. No deviation from the insulation schedule will be allowed.
  - b. Thermal insulation must be a type that is flame retardant (closed cell or fiberglass) with waterproof covering.
7. Approval
- a. The system (heating cable, connection kits, and controller) shall be UL Listed, CSA Certified, or FM Approved for hot water temperature maintenance.
  - b. The temperature maintenance system shall have a design, installation and operating manual specific to domestic hot water piping.

## PART 3 EXECUTION

### 3.1. EXAMINATION

- A. Verification of Conditions
1. Prior to installation of heating cable system, verify that all piping which will be heat traced has passed all hydrostatic/pressure tests and is signed off by plumbing inspector.
- B. Preinstalling Testing
1. Prior to installing heating cable on the piping, an insulation resistance test shall be performed by the installing contractor to ensure integrity of heating cable as described in the installation and maintenance manual.

### 3.2. PREPARATION

- A. Protection of In-Place Conditions
  - 1. All heating cable ends shall be protected from moisture ingress until cable is terminated.
  - 2. Acceptable methods are by installing nVent RAYCHEM RayClic-E end seals.

### 3.3. INSTALLATION

- A. Comply with manufacturer's recommendations in the HWAT System Installation and Operation Manual H57548.
- B. Apply the heating cable linearly on the pipe after piping has successfully completed any pressure tests.
- C. Secure the heating cable to piping with the approved attachment method which shall be either:
  - 1. GT-66 – general purpose, high temperature, glass filament tape for installation @ 40°F (5°C) and above. Contractor to affix the heating cable to the pipe every 12" by wrapping the GT-66 tape around the pipe and over the heating cable.
  - 2. AT-180 – aluminum tape, high temperature is required for all plastic piping, for installations @ 32°F (0°C) and above. Tape is installed lengthwise over the heating cable.
- D. Install electric heating cable according to the drawings and the manufacturer's instructions. The installer shall be responsible for providing a completely functional system, installed in accordance with applicable national and local requirements.
- E. Any deviation in circuitry, insulation, or piping material must be approved by engineer prior to execution.
- F. Distribution pipes and express risers must be isolated electrically. Each shall have its own circuit.
- G. Branch lines shall be grouped electrically based on location.
- H. All power connections must be located in accessible areas. Access panels for power connection shall be a minimum of 12" x 12" and within reach of power connection kit.
- I. Refer to Electrical Specification for power connection locations.
- J. All power, tee, and splice connection points shall be shown on the plumbing as-built drawings.

## DOMESTIC HOT WATER TEMPERATURE MAINTENANCE

- K. Installation training, provided by an authorized manufacturer's representative, must be completed prior to work mobilization.
- L. Interface with Other Work
  - 1. Grounding of controller shall be according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
  - 2. Connection of all electrical wiring shall be according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
  - 3. Pipe shall be thermally insulated in accordance with the HWAT design guide insulation requirements.

### 3.4. FIELD QUALITY CONTROL

- A. Initial start-up and field testing (commissioning) of the system shall be performed by factory technician or factory representative per the owner's requirements.
- B. Field Tests and Inspections
  - 1. The system shall be commissioned in accordance to the HWAT Installation and Operation Manual H57548
  - 2. The heating cable circuit integrity shall be tested using a 2500 Vdc megohmmeter at the following intervals:
    - a. Before installing the heating cable
    - b. After heating cable has been installed onto the pipe
    - c. After installing connection kits
    - d. After the thermal insulation is installed onto the pipe
    - e. Prior to initial start-up (commissioning)
    - f. As part of the regular system maintenance
    - g. Minimum acceptable insulation resistance shall be 1000 megohms or greater
  - 3. The technician shall verify the insulation schedule is in compliance with the HWAT Installation and Operation manual.
  - 4. The technician shall verify that the HWAT-ECO-GF control parameters are set to the application requirements.
  - 5. The technician shall verify that the HWAT-ECO-GF alarm contacts are correctly connected to the BMS.
  - 6. The technician shall verify that the ACS-30 and ProtoNode-RER are configured correctly with the BMS.
- C. Non-Conforming Work
  - 1. Any heat tracing circuit which fails the any of the above tests must be corrected prior to commissioning or startup of the system.

## DOMESTIC HOT WATER TEMPERATURE MAINTENANCE

- D. Retain the services of nVent to provide factory design build and inspection services to prepare submittals for complete design layouts, wiring diagrams, installation details for all heat trace equipment including heating cable, connection kits, controllers and sensors. nVent shall supply 11"x17" isometric drawings for every circuit for a complete heat tracing system.
- E. Provide factory inspection report as part of a complete manufacturer approved installation that is compliant to Code.
- F. Start-up – Start-up of system shall be performed by factory technician or factory representative per the owner's requirements.

### 3.5. SYSTEM STARTUP

- A. Provide a factory-certified technician or manufacturer's representative for startup and commissioning of the heat tracing system and controller.
- B. Coordinate all controller settings with plumbing engineer prior to programming the controller.
- C. Provide commissioning report in submittals package to owner.

**END OF SECTION**

**SECTION 220534**  
**HEAT TRACING FOR PLUMBING PIPING**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes plumbing piping heat tracing for pipe freeze prevention, grease waste flow maintenance, and domestic hot-water-temperature maintenance with the following electric heating cables:
  - 1. Self-regulating, parallel resistance.
- B. Related Requirements:
  - 1. Section 220710 Insulation for Plumbing Systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include the following:
    - a. Heating cable data sheet.
    - b. Plumbing piping freeze protection design guide
    - c. System installation and operation manual.
    - d. System installation details.
    - e. Connection kits and accessories data sheet.
    - f. Controller data sheet.
    - g. Controller wiring diagram.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
  - 3. Schedule heating capacity, length of cable, and electrical power requirement for each electric heating cable required.
  - 4. Include heat loss calculations for each pipe including pipe and insulation characteristics, heat loss, and watts per foot supplied by the heating cable.
- B. Shop Drawings: For electric heating cable.

1. Include plans, elevations, sections, and attachment details.
  2. Include diagrams for power, signal, and control wiring.
  3. Manufacturer to produce detailed design as described below.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Delegated design submittals include the following:
1. Heat Trace Circuit Layout Drawings, including:
    - a. Location/identification of area to be traced.
    - b. Heater circuit number.
    - c. Electrical load.
    - d. Heater catalog numbers.
    - e. Heater termination points.
    - f. Start-up temperature.
    - g. Location of all components.
    - h. Material list and quantities of all components.
    - i. Heating cable layout.
  2. Heat Trace Isometric, including the following:
    - a. Location of line.
    - b. Piping line numbers
    - c. Valves, pumps, flanges, fittings, and instruments.
    - d. Heat loss and heater output.
    - e. Electrical load.
    - f. Heater catalog number.
    - g. Heater termination points.
    - h. Design parameters.
    - i. Insulation type and thickness.
    - j. Position of all components.
    - k. Material schedule listing all components and quantities used.
    - l. Panel ID number.
  3. Pipe Freeze Protection Detail Drawings: Project-specific Detail Drawings, including details showing the following:
    - a. Installation and positioning of all components.
    - b. Proper amounts of tracing for valves, pumps, flanges, fittings, instruments, etc.
    - c. Junction box layouts.
  4. Control Panel Drawings: Drawings for each control panel shall include the following:
    - a. Physical arrangement and structural detail drawings.



- b. Complete power and control wiring diagrams showing all internal wiring connections for electrical and instrument components in each control panel. All wires, terminals, and devices shall be numbered and tagged in accordance with system elementary diagrams.
- 5. System Wiring Diagram: Project-specific Drawings (if applicable) including:
  - a. Interconnect of all major components.
  - b. Assignment of circuiting.
  - c. Connection of circuit wiring in terminal blocks.
  - d. Connection of sensor wiring.
  - e. Connection of external alarm wiring.
- 6. Controller Setpoint Schedule (if applicable) showing the following:
  - a. Circuit addresses.
  - b. Circuit set points,
  - c. Circuit alarms and settings.
- D. Testing Instructions and Reporting Form: Provide documentation for use in preinstallation testing of heat-tracing system.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
- B. Testing: Completed system test report.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. ISO-9001 registered.
  - 2. Provide products consistent with UL 515, CSA 22.2 No 130-03, and IEEE 515.1 requirements.
- B. Installer Qualifications:

1. System Installer to have complete understanding of product and product literature from manufacturer or authorized representative prior to installation.
  2. Electrical connections to be performed by licensed electrician.
- C. Certification - System (Heating Cable, Connection Kits, and Controller): UL Listed, CSA Certified, or FM Approved for freeze protection of metallic and non-metallic piping associated with HVAC, Plumbing, and Fire Suppression systems.
- D. Testing: Self-regulating heating cable for pipe freeze protection/flow maintenance to be qualified and tested to demonstrate a useful lifetime in excess of 20 years; for hot-water-temperature maintenance to be qualified and tested to demonstrate a useful lifetime in excess of 40 years.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels identifying the following:
1. Product and manufacturer.
  2. Length/quantity.
  3. Lot number.
  4. Installation and operation manual.
  5. Material safety data sheet (MSDS).
- B. Store heating cable in clean, dry location with a temperature range of 0 to 140 deg F.
- C. Protect heating cable ends from moisture ingress until final termination of the heating cable is complete.

#### 1.8 WARRANTY

- A. Manufacturer's Limited Warranty: Manufacturer agrees to repair or replace heat tracing products listed below that fail in materials or workmanship within specified warranty period, when such goods are properly installed, operated, and maintained in accordance with product documentation.
1. Covered Products include the following:
    - a. Heating cables, connection kits, and accessories.
    - b. Thermostats, controllers, panels, contactors, sensors, and accessories.
  2. Warranty Period: Two years from date of Substantial Completion.
- B. Manufacturer's Extended Warranty: Provide Owner an extended product warranty for heat tracing products described below.

1. Contractor must complete and forward to Owner the Installation, Inspection, or Commissioning Record(s), and complete manufacturer's online warranty registration form within 30 days from date of installation, otherwise only standard limited warranty applies.
2. Heating Cable Warranty Period: 10 years from date of Substantial Completion.
3. Heating cables, connection kits, and accessories not automatically offered with a 10-year manufacturer's warranty, as a standard matter of course, will not be allowed. Warranty information must be published on manufacturer's website.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- A. Complete pipe freeze protection system for insulated pipes exposed to the risk of freezing. System consists of a self-regulating heating cable, connection kits, accessories, and energy-efficient control, monitoring, and Building Management System (BMS) communication capabilities. The heating cable shall have a polyolefin jacket for above ground, water piping, and a fluoropolymer jacket for below ground grease waste or fuel piping.
  1. Pipe freeze protection of above ground water piping.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage manufacturer to design complete and functional heat-tracing system as required by Project documents.

### **2.3 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES FOR PIPE FREEZE PROTECTION AND GREASE WASTE FLOW MAINTENANCE**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide RAYCHEM, a brand of nVent; XL-Trace Pipe Freeze/Flow Maintenance or approved equal.
- B. Source Limitations: Obtain heat-tracing components and controllers from single manufacturer. To ensure system integrity and meet warranty requirements, only components and controllers supplied by cable manufacturer are to be used.
- C. Heating cable and connection kit shall be included in a UL Listed, CSA Certified, and FM Approved system.
- D. Heating Element: Pair of parallel No.16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end

with a watertight end seal. Cable shall be capable of crossing over itself without overheating.

- E. Electrical Insulating Jacket: Flame-retardant modified polyolefin.
- F. Ground Braid: Tinned-copper braid. Minimum 70 percent for ground path and mechanical ruggedness.
- G. Outer Jacket Requirements.
  - 1. For aboveground freeze protection of water lines where fuel oil or aqueous chemicals are not present, use a modified polyolefin with ultraviolet inhibitor. Outer jacket to be printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).
  - 2. For below-grade applications, grease waste, or where fuel oil and aqueous chemicals are present, use fluoropolymer with ultraviolet inhibitor. Outer jacket to be printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).
- H. Maximum Operating Temperature (Power On): 150 deg F. Set on at 40 deg F.
- I. Maximum Exposure Temperature (Power Off): 150 deg F. Set off at 50 deg F
- J. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- K. Capacities and Characteristics:
  - 1. Maximum Heat Output at 50 deg F, 5 W/ft or as required to maintain freeze protection.
  - 2. Piping Diameter: Refer to plans, maximum line size is 6" diameter.
  - 3. Electrical Characteristics for Single-Circuit Connection:
    - a. Volts: 277.
    - b. Phase: Single.

## 2.4 CONTROLS

- A. Single Circuit Local Digital Controller for Freeze Protection.
  - 1. Basis-of Design Product: RAYCHEM; C910-485.
  - 2. Control self-regulating heating cable via an energy-saving, programmable single-circuit controller to provide adjustable maintained temperatures in the range of -40 to 140 deg F.
  - 3. Provide one controller for each heat-tracing circuit.

4. Controller to include self-test function to verify heat-tracing integrity at least once every 24 hours.
5. Controller Capabilities:
  - a. Supply Voltage: 277 VAC.
  - b. Enclosure: NEMA 4X FRP.
  - c. Operating Temperature Range: - 40 to 140 deg F.
  - d. Display: Six-character, alphanumeric LED.
  - e. Control: DP mechanical relay type.
  - f. Control Algorithms: On/Off. PASC for energy savings.
  - g. Monitoring:
    - 1) Temperature:
      - a) Low Alarm: 30 deg F.
      - b) High Alarm: 60 F.
    - 2) Ground Fault:
      - a) Alarm Range: 20 to 100 mA.
      - b) Trip Range: 20 to 100 mA
    - 3) Current:
      - a) Low Alarm Range: 3. to 20 A, or off.
    - 4) Autocycle Test: Interval of 1 to 240 minutes or 1 to 240 hours.
  - h. Temperature Sensor Inputs:
    - 1) Quantity: Two.
    - 2) Type: 100 ohm, platinum, 3-wire, shielded.
  - i. Alarm Outputs:
    - 1) AC Relay: Isolated solid state triac, SPST, 0.75 A maximum, 100 to 277 V ac nominal.
    - 2) Dry Contact Relay: Pilot duty, 48 V ac/dc, 500mA maximum, 10 V maximum resistive switching.
    - 3) Outputs: Normally open or normally closed.
  - j. Stored Parameters:
    - 1) Minimum temperature.
    - 2) Maximum temperature.
    - 3) Maximum ground fault current.
    - 4) Maximum heater current.
    - 5) Contactor cycle count.

- 6) Time in use.
- k. Alarm Conditions:
  - 1) Low and high temperature.
  - 2) Low current.
  - 3) Ground fault alarm and trip.
  - 4) RTD failure.
  - 5) Loss of programmed values.
  - 6) EMR failure.
- l. Communications:
  - 1) Protocol: Modbus RTU.
  - 2) Topology: Daisy Chain.
  - 3) 26 AWG shielded twisted pair.
- 6. Temperature Sensors:
  - a. For each temperature sensing controller, provide at least one of the following:
    - 1) One, 100-ohm, platinum 3-wire, shielded RTD for pipe temperature sensing.
      - a) Basis-of-Design Product: RAYCHEM; RTD-10CS.
    - 2) One, 100-ohm, platinum 3-wire, shielded RTD for ambient temperature sensing.
      - a) Basis-of-Design Product: RAYCHEM; RTD-200.
- 7. Approval: Complete heat trace system (heating cable, connection kits, and controller) shall be listed by a nationally recognized testing laboratory (NRTL), and marked for intended freeze protection of metallic and non-metallic piping associated with HVAC, Plumbing, and Fire Suppression systems.
- B. Single Circuit Local Digital Controller for Freeze Protection. (Indoor use only)
  - 1. Basis-of Design Product: RAYCHEM; 460.
  - 2. Control self-regulating heating cable via an energy-saving, programmable single-circuit controller to provide adjustable maintained temperatures in the range of 32 to 176 deg F (0 to 80 deg C).
  - 3. Contractor shall provide one (1) 460 controller for each heat tracing circuit as indicated on heat tracing schedule
  - 4. Controller shall include a user defined self-test function to verify heat-tracing integrity daily, weekly or monthly.

5. Controller shall be able to use two temperature sensors per circuit with ability to assign any of them for high temperature cut-out function.
6. Controller shall include user-defined filters for temperature alarms to avoid nuisance alarms.
7. Controller shall have ground fault current sensing and relaying equipment that complies with UL1053 requirements. External ground fault devices are not allowed.
8. Controller shall have user-defined settings for ground fault alarm and trip levels.
9. Controller shall store at least 100 past events/alarms to aid maintenance
10. Controller Capabilities:
  - a. Supply Voltage: 120 to 277 V ac.
  - b. Enclosure: NEMA 12 (indoor use).
  - c. Operating Temperature Range: 32 to 105 deg F (0 to 40 deg C).
  - d. Display: 5" touchscreen color display.
  - e. Control: DP mechanical relay type.
  - f. Control Algorithms: Ambient On/Off. Line Sensing. Proportional Ambient Sensing Control (PASC) for energy savings.
  - g. Monitoring:
    - 1) Temperature:
      - a) Low Alarm: -40 to 190 deg F (-40 to 88 deg C).
      - b) High Alarm: 32 to 190 deg F (0 to 88 deg C).
    - 2) Ground Fault:
      - a) Alarm Range: 20 to 200 mA.
      - b) Trip Range: 20 to 200 mA
    - 3) Current:
      - a) Low Alarm: Built-in 0.25 A.
    - 4) Autocycle Diagnostics: Built-in (Daily).
  - h. Temperature Sensor Inputs:
    - 1) Quantity: Two.
    - 2) Type: Thermistor 2 K-Ohm / 77°F (25°C), 2-wire.
  - i. Alarm Outputs:
    - 1) AC Relay: Single pole double throw relay, volt-free; maximum switching capacity (resistive load only) 1 A/30 VDC, 0.5 A/125 VAC. Maximum 60 VDC/125 VAC.
    - 2) Outputs: Normally open or normally closed.

- j. Stored Parameters:
  - 1) Time stamp.
  - 2) Warning.
  - 3) Event description.
  - 4) Device ID.
  - 5) Language.
  - 6) Country.
  - 7) Control mode.
  - 8) Cable type.
  - 9) Supply voltage.
  - 10) Sensor 1 and 2.
  - 11) Setpoint.
  - 12) Deadband.
  - 13) Minimum expected ambient temperature.
  - 14) Power adjustment.
  - 15) GFCI current.
  - 16) Load current.
  - 17) Board temperature.

- k. Alarm Conditions:
  - 1) Low and high temperature.
  - 2) Low current.
  - 3) Ground fault alarm and trip.
  - 4) RTD failure.
  - 5) EMR failure.

- l. Communications:
  - 1) Alarm relay to fire alarm panel

11. Temperature Sensors: [Select One]

- a. Contractor shall use one sensor provided for ambient temperature sensing and second sensor provided for pipe temperature sensing for each 460 controllers.
- b. Contractor shall be able to program the controller to keep the heating cable powered in case of temperature sensor failure.

12. Approval: Complete heat trace system (heating cable, connection kits, and controller) shall be listed by a nationally recognized testing laboratory (NRTL) and marked for intended freeze protection of metallic and non-metallic piping associated with HVAC, Plumbing.

C. Multi-Circuit Distributed Digital Control System:

- 1. Control and monitor pipe freeze protection using a centralized control system with distributed power and control modules.



- a. Basis-of Design Product: RAYCHEM; ACS-30.
2. Multi-Application: Distributed digital control system shall be pre-programmed parameters to provide concurrent control for heating cables used for pipe freeze protection, flow maintenance, HVAC piping, hot-water-temperature maintenance, surface snow melting, roof and gutter de-icing, freezer frost heave prevention and floor heating applications.
3. Central User Interface Terminal: For all programming.
  - a. Basis-of Design Product: RAYCHEM; ACS-UIT2.
  - b. Certification: c-CSA-us Certified.
  - c. Terminal Display: Color LCD display with password protection to prevent unauthorized system access.
  - d. Capable of communicating with up to 52 power control panels, where each panel can control up to five circuits and accept up to five temperature inputs.
  - e. Digital control system shall be capable of assigning up to four temperature inputs per heat-tracing circuit.
  - f. Capable of communicating with up to 16 remote monitoring modules, where each module can accept up to eight temperature inputs.
  - g. USB port to allow for quick and easy software update.
  - h. Programmable Alarm Contacts: Three, including alarm light on enclosure cover.
  - i. Provide separate offline software tool to allow users to preprogram digital control system and transfer program via USB drive or Ethernet.
  - j. Enclosure: NEMA 4 for indoor or outdoor locations.
4. Power Control Panels:
  - a. Basis-of-Design Products: RAYCHEM; ACS-PCM2-5.
  - b. Certification: c-UL-us Listed.
  - c. Enclosure: NEMA 4/12 enclosure approved for nonhazardous indoor and outdoor locations.
  - d. Provide ground-fault and line current sensing alarming, switching and temperature inputs for five heat-tracing circuits.
  - e. Contactors: 3-pole, 30A contactors, EMR type. Quantity: Five.
  - f. Capable of operating at 120 to 277 V.
  - g. Alarm contact, including alarm light on panel cover.
5. Digital Controller:
  - a. Integrated adjustable GFPD (10 to 200 mA).
  - b. Capable of being configured for On/Off, ambient sensing, PASC, and timed duty cycle control modes based on application. PASC control proportionally energizes power to heating cable to minimize energy based on ambient sensed conditions.
  - c. Upon communication loss with user interface terminal, panels shall control with the last downloaded set point.

- d. Include built-in self-test feature to verify proper functionality of heating cable system.
  - e. BMS Communication Protocol: By one of the following protocols: *The controls system shall be fully compatible and capable to communicate with City of Huntsville existing systems. DDC to be Honeywell Webs AX.*
  - f. Variables monitored by digital controller and reported back to BMS include the following:
    - 1) Temperature.
    - 2) Ground-fault.
    - 3) Current draw.
    - 4) Power consumption.
    - 5) Associated alarms.
6. Approval: Complete heat trace system (heating cable, connection kits, and controller) shall be listed by an NRTL, and marked for intended freeze protection of metallic and non-metallic piping associated with HVAC, Plumbing, Domestic Hot-Water-Temperature Maintenance, and Fire Suppression systems.

## 2.5 HEATING CABLE CONNECTION KITS

- A. Basis-of-Design Product: RAYCHEM; RayClic.
- B. Provide power connections, splices/tees, and end seal kits to properly connect and terminate heating cable circuit along specified length of the piping.
- C. Install splices, tees, and crosses underneath the pipe insulation with service loops installed to allow for future service of piping.
- D. Connection kits shall be rated NEMA 4X to prevent water ingress and corrosion. All components shall be UV stabilized and shall not require cutting into heating-cable core to expose bus wires.
- E. Certification: UL Listed, CSA Certified, and FM approved.
- F. Locate connection kits above grade for buried applications.

## 2.6 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, cable ties, connection kits, and end seals all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Identification: Provide and install "Electric Heat Traced" labels on exterior of pipe insulation every 10 ft. on opposite sides of pipe, and on all splices, tees, crosses, and power connections for the entire length of heat traced piping.

- C. Warning Labels: To be provided per manufacturer recommendations.
- D. Thermal Pipe Insulation:
  - 1. Pipes to be thermally insulated in accordance with manufacturer's written requirements.
  - 2. Thermal Insulation: Flame retardant, closed-cell in masonry walls or fiberglass with waterproof covering.

## 2.7 SYSTEM APPROVAL

- A. Complete heat trace system (heating cable, connection kits, and controller) shall be listed by an NRTL, and marked for intended freeze protection of metallic and non-metallic piping associated with HVAC, Plumbing, Domestic Hot-Water-Temperature Maintenance, and Fire Suppression systems.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Prior to installation of heating cable system, verify that all piping that will be heat traced has passed all hydrostatic/pressure test and is signed off by plumbing inspector.
  - 2. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
- B. Preinstallation Testing:
  - 1. Prior to installing heating cable on piping, an insulation resistance test shall be performed by installing contractor to ensure integrity of heating cable as described in the installation and maintenance manual.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect all heating cable ends from moisture ingress until cable is terminated with end seals.
  - 1. Basis-of-Design Product: RAYCHEM; RayClic-E end seals.

### 3.3 INSTALLATION

- A. All heat-tracing components including power connections, splices, tees, crosses or end seal, must be installed above grade and protected from abuse or damage. In accordance with NEC and CEC, electrical connections are not permitted to be installed below grade.
- B. In the field, all heating cables shall be meggered with a minimum of 2,500 V dc for self-regulating cable. The following field megger readings shall be taken on each heating cable:
  - 1. Heating cable shall be meggered when received at Project site before installation.
  - 2. Heating cable shall be meggered after installation, but before insulation is installed.
  - 3. Heating cable shall be meggered after insulation is installed.
  - 4. Heating cable shall be meggered at final commissioning prior to being energized.
  - 5. Insulation resistance must exceed 1.000 megohms at 2,500 V dc.
  - 6. All results must meet manufacturer's specification.
- C. Install electric heating cables after piping has been tested and before insulation is installed.
- D. Install electric heating cables in accordance with IEEE 515.1.
- E. Install insulation over piping with electric heating cables in accordance with Section 220719 "Plumbing Piping Insulation."
- F. Install warning labels on piping insulation where piping is equipped with electric heating cables.
- G. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.4 CONNECTIONS

- A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Initial start-up and field testing (commissioning) of system shall be performed by factory technician in accordance with Owner's requirements.

- B. Contractor to perform the following tests and inspections during installation:
  - 1. Heating cable shall be meggered when received at Project site before installation.
  - 2. Heating cable shall be meggered after installation, but before insulation is installed.
  - 3. Heating cable shall be meggered after insulation is installed.
  - 4. Insulation resistance must exceed 1,000 megohms at 2,500 V dc.
  - 5. All results must meet manufacturer's specification.
  - 6. Test cables for electrical continuity during installation.
  - 7. Test insulation integrity before energizing.
  - 8. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- D. Cables will be considered defective if they do not pass tests and inspections in accordance with manufacturer's testing requirements.
- E. Prepare test and inspection reports.

### 3.6 PROTECTION

- A. Protect installed heating cables, including nonheating leads, from damage and moisture ingress during construction.
- B. Remove and replace damaged heat-tracing cables.

**END OF SECTION**

**SECTION 220553**  
**PLUMBING IDENTIFICATION**

**PART 1        GENERAL**

**1.01    WORK INCLUDED**

- A.    Description of Work: Provide all labor, materials, equipment and services required for complete installation of all plumbing identification indicated on Drawings and specified herein. Identification of domestic nitrogen, argon, compressed air, cold, hot & recirculating water, non-potable water, service valves, natural gas, sanitary drain, sanitary vent, emergency rain leaders and rain leader piping systems.

**1.02    SUBMITTAL**

- A.    Submit samples and manufacturer's installation instructions for all plumbing identification        products used.

**PART 2        PRODUCTS**

**2.01    MATERIALS**

- A.    Ceiling Markers: Markserv MS900 self adhesive vinyl, 0.0032" thick PVC with permanent pressure-sensitive acrylic adhesive for use of identifying valve locations above acoustical tile ceilings 7/8" diameter, 7 colors available - yellow, green, blue, orange, black, red and white. Fire protection watercolor to be orange with white number. Markers shall be numbered consecutively with standard 3/16" characters. Markers shall be installed on metal grid of lay-in ceilings and located within 24" of valve above ceiling. Markers shall be Markserv, Seton or equal. Markers shall have identification stamp.
- B.    Plastic Nameplates (Equipment): Laminated three-layer plastic with engraved white letters on black background color.
- C.    Metal Tags: Brass with 1/2-inch-high black filled numbers and/or letters, minimum 1-1/2-inch diameter, brass link chain and hooks.
- D.    Interior of building pipe markers: Seton Economy Self-Adhesive Pipe Markers: Color coded background, color of legend letter size and length of letter size and length of color field shall conform completely with the latest edition of ANSI A13.1. Markers shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be by Seton, Kolbi, Brady, or approved equal or approved equal.
- E.    Exterior and Limited Interior pipe markers: Snap/Strap-Around Markers: Outdoor grade acrylic plastic with UV inhibitors. Color coded background, color of legend letter size and length of letter size and length of color field shall conform completely with the latest edition of ANSI A13.1 marker shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be factory formed for the installed diameter. Markers less than 6-inch diameter shall Snap-On. Markers 6-inch diameter and larger shall be secured with stainless steel spring fasteners provided by the marker manufacturer. Markers shall be Set Mark pipe markers by Seton or approved equal.

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. Degrease and clean surfaces to receive adhesive for roll form pipe identification markers. These markers shall be installed on piping above ceilings.

**3.02 PIPING**

- A. Piping shall be identified at maximum 10 feet intervals, at each side of wall penetration, and at each valve. Piping in exposed areas may be identified at maximum 20' intervals. Piping identification shall include type of service and direction of flow.
- B. Piping above ceiling shall be marked by the following schedule:
  - 1. Domestic Cold Water - White letters on Green, Seton Style No. 29958. Provide heat trace labels where required identifying electric cable.
  - 2. Domestic Hot Water - Black letters on Yellow, Seton Style No. 99368. Provide warm trace labels identifying electric cable.
  - 3. Non-potable Water - Black letters on Yellow, Seton Style No. 29916.
  - 4. Natural Gas - Black letters on Yellow, Seton Style No. 29909.
  - 5. Sanitary Drain - White letters on Green, Seton Style No. 88800.
  - 6. Sanitary Vent - White letters on Green, Seton Style No. 30005.
  - 7. Roof Drain - White letters on Green, Seton Style No. 88798.
  - 8. Argon - White letters on Green, Seton Style No. 21704D.
  - 9. Vacuum - Black letters on Yellow, Seton Style No. 34652.
  - 10. P-5 (Argon-Methane) - Custom White letters on Green, Seton Style No. M4068.
  - 11. Acid Waste - Custom White letters on Orange, Seton Style No. M4068.
  - 12. Helium - Custom White letters on Brown, Seton Style No. M4068.
- C. Piping exposed to exterior or visible at interior spaces (no ceilings) shall be marked with Snap/Strap-Around Markers by the following schedule:
  - 1. Domestic Cold Water - White letters on Green, Seaton Style No. M3991. Provide heat trace labels where required identifying electric cable.
  - 2. Domestic Hot Water - Black letters on Yellow, Seaton Style No. M3993. Provide warm trace labels identifying electric cable.
  - 3. Hot Water Recirculating - Black letters on Yellow, Seaton Style No. M4012.
  - 4. Non-potable Water - Black letters on Yellow, Seaton Style No. M4038.
  - 5. Natural Gas - Black letters on Yellow, Seaton Style No. M4037 or stencil

as indicated by Engineer.

6. Sanitary Drain - White letters on Green, Seaton Style No. M4085.
  7. Sanitary Vent - White letters on Green, Seaton Style No. M4095.
  8. Roof Drain - White letters on Green, Seaton Style No. M4064.
  13. Argon - White letters on Green, Seton Style No. 32056.
  14. Vacuum - Black letters on Yellow, Seton Style No. 23978.
  15. P-5 (Argon-Methane) - White letters on Green, Seton Style No. M4154.
  16. Acid Waste - Black letters on Orange, Seton Style No. 2211B.
  17. Helium - White letters on Brown, Seton Style No. 23812.
- D. Piping exposed shall be marked with Set Mark pipe markers per manufacturer's schedule of pipe sizes. Markings to read same as indicated above.

### 3.03 VALVES

- A. Valves in main and branch piping shall be identified with metal tags chained to the valve.
- B. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.
- C. All valves locations shall be marked below the ceiling with color coded markers i.e. color dot on ceiling grid. Colored marker shall be submitted for approval.

### 3.04 EQUIPMENT

- A. Large equipment such as water heaters and pumps, etc., shall be identified with plastic laminated nameplates.
- B. Control panels and major control components not located at control panels shall be identified with plastic nameplates.

**END OF SECTION**



**SECTION 220560**  
**PLUMBING THROUGH PENETRATION FIRE STOPPING**

**PART 1        GENERAL**

1.01    WORK INCLUDED

- A.    Provide fire stopping for ALL through penetrations. Examples include but are not limited to:
  - 1.    Domestic hot, cold and hot water recirculation water, rain leaders, emergency rain leaders, sanitary waste and vent and acid waste & vent when applicable, and gas pipe.

1.02    REFERENCES

- A.    Underwriters Laboratories (UL)
- B.    American Society for Testing and Materials (ASTM)

1.03    CONTRACTOR REQUIREMENTS

- A.    This work shall be performed by a contractor trained in the installation or application of systems similar in complexity to those required for this project. The contractor shall have at least 2 years experience with through penetration fire stopping systems and shall have completed a least 5 comparable scale projects using these systems.

1.04    SUBMITTALS

- A.    Product data including the following:
  - 1.    Manufacturers specifications and technical data
  - 2.    Detailed specification of construction and fabrication installation instructions
- B.    Shop drawings
  - 1.    For each standard application of penetration item and surface being penetrated provide a manufacturers UL approved system cut sheet identifying the UL system number, UL classified devices or materials to be used, other materials to be used, anchorages, sleeves, annular space requirements and sizes, dimensions and locations of all items.
  - 2.    For each non-standard application, provide a manufacturer's qualified engineering judgment and drawing. The drawing shall indicate those items specified in "A" above.
  - 3.    All UL approved systems shall be selected based on their "F" rating. All systems shall provide the same ratings as the rating of the floor or wall being penetrated, as shown on the plans.
- C.    Qualifications
  - 1.    Provide list of past projects indicating past experience.

## PLUMBING THROUGH PENETATION FIRE STOPPING

2. Provide statement from manufacturer that installer has to be trained in the proper method of installing fire stop systems.
- D. Guarantee
  1. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

### 1.05 STORAGE

- A. Coordinate delivery with scheduled installation date, comply with manufacturers maximum storage requirements. Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing.

### 1.06 PROJECT CONDITIONS

- A. Contractor shall visit the job site prior to bid, to verify wall and floor types to be penetrated. Fire ratings of walls are indicated on the plans. Ratings of the floors are assumed to be two (2) hours unless otherwise indicated on the Architectural Plans.
- B. Contractor shall coordinate with the other trades for any penetrating items (pipe, conduit, etc.) that have to be routed differently than shown on the plans. Contractor shall provide fire stopping for all rerouted items whether different UL approved systems or additional materials are required.

## PART 2 PRODUCTS

### 2.01 THROUGH PENETRATION FIRE STOPPING

- A. Acceptable manufacturers and products shall be those listed in the UL fire resistance directory for the UL system involved.
- B. All systems and devices shall be asbestos free.
- C. Systems or devices listed in the UL. Fire resistance directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance and that the system be symmetrical for wall applications.
- D. Fill, void or cavity materials shall be as classified under category XHHW in the UL fire resistance directory.
- E. Forming materials shall be as classified under category XHKU in the UL fire resistance directory.
- F. All fire-stopping products shall be from a single manufacturer.

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
- C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

**3.02 INSTALLATION**

- A. Install penetration seal materials in accordance with printed instructions of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.
- B. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
- C. Protect materials from damage on surfaces subject to traffic.
- D. Place rock wool or other approved non-flammable material in annular space around fire dampers before installation of damper's anchoring flanges, which are installed in accordance with fire damper manufacturers' recommendations.
- E. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with fire stopping material tested for the application. See U.L. Fire Resistance Directory and Section 3.06 of this document.
- F. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12-inch-wide fiber dams for full thickness and height of air cavity at maximum 15 foot intervals.

**3.03 ADJUSTING AND CLEANING**

- A. Clean up spills of liquid components.
- B. Neatly cut and trim materials as required.
- C. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

## PLUMBING THROUGH PENETATION FIRE STOPPING

### 3.04 FIELD QUALITY CONTROL

- A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

**END OF SECTION**

**SECTION 220710**  
**INSULATION FOR PLUMBING SYSTEMS**

**PART 1      GENERAL**

**1.01    WORK INCLUDED**

- A.    Work of this section shall include the thermal insulation for the following plumbing systems that may or may not be present on this project: NOTE: Items not applicable noted as (N/A)
  - 1.      Rain Leaders and/or Emergency Rain Leaders
  - 2.      Traps, trap arms, cold and hot water supplies
  - 3.      Traps on condensate receiving floor drains above grade
  - 4.      Equipment (N/A)
  - 5.      Hot water piping below grade
  - 6.      Domestic cold water, domestic hot water, hot water recirculating and non-potable water
- B.    This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years.

**1.02    SUBMITTALS**

- A.    Provide submittals consisting of product literature for each insulation type, finish type and equipment served. Provide submittals on method of installation for each type of insulation used.
- B.    Product samples and installation samples are required and shall be provided at the discretion of the engineer. Samples may include but are not limited to, 90° Ells, 45° Ells, valves and sections of pipe.
- C.    Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Engineer. Use materials indicated for the completed Work. Piping Mockups:
  - 1.      One 3-foot section of NPS 2 straight pipe with a joint.
  - 2.      One each of a 90-degree threaded, flanged, & sweat elbow.
  - 3.      One NPS 2 or smaller valve and one NPS 2-1/2 or larger valve.
  - 4.      Each type of support hanger to be used including hanger shield and insert.
  - 5.      One threaded strainer and one flanged strainer with removable portion of insulation.

**PART 2      PRODUCTS**

## INSULATION FOR PLUMBING SYSTEMS

### 2.01 THERMAL INSULATION

- A. All insulating systems shall be tested on a composite basis in accordance with ASTM E-84, NFPA 255 and UL 723. All material shall be finished with surfaces having a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 and under ASTM E-84.
- B. Interior piping Rigid Fiberglass - .23K Factor, 3# density, minimum R Factor 4.3 suitable for 0°F, flame spread rating 25, maximum smoke developed rating 50. Equal to Owens Corning - Fiberglass ASJ/S1-11.
- C. Interior fittings on 1/2- and 3/4-inch pipes and accessories may use job built mitered fittings of same material as piping. Valves and fittings 1 inch and up will use molded preformed fiberglass fittings sized for the fitting or device being insulated. All fittings and devices being insulated shall be covered with a preformed, white, snap-on type, molded PVC jacket cover. Stainless steel tack fasteners hold the cover together at the overlapping throat seam. Matching white, pressure sensitive tape seals and finishes the fitting and adjacent pipe insulation joint. Molded covers shall be equal to Certainteed Snap Form Fitting System. Fittings and accessories to be covered include, but not limited to, 45 and 90-degree elbows, tees, reducers, increasers, valves, check valves & unions.
- D. Above ground exterior piping shall be equal to Foamglass - .33K factor suitable for 900°F, 8.5 # density per square foot. Equal to Pittsburgh Corning - Strata - Fab system with ASJ jacket.
- E. Fittings for above ground exterior piping shall be machine formed, routed and fitted for specific size fitting and of same material as in D.
- F. Below ground exterior piping shall be of same materials as D except without ASJ jacket.
- G. Below ground exterior fittings shall be of same material as in D except without ASJ jacket.
- H. Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing, equal to Armaflex AP 2000.
- I. Closed cell, flexible elastomeric thermal sheet insulation, 1/2-inch-thick, black in color.
- J. Semi-rigid fiberglass board, 3 lb density, thermal conductivity compliance ASTM C 165, 650°F temperature limit, 1 1/2" thick. High temperature fiberglass bonded to a flexible jacketing. Jacketing is to be laminated of white Kraft and aluminum foil, reinforced with fiberglass, chemically treated for fire and smoke safety. Equal to Manville Pipe and Tank insulation.

### 2.02 INSULATION FINISH MATERIALS

- A. White all Service Jacket (ASJ).
- B. Glass fabric equal to Foster Mast-A-Fab.
- C. Smooth Aluminum 0.016-inch thickness and 0.032-inch thickness for exterior use.

## INSULATION FOR PLUMBING SYSTEMS

Equal to Pabco.

- D. Aluminum fittings for elbows, tees and devices, precision formed, smooth and mar-free finish, 0.024 inches thick. Equal to Pabco.
- E. Roofing Felt, 15 lb.
- F. Black asphaltic cutback mastic for underground or outdoor use. Equal to Foster C.I. Mastic 60-25.

### 2.03 ADHESIVES

- A. An air-drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000 in Specification Section 2-2.1 I. Equal to Armstrong 520 Adhesive.

### 2.04 FINISHES

- A. A white elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel; equal to WB Armaflex Finish.

## PART 3 EXECUTION

### 3.01 WORKMANSHIP

- A. All materials shall be applied by workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
- D. Cellular glass block supports or other suitable non-compressible insulation material equal in thickness to the insulation and 12 inches in length shall be installed at hangers to eliminate through-metal conductance. Provide 16 GA, 180-degree, galvanized sheet metal saddles in lengths as detailed on the drawings.
- E. All insulation shall be vapor sealed. All joints, laps, breaks, and faults in vapor barriers of insulations covering cold surfaces, shall be thoroughly sealed.
- F. Insulation that becomes wet for any reason shall be removed, replaced and resealed at the expense of this Contractor.
- G. Piping systems requiring testing to be witnessed by the Engineer shall not be insulated until such systems have been tested and approved.
- H. Do not insulate any moving parts; valve handles, expansion tanks or backflow preventers.

### 3.02 APPLICATION

- A. Insulation application schedule

NOMINAL PIPE SIZE	INTERIOR	EXTERIOR ABOVE GRADE	BELOW GRADE/SLAB
1/2" - 1"	1"	1"	1"

## INSULATION FOR PLUMBING SYSTEMS

1 1/4" - 2 1/2"	1"	1 1/2"	1"
3" and above	1 1/2"	2"	1 1/2"

### B. Rigid Fiberglass Insulation

For interior domestic cold, hot & recirculating, **NOTE 1/2" thick insulation may be used on Domestic Cold water ONLY.**

#### 1. Piping

All insulation shall be butted together and securely stapled in place with outward clinching staples on 3" centers on the lapping seams. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on butt joints as per (Part 2-2.1-B).

#### 2. Fittings

Fittings shall be molded fiberglass with snap on PVC jacket and matching white tape on adjacent pipe insulation as per (Part 2-2.1-C).

#### 3. Piping in concrete masonry walls (CMU): All insulation shall be as per (Part 2-2.01.H) with Armacell fabricated fittings. Provide AP Armaflex Insulation tape and/or Armaflex adhesives as required for joints and fittings as recommended by manufacturer. Provide Armaflex pipe hangers when required for supports.

### C. Rain Leaders and/or Emergency Rain Leaders

#### 1. Insulation Thickness Schedule

NOMINAL PIPE SIZE	EXPOSED CONDITIONED SPACE	EXPOSED NON- CONDITIONED SPACE	CONCEALED WITHIN BLDG. INSULATION	CONCEALED OUTSIDE BUILDING INSULATION
3" and 4"	1"	1 1/2"	1"	2"
6" to 10"	1"	1 1/2"	1"	2"
12" to 16"	1 1/2"	2"	1 1/2"	2 1/2"



## INSULATION FOR PLUMBING SYSTEMS

18" to 24"	2"	2 1/2"	2"	2 1/2"
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2. Rain leaders and emergency rain leaders are to be completely insulated including all portions of horizontal and 24" vertically beyond last elbow where piping transitions downward. Insulation will continue up to the roof drain hub joint. The roof drain hub and pan and any area surrounding the roof drain exposed shall be insulated by this contractor.
  3. Piping  
All insulation shall be butted together and securely stapled in place with outward clinching staples on 3" centers on lapping seams. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on butt joints as per (Part 2-2.1-B).
  4. Fittings  
Fittings shall be molded fiberglass with snap on PVC jacket and matching white tape on adjacent pipe insulation as per (Part 2-2.1-C).
  5. Roof drain hubs and pans to be insulated per (Part 2-2.1-I) Miter cut the insulation to fit and glue into place.
  6. At ends of pipe insulation, bevel the insulation 30 degrees and seal with two coats Childers CP-30.
- D. Traps on condensate receiving floor drains above grade.
1. Wrap traps on hub and floor drains per (Part 2-2.1 I). Insulation shall be cut and formed to the contours of the hub and wrapped around pipe. Factory adhesive shall be used to seal the mitered joints and connection.
- E. Storage tanks
1. Hot water storage tanks shall be wrapped with semi-rigid fiberglass board as per (Part 2-2.1 J). Wrap the insulation around the tank to verify the length to be joined for an overlap. Cut the insulation and strip off a 3" wide strip for the overlap. Wrap the insulation around the tank and verify that the insulation is butted. Attach the 3" wide overlap with outward clinching staples spaced 3 inches O.C. Cut neatly for all penetrations and seal off any tears, joints or staples with ASJ jacket tape of same materials.
- F. Hot water piping below grade
1. Underground hot water pipe and fitting shall use the following schedule of sizes (see Part 3-3.2 A).
  2. Provide Foamglass insulation for underground hot water piping as per (Part 2-2.1 F). Underground piping insulation shall be applied over a clean dry surface. Provide 22 gage galvanized wire at 12" O.C. Cover impregnated felt and stagger joints at midpoint. Apply sealant at joints, laps and seams. Secure felt with wire at 12" O.C. with 22 gage galvanized wire. Apply tack coat over felt at not less than 4 gal. per 100 square feet. Embed cloth

## INSULATION FOR PLUMBING SYSTEMS

membrane into wet tack coat. Smooth membrane to avoid wrinkles and overlap seams at least 2". Apply a finish coat at 8 gallons per 100 square feet making certain that membrane is fully covered. Allow 8 hours of drying time before any piping is covered.

3. Underground fittings shall be installed as described above. Provide materials as per (Part 2-2.1 G).
- G. Cold, hot water, hot water re-circulating and non-potable water piping above exterior grade exposed and concealed.
1. Above grade exterior cold and hot water shall be insulated with Foam glass as per (Part 2-2.1 D). Fittings shall be as in (Part 2-2.1 E).
  2. Piping  
All insulation shall be applied over a clean dry surface. Factory provided laps of ASJ tape of same type as jacket on insulation shall be used on butt joints. All laps and penetrations shall be sealed with a vapor barrier mastic finish.
  3. Fittings  
Fitting insulation shall be covered with two coats of vapor barrier mastic with an intermediate layer of glass fabric.
  4. All above grade exterior piping shall be covered with aluminum jacketing. Aluminum shall be applied to a clean dry surface. Overlap butt joints 4" and apply 1/2" wide bands of aluminum on 8" O.C. and at each end of fittings. On exterior piping, the longitudinal seam shall be located at the bottom center of piping and turned 1/4" down for a drip edge. All joints on exterior piping shall be made watertight with suitable silicone caulking. Caulking is to be applied to joints prior to bands being installed.
- H. All interior exposed piping and fittings located in manufacturing areas, mechanical rooms, etc. below 8'0" AFF shall be wrapped with aluminum jacketing as per (Part 2-2.2 C and D). Provide 1/2" wide aluminum bands located at a maximum of 8" O.C.

### 3.03 MISCELLANEOUS

- A. This contractor will contact the engineer prior to start of all phases of work as follows:
1. Installation of underground insulation.
  2. Exterior above grade installation.
  3. Interior insulation installation.
- B. The engineer will ascertain the continuation of work subject to the requirements.

**END OF SECTION**

**SECTION 221110**  
**DOMESTIC WATER PIPING**

**PART 1        GENERAL**

**1.01    WORK INCLUDED**

- A.     The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.
  - 1.       All domestic water service and piping to all fixtures and equipment.

**1.02    REFERENCES**

- A.     All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

**1.03    SUBMITTALS**

- A.     Submit catalog data for all materials listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B.     Materials installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C.     All materials shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D.     The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E.     Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

**PART 2        PRODUCTS**

**2.01    DOMESTIC WATER PIPING SYSTEM**

- A.     Buried, Exterior:
  - 1.       Copper Pipe, 3 1/2" and smaller: Type K hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: hard temper with brazed joints.
  - 2.       Ductile Iron Pipe (D.I.P.), 4" and larger: Cement lined, per ANSI/AWWA C151/A21.51. Joints: Shall be push on or mechanical type as indicated on drawings.
- B.     Buried Below Slab:

1. Copper Pipe, 1" and smaller: Type K soft drawn copper per ASTM B-88 terminate 12" AFF. Fittings and joints shall not be permitted below slab. Provide poly wrap on buried piping.
2. Copper Pipe, 1-1/4" and larger: Type K hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: All joints below slab shall be hard temper with brazed joints. Provide poly wrap on buried piping.

C. Above Grade:

1. Copper Pipe: Type L hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: Lead-free, tin-silver solder. Pipes greater than 3" shall have flanged connections at ALL valves and equipment.

Notes:

- 1) Mechanically formed and brazed TEE connections will not be allowed on copper water piping.
- 2) Copper press fittings on above grade copper piping will be allowed. System shall be Rigid Tool Company "Viega Pro-Press" system ProPress Fittings: Bronze or copper shall conform to the material requirements of ASME B16.18 or ASME B16.22, NSF/ANSI 61-G when used in a potable water systems and ICC LC-1002. Pro-Press fittings shall have either an EPDM, FKM, or HNBR sealing element and Smart Connect (SC) feature. 1/2-inch thru 2" shall have a press on each side of the sealing element identified by the double press. 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, PBT separator ring, and either EPDM, or FKM sealing element. Sealing elements shall be verified for the intended uses.
- 3) Pro-Press fittings shall not be exposed on finish side of wall.

- D. All solder joints shall be soldered with an approved listed solder. Acid core solder shall not be used.

2.02 P & T RELIEF PIPING

A. Above Slab:

1. Copper Pipe: Type L hard drawn copper per ASTM B-88. Fittings: Wrought copper or cast brass. Joints: Lead-free, tin-silver solder.
2. Relief piping terminating outside the area of the installed water heater shall be installed with an air gap. The air gap shall be Watts model 909, 1" in-line type, and installed at the water heater below the T & P relief valve.

2.03 DOMESTIC WATER SPECIALTIES

**NOTE ALL SPECIALTIES & VLAVES SHALL BE 100% LEAD FREE (regardless of model number indicated).**

- A. SA: Water Hammer Arrestors, ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged suitable for operation in temperature range -100 to 300°F and maximum 250 psig working pressure; Model Z-1700 manufactured by Zurn or approved equal.
- B. ET: Thermal Expansion Tanks: Provide as indicated on the Drawings. Amtrol Model ST ThermXTrol or approved equal. Size shall be as indicated in the fixture schedule.
- C. Gauge Cocks shall be polished brass valves with 1/4" NPT female connections and handles. Valves shall be suitable for 125 psi. Acceptable Manufacturers: Trerice No. 865 or equal by Marsh.
- D. Pressure gauges shall have type 316 stainless steel tube and stainless-steel rotary movement. The gauge case shall be stainless steel. Windows shall be glass or clear acrylic. Gauges shall have 4" dials with white faces and black graduations. Scales shall have a minimum arc of 260 degrees. Gauges shall be accurate to within 1% of the full-scale reading over at least the middle half of the span. The accuracy over the remainder of the scale shall not exceed 2%. Gauge ranges shall be selected so that the normal operating point is approximately mid-scale. Scales shall indicate psi. All gauges shall be provided with a pulsation damper, snubber, restrictor, or similar device to dampen pulsation surges (use of the gauge cock for this purpose is not acceptable). Gauges shall have 1/4" NPT bottom outlets. Weiss style NF4S-2 or equal by Trerice.
- E. Thermometers shall be adjustable angle type with separable matching socket. Thermometers shall have cast aluminum cases with baked enamel finish, red reading mercury tubes with black scale graduations, and glass or acrylic plastic covers. Scales shall be a minimum of 9 inches with appropriate ranges for indicating temperatures at least 25% above and below normal readings. Sockets shall have stem length suitable for pipe receiving thermometer. Sockets and stems shall be brass, fully adjustable with 360 deg. movement. Sockets on insulated pipes shall have lagging extensions of adequate length to clear insulation. Weiss No. A9VS or equal by Trerice.
- F. Service valves 1/2" thru 4" shall be full port 1/4 turn brass ball valves, two piece construction, soldered end connection, with PTFE seats and seals, adjustable stem packing gland, stem o-ring and steel handle with vinyl sleeve. 1/2" thru 2" valves shall be pressure rated at 600 psi WOG and 150 psi WSP. 2 1/2" thru 4" valves shall be pressure rated at 600 psi WOG and 125 WSP.

Valves shall be Kitz series AKSZA (code #59), Nibco model S-FP-600 or Stockham model S-255-FB-R-UL-EL.

All ball valves shall be furnished with valve handle extensions.

- G. Check valves shall be class 150 bronze body horizontal swing Wye-type with renewable seat and disc, screw cap, threaded end connections, pressure rated at 300 psi non-shock working pressure. Valves shall be Kitz series AK150YR (code #29), Nibco model T-433 or Stockham model B-321.
- H. Strainers shall be bronze body with tapped retainer cap and closure plug, threaded end connections, 20 mesh strainer screen, pressure rated at 400 psi WOG and 125 psi WSP. Strainers shall be Watts series 777SI, Wilkins model YSBR100 or Spirax Sarco model BT.
- J. Piping inside chase areas shall be supported with bracketing system equal to Sioux Chief Grid Iron series. System shall include but not be limited to a center span bracket, two end bracket clamps and necessary retaining brackets to support the copper piping. Where piping is supported off the vent system, the vent piping shall be bracketed to the inside chase wall. Stainless steel clamps shall be incorporated into the support system when connections are made to the PVC piping.
- K. WHB1: Exterior Wall Hydrant Box: Woodford model B65-PB, polished brass, anti-siphon vacuum breaker, brass valve body with hemispherical seating surface, stainless steel stem, loose key operator, wall clamp assembly, 3/4" inlet. Hydrant shall be housed inside a tamper resistant brass box. Install tight to wall and caulk weather tight. Coordinate operating rod depth with wall thickness and building insulation location. Hydrant shall be of sufficient length to extend through walls and place the valve seat inside the building. Bonnet and valve stem shall be removable from outside of the building. Coordinate exact location with Architect before installation.
- L. HB: Hose Bibb: Prier Model P-156/166 exposed pipe angle sill faucet, 3/4" inlet, satin nickel-plated finish with metal handle and vacuum breaker.
- M. IMVB: Icemaker Wall Box, Sioux Chief, ABS material wall box with faceplate, 1/4 turn valve with integral water hammer arrestor, debris cover, steel box clip & bracket, 1/2" inlet 1/4" outlet. Provide fire rated box when installed in rated wall assemblies.
- N. TMV-1: Leonard Model 270-LF-BRKT or 370-LF-BRKT lead free mixing valve with integral check and mounting bracket installed above the lay-in ceiling when available or below sink when lay-in ceiling is not available, below cabinet when cabinet is available, rough bronze finish. Discharge temperature shall be 109°F. Provided at all lavatories and sinks. Model shall be based on quantity of fixtures.
- O. WCO/AP: The Contractor shall furnish access panels not smaller than 8" X 8" for access to concealed valves, traps, dampers, etc. where no other means of

access is provided. Access panels shall be all steel construction with no. 16 gauge wall or ceiling and no. 14 gauge panel door with not less than 1/8" insulation secured to inside of the door. Doors shall be supported with concealed hinges and secured with suitable clips and countersunk flush screws. Outside of access panels shall be flush with finished wall or ceilings, except that where panels are located in acoustic tile or paneling, the door shall be recessed to receive adjacent finish material. The Contractor shall determine the final position of each access door and the size to be used. Access panels shall be as manufactured by MILCOR. Fire ratings of access door shall not be less than the surface on which the door is installed. Where locking access doors are required by specifications, doors shall be fitted with a cylinder key lock. Stainless steel is to be used at exterior locations and areas than cannot be painted to match adjacent surface. Finish for other than stainless steel shall be prime coat white, for final paint to be by others. All access panel doors shall have vandal proof hardware. Size of the door to be sufficient for access and service of the trap primer, water hammer arrestor, or other valve access. Access door panel shall be Mifab series UA-A-VP-C or prior approved equal.

- P. TP: Trap primer shall be activated by a drop in Building pressure. Primer shall be all brass construction and in conformance with A.S.S.E. Standard #108. Units shall be accepted equivalent to PPP "Prime Rite" PR-500. Provide with "DU-4" distribution units for more than one floor drain in an area. Install per manufacturers instructions or per details on the drawings. Provide access panels when installed in inaccessible walls or chases.
- Q. WH, Wall Hydrant: Woodford Model 26, 3/4" inlet, rough brass with metal handle and vacuum breaker.
- R. WMVB: Washing Machine Supply and Drain: Oatey model 38540, high impact polystyrene recessed wall box with faceplate, with 2" drain & 1/2" hot and cold 1/4 turn ball valves with integral water hammer arrestors. Elevation of the wall box to be as detailed on the drawings

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets. Water supplies shall connect through walls with stops and chrome plated escutcheons with setscrews.

#### **3.02 DOMESTIC WATER PIPING SYSTEM**

- A. Provide a complete system of domestic water piping including interior and exterior work as indicated.

- B. Piping shall be accurately cut to measurements established at the project site, worked into place without springing or forcing, run as directly as possible, run parallel or perpendicular to building lines, located as indicated on the Drawings and supported as specified elsewhere. Parallel piping shall be grouped together as much as practical. Piping shall be supported as high as practical. Piping not located in mechanical rooms shall be concealed unless noted otherwise.
- C. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
- D. Contractor shall provide for expansion and contraction of piping systems. Expansion and contraction of piping shall not impart excess stress or strain on the building, pipe fittings, joints, or connections to equipment.
- E. Piping shall be installed with sufficient spacing between fittings, valves, flanges, etc. so as to allow insulation fittings to be installed without trimming or modification.
- F. Sleeves for insulated piping above grade shall be sized for the insulation diameter. Annular space between the insulation and sleeve shall be sealed or fire caulked as detailed on the drawings. Sleeves for piping through walls below grade shall be sized for use of compressible rubber link seals unless noted otherwise.
- G. Provide solid type stainless steel escutcheon plates at each exposed piping penetration of walls and ceilings and inside cabinets at water and waste penetrations. Escutcheon plates for insulated piping shall be sized for the insulation diameter. Split ring escutcheons will not be allowed. Waste escutcheons inside cabinets or exposed below sinks or lavatories shall be bell type escutcheons sized to cover the hub and fit flush with wall.
- I. All piping shall be installed to allow complete draining, slope as required. Provide drain valves at all low points where fixtures cannot be used to drain piping. Provide hose bibb with 3/4" hose connection, vacuum breaker/backflow preventer and service valve at the water main entrance.
- J. Provide shutoff valves at each branch from main. Provide shutoff valves for each fixture group to minimize interruption of service for maintenance and repair. Provide an exterior main shutoff valve and valve box as indicated on drawings. Provide area shut-off valves as necessary to facilitate testing and isolation of piping where tested and approved pipes are put into service.
- K. Piping thru metal studs shall be isolated from metal to metal contact with plastic bushings specifically designed for the application.
- L. Provide water hammer arrestors on all hot and cold-water branch lines. Arrestors shall be sized for the fixture unit load installed on the branch line and shall be accessible for inspection and/or replacement, provide access panels as required. Water hammer arrestors shall be located at the end of the



branch line between the last two fixtures served. When the branch line exceeds 20' in length, an additional water hammer arrestor shall be used. Each water hammer arrestor in this case shall be sized for half the total fixture unit load on the branch line and the location of the second water hammer arrestor shall be midway along the branch line. On a branch line that serves a single piece of equipment, the water hammer arrestor shall be located as close to equipment as possible.

- M. All stubouts and exposed piping shall be rigidly supported to eliminate movement.
- N. This Contractor shall complete all equipment connections to the domestic water piping system. Provide shutoff valves and unions for each connection.
- O. Connections to water heaters and connections between ferrous and copper pipe shall be made with dielectric unions or flanges. Joints between plastic and metallic pipe shall be made with transition fittings for the specified purpose.

### 3.03 TESTING

- A. All piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- B. Water piping systems shall be subjected to a hydrostatic test of one hundred twenty-five pounds minimum or 1 1/2 times operating pressure whichever is greater. The system shall be proven tight after a twenty-four (24) hour test.
- C. All rainwater leaders, soil waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head. Piping shall be tested for not less than 4 hours, prior to installing fixtures. Underground piping shall be tested before backfilling.
- D. Provide test report in booklet form showing all field test performed to prove compliance with the specified performance criteria. Booklet shall be submitted prior to submitting for final payment. Booklet shall include the following
  1. SYSTEM TESTED (sanitary) (domestic water) (rain leaders)
  2. Date of test
  3. Test medium
  4. Persons present
  5. Pressure tested
  6. Lines tested and location
  7. Length of time test pressure was held

8. Pressure drop
  9. Water pressure at most remote and highest location
  10. Residual chlorine
- E. This Contractor shall conduct all specified tests until approved by the Engineer. All tests shall be repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests inspections have been made and approvals obtained. This Contractor shall notify the Engineer four days prior to testing to allow for scheduling.

#### 3.04 STERILIZATION OF DOMESTIC WATER PIPING SYSTEM

- A. Thoroughly flush for a minimum of two hours and then drain the domestic water piping prior to sterilizing by the following method or other methods satisfactory to the Engineer and the Authority Having Jurisdiction.
- B. Fill piping with a solution containing 50 ppm of available chlorine. Open and close all valves to thoroughly distribute solution thru all piping. Allow solution to stand for 24 hours then test for residual chlorine at the ends of the lines. If less than 25 ppm is indicated, repeat the sterilization process. When tests show at least 25 ppm of residual chlorine, flush out the system until all traces of chlorine are removed. Open and close all valves in system several times during flushing period.
- C. The Engineer reserves the right to test the water again at any time prior to final acceptance of the work and if found to be unsafe bacteriologically, to require the Contractor to rechlorinate the system until the water is proven equal to that supplied by the public system.
- D. Contractor shall arrange for laboratory testing for a bacteriological examination of potable water system at various locations. The samples shall be tested to meet requirement of city and shall not be of less quality than provided by city. Submit copy from testing agency prior to submitting for final payment.
- E. Minor work such as repairs or replacement of single fitting or valve, pre-clean and disinfect by immersion in solution of 300 ppm chlorine for 1 hour.

#### 3.05 FINAL ACCEPTANCE

- A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test, sterilization compliance and backflow devices certificates.

#### END OF SECTION



**SECTION 221310**  
**SANITARY SEWER (INTERIOR) PIPING SYSTEM**

**PART 1        GENERAL**

**1.01    WORK INCLUDED**

- A.    The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.
  - 1.     All sanitary sewer piping and equipment shown throughout the building and extension of the sanitary sewer to the indicated termination point.

**1.02    REFERENCES**

- A.    All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

**1.03    SUBMITTALS**

- A.    Submit catalog data and shop drawings for all materials and equipment listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B.    Materials or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C.    All materials and equipment shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D.    The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E.    Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

**PART 2        PRODUCTS**

**2.01    SANITARY SEWER PIPING SYSTEM**

Notes:

- 1. This contractor shall provide/install cast iron pipe at all fire rated assemblies, return air plenums, and ALL kitchen areas below slab grease waste as depicted on drawings, this includes exterior piping extended to grease interceptors, and where indicated on the drawings for sound purposes. All waste piping serving mechanical boilers shall be as cast iron to exterior or as indicated on plans. All grease waste vent piping shall be PVC as specified below unless located in plenums. This contractor shall coordinate with Architectural and Mechanical drawings.

2. Waste and vent piping installed inside a turned down slab condition at the building perimeter, at column footings, through or under footings or foundation walls shall be sleeved with steel pipe, 2 pipe sizes larger than the sized waste / vent pipe. Coordinate with the Architectural and Structural drawings for locations.

Provide relieving arch as detailed on plans, provide 1-inch thick Armaflex insulation around pipe at wall where vent extends up thru CMU to allow for settlement. This shall be provided at ALL wall/foundation penetrations.

A. Buried, Exterior & Below Slab:

1. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2665.  
Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564.  
Foam Core will not be allowed on drain, waste and vent systems.

B. Above Slab, Interior:

1. PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2466.  
Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564.  
Foam Core will not be allowed on drain, waste and vent systems.

2.02 SANITARY SEWER SPECIALTIES

NOTES:

1. PLUMBING CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH GENERAL CONTRACTOR AND FOR SLOPING OF CONCRETE FLOORS TO ALL FLOOR DRAINS. IMPROPER DRAINAGE WILL RESULT IN REMOVING CONCRETE AND REPLACING TO SLOPE TO DRAINS AT ENGINEERS DIRECTION. ALL SLABS SHALL BE SLOPED TO FLOOR DRAINS. VERIFICATION OF PROPER DRAINAGE WILL BE REQUIRED AS FOLLOWS:
2. AFTER SLAB HAS BEEN POURED AND CURED, PLUG FLOOR DRAIN, FLOOD FLOOR AREAS WITH WATER AND REMOVE PLUG AFTER PROOF OF ADEQUATE DRAINAGE CONTRACTOR MAY CONTINUE CONSTRUCTION WORK. SHOULD INADEQUATE DRAINAGE BE PROVEN, THE SLAB SHALL BE REMOVED AND REPLACED UNTIL PROPER DRAINAGE HAS BEEN PROVEN.
3. ONCE TILE WORK HAS BEEN COMPLETED, PLUG FLOOR DRAIN, FLOOD FLOOR AREAS WITH WATER AND REMOVE PLUG AFTER PROOF OF ADEQUATE DRAINAGE CONTRACTOR MAY CONTINUE CONSTRUCTION WORK. SHOULD INADEQUATE DRAINAGE BE PROVEN, THE TILE FLOOR SHALL BE REMOVED AND REPLACED UNTIL PROPER DRAINAGE HAS BEEN PROVEN.

## SANITARY SEWER (INTERIOR) PIPING SYSTEM

4. AREA FLOOR SLOPE TO ALL FLOOR DRAINS SHALL BE 1% (1/8"/FT) MINIMUM OR 2% (1/4"/FT) MAXIMUM. COORDINATE TO MAINTAIN CONCRETE THICKNESSES AS REQUIRED.
5. ALL FLOOR DRAINS ARE TO BE SUPPLIED WITH A METALLIC COVER PLATE (DEBRIS COVER OPTION-DC), FORMED AND DRILLED TO FIT ABOVE THE STRAINER/GRATE FOR THE DURATION OF CONSTRUCTION. UPON COMPLETION OF CONSTRUCTION AND BEFORE FINAL INSPECTION, THE COVER IS TO BE REMOVED AND TRAP GUARD SHALL BE INSTALLED. ANY GRATES AND TRAP GUARDS INSTALLED DURING CONSTRUCTION THAT HAVE ANY ACCUMULATION OF CONSTRUCTION DEBRIS, CONCRETE, MORTAR, ETC., WILL NOT BE CLEANED, BUT WILL BE REPLACED WITH NEW PRODUCT. NO EXCEPTIONS.
  - A. FD1: Floor Drain: Zurn no. ZN-415B, two-piece cast iron threaded fully adjustable 3" drain body with flashing collar. Install with 7" diameter polished nickel bronze, heel proof strainer, and deep seal trap. Floor drain shall be furnished with a trap primer connection connected to trap primers (not shown on plans) and ProSet Systems Trap Guard.
  - B. FD2: Refer to Specification 22 66 10 Acid Waste & Vent Piping System.
  - C. FD3: Floor Drain: Zurn no. ZN-415B, two-piece cast iron threaded fully adjustable 2" drain body with flashing collar. Install with 7" diameter polished nickel bronze, heel proof strainer, and deep seal trap. Floor drain shall be furnished with a trap primer connection connected to trap primers (not shown on plans) and ProSet Systems Trap Guard.
  - D. WCO: Wall cleanouts: Cast iron piping shall be cast iron ferrules with no-hub joints, cadmium plated cast iron counter sunk plugs and stainless steel or paintable access cover per general notes on drawings. Access panels are only required when labeled WCO/AP on plans.
  - E. Trap guard (see floor drains under sanitary specialties): ProSet Systems, Inc, flexible elastomeric PVC material molded into shape of duck's bill, open on top with curl closure at bottom. Compliance: ASME A112.6.3, NSF/ANSI 14, CSA B 79. Coordinate with floor/hub drain being specified and size of throat. Install per manufacturers recommendations.
  - F. FCO: Floor Cleanout: Zurn no. ZN-1400-BP, 4" adjustable floor cleanout with polished nickel bronze top in a coated cast iron ferrule with bronze cleanout plug. Top to be mounted flush with the floor. Cleanouts in carpeted floors shall have round, heavy duty, nickel bronze tops with carpet retainer Zurn No. Z-1400-CM. Cleanouts shall be the same

## SANITARY SEWER (INTERIOR) PIPING SYSTEM

nominal size as the pipe served up to 4" and not less than 4" for line sizes greater than 4".

- G. YCO/DYCO: Yard Cleanout/Double yard cleanouts same material as FCO above: See details on drawings.
- H. HD-1: Hub drain, 2" indirect waste funnel Zurn Z326 or prior approved equal with dome strainer or approved equal. Hub drain shall be furnished with ProSet Systems Trap Guard. See plan for size.
- I. HD-2: Hub drain, 4" indirect waste funnel Zurn Z326 or prior approved equal with dome strainer or approved equal. Hub drain shall be furnished with ProSet Systems Trap Guard. See plan for size.
- J. Backwater valve (BWV): Rectorseal clean check backwater valve kit for 4" pipe. Provide riser pipe, upper collar, insert pipe, valve, lower collar and flapper, product code 97034 or approved equal.
- K. Grit Trap: ZURN Z1189-K, Size 100 Acid Resistant Coated interior and exterior fabricated steel oil/sediment interceptor, bronze cleanout plug and visible double wall trap seal, removable sediment bucket, horizontal baffle, internal vent connection, with Dura-Coated heavy-duty cast iron grate and anchor flange.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will  
  
be straight and true without bends or off-sets.
- B. All rough-in sanitary sewer piping shall be properly plugged or capped in a manner approved by the Engineer.

#### **3.02 SANITARY SEWER PIPING SYSTEM**

- A. Provide a complete system of sanitary sewer drain, waste and vent piping including interior and exterior work as indicated.
- B. Piping up to 2" shall be sloped at least 1/4" inch per foot. Piping 3" thru 6" shall be sloped at least 1/8 inch per foot. Piping 8" and larger shall be sloped at least 1/16 inch per foot. Piping below slabs shall not be sloped less than 1/8" per foot regardless of size.

- C. Buried piping below slab and exterior of building perimeter shall be laid in minimum 4 inches of bedding below and 6" above pipe, and sloped as specified herein. Bedding shall be accurately and uniformly graded. Bedding shall be crushed stone equal to Alabama Highway Department #9 crushed stone. Bedding shall be free of organic material. Backfill below floor slabs shall be No. 57 crushed stone full depth from top of bedding to bottom of slab.
  - D. Provide cleanouts as required by Code and as indicated on the Drawings. Cleanouts for piping 4" and smaller shall be line size. Cleanouts for piping 6" and larger shall be 4". Provide dual exterior cleanouts within 5 feet of building. Interior cleanouts in floors shall be flush with finished floors. Interior cleanouts in walls shall be above the flood level of plumbing fixtures. Exterior cleanouts in unpaved areas and areas paved with other than concrete shall be set in concrete pads flush with finished grade as detailed on the drawings.
  - E. Vents through roof shall be a minimum of 3 inches in diameter and shall terminate at least 12 inches above the roof. See plans for other sizes.
  - F. This Contractor shall be responsible for locating vents at least 10 feet from Outside Air intakes, offset vents as required.
  - G. Drainage piping shall be installed with hubs upstream of each pipe section. Provide reducing fittings where different sizes of pipe are to be connected. Bushings shall not be used. Provide long sweep fittings, sanitary tees, and combination wyes with 1/8 bends as applicable.
  - G. All rough-in soil, waste, vent, and storm piping shall be properly plugged or capped in a manner approved by the Engineer.
  - I. Escutcheons shall be provided on wall penetrations as indicated in Section 221110, Domestic Water Piping System.
  - J. Interior wall cleanouts shall have stainless steel wall covers sized for the cleanout and covering the wall opening. Cleanout covers shall be installed flush with the wall.
  - K. Back to back water closets shall be installed with double combination wye with 1/8 bend. Double sanitary tees and double fixture fitting shall not be used.
- 3.03 TESTING
- A. All piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
  - B. All soil waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head. Piping shall be tested for not less than 4



hours, prior to installing fixtures. Underground piping shall be tested before backfilling.

C. VENT TEST as required by Engineer:

The final test of the completed drainage and vent system shall be visual and in sufficient detail to determine compliance with the provisions of this code except that the plumbing shall be subjected to a smoke test. Where the smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines or introducing a white/gray non-toxic smoke emitter. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column shall be held for a test period of not less than 15 minutes. This method may be used at rough-in prior to gyp board installation for testing vents in lieu of hydrostatic testing at Engineers discretion, except that plugs will be used at stacks to isolate system where traps have not been installed. Contractor should follow Inspection Department required methods and/or procedures should they differ.

3.04 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

3.05 FINAL ACCEPTANCE

- A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test and backflow devices certificates.
- B. Provide test report in booklet form showing all field test performed to prove compliance with the specified performance criteria. Booklet shall be submitted prior to submitting for final payment. Booklet shall include the following
  - 1. SYSTEM TESTED (sanitary)
  - 2. Date of test
  - 3. Test medium
  - 4. Persons present
  - 5. Pressure tested
  - 6. Lines tested and location
  - 7. Length of time test pressure was held

## SANITARY SEWER (INTERIOR) PIPING SYSTEM

- 8. Pressure drops
- 10. Sump pump tested at rated flow
- C. This Contractor shall conduct all specified tests until approved by the Engineer. All tests shall be repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests inspections have been made and approvals obtained. This Contractor shall notify the Engineer four days prior to testing to allow for scheduling.

**END OF SECTION**

SECTION 22 14 30  
ELEVATOR SUMP PUMP

**PART 1 - GENERAL**

1.01 WORK INCLUDED

- A. The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.
  - 1. All sump pumps and accessories as shown on the Drawings and as herein specified.

1.02 REFERENCES

- A. All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

1.03 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials and equipment listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B. Materials, fixtures, or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C. All materials, equipment, and appliances shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E. Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

**PART 2 - PRODUCTS**

2.01 ELEVATOR SUMP PUMP - GENERAL

- A. Provide all sump pumps complete with accessories required and connect in a manner conforming to the local Building Code.

2.02 ELEVATOR SUMP PUMP

- A. Refer to schedule and details on drawings.

**PART 3 - EXECUTION**

3.01 GENERAL

- A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets.
- B. Coordinate Elevator Equipment Room elevator equipment locations PRIOR to installation of hub drain when installed in this room.
- C. Installation of sump pump discharge lines to be coordinated with Elevator Contractor PRIOR to installation.
- D. Pumps are to be connected to emergency power systems when available.
- E. Control panel shall have contacts to connect to Building Automation System (BAS) when available.
- F. Pumping systems are to be witnessed by the Engineer during Final Observations. A pump down test will be required and shall show all level sensors operating as well as alarm panel displays and reset features with manual overrides.
- G. Pump, floats and control panel will be required to be tested as directed by Engineer.

**END OF SECTION**

**SECTION 224210  
PLUMBING FIXTURES**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

**1.02 DESCRIPTION OF WORK**

- A. Provide all labor, materials, equipment and services required for complete installation of all plumbing fixtures indicated on Drawings and specified herein. All plumbing fixtures, accessories and trims as shown on the Drawings and as herein specified.

**1.03 REFERENCES**

- A. All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

**1.04 SUBMITTALS**

- A. Submit catalog data and shop drawings for all materials and equipment listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B. Materials, fixtures, or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C. All materials, equipment, and appliances shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D. The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E. Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

**PART 2 PRODUCTS**

**2.01 PLUMBING FIXTURES – GENERAL**

- A. Provide all plumbing fixtures complete with trim required, and connect in a manner conforming to the Local, State and International Building Codes. Provide rough-in and final connections including all valves, traps, specialties, etc. required.
- B. Provide traps for all waste connections where not furnished with the equipment and stop cocks or valved shut-offs for all water connections to all sinks and other items of equipment. All exposed pipe and metal, including that within cabinets, shall be chrome plated cast brass with the same gauge thickness as the specified trap.

Stainless steel bell escutcheons shall be installed covering the hub connections below sinks and lavatories and extend to the wall or back of cabinet for a tight fit.

- C. Carriers are specified by Zurn catalog numbers to establish quality, type and supporting capacities only. Carriers of equal quality, type and supporting capacities as manufactured by Wade or Josam will be acceptable.
- D. Quality and Type of Fixtures
  - 1. Plumbing fixtures, carriers, etc. are specified by manufacture and model numbers for the purpose of establishing type and quality. Equals must be pre-approved by the Engineer. Pre-approval submittals must be received by this office no later than 10 working days before the job bids. (The following additional item/manufacturers are approved:
    - A. American Standard
    - B. Zurn P-traps
    - C. Powers TMV
    - D. Stern mop sinks
    - E. Wilkins back flows & Pressure reducing valves
    - F. Acorn Mop Sink
    - G. Zurn mop sink faucet
    - H. Just sinks counter mounted only
    - I. Symmons Lavatory faucets
    - J. T&S mop sink faucet
    - K. Smith Hydrants

## 2.02 FIXTURE SCHEDULE

- P1 Water Closet (ADA Accessible): Kohler Kingston K-25077, 16-1/2" rim height, 1.28 gal/flush, white, floor mounted tank type, elongated, 1/8" fully glazed trap-way & bolt caps. Install with Olsonite model 95SSCT solid plastic open front seat with stainless steel self-sustaining check hinge. Provide Urethane reinforced wax bowl ring with sleeve. Provide closet flange with adjustable stainless-steel ring.
- P1A Water Closet (ADA Accessible): Kohler Kingston K-25077, 16-1/2" rim height, 1.28 gal/flush, white, floor mounted, tank type, elongated, 2-1/8" fully glazed trap-way & bolt caps. Sloan Regal Pro flush valve model 111-YK with cast wall flange with set screw, and solid ring pipe support. Install with Olsonite model 95SSCT solid plastic open front seat with stainless steel self-sustaining check hinge. Provide Urethane reinforced wax bowl ring with sleeve. Provide closet flange with adjustable stainless-steel ring.
- P2 Lavatory (ADA Accessible) wall hung: Zurn Z5844, white enameled cast iron, wall hung, 20" x 18", modification with lugs for exposed arm carrier, and 4" center holes. Faucet shall be Kohler K-7515 electronic faucet with mixer, single hole, vandal resistant aerator, 0.50 GPM, polished chrome finish. Provide stainless steel grid

strainer and waste tail piece. McGuire grid drain, 17-gauge cast brass chrome plated trap with cleanout & McGuire 2165-wheel handle supplies with stops, provide vandal resistant, polished chrome finish. Carrier shall be Zurn model Z-1231-AL. Provide point of use thermostatic mixing valve with mounting bracket and integral check valve Leonard model 270-LF-BRKT or approved equal. Required to be install above ceiling (not shown on plans) for fixtures. Contractor may add additional fixtures to TMV but is required to select/provide appropriate size valve model 370-LF-BRKT or as required per manufacturer. Discharge temperature shall be set at 109°F. Insulate the water and waste pipes below the lavatory with Plumberex Pro-Extreme series molded vinyl covering, white finish with reusable snap clip fasteners. Mounting height shall be as directed by the Architect.

- P2A Lavatory (ADA Accessible) wall hung: Zurn Z5844, white enameled cast iron, wall hung, 20" x 18", modification with lugs for exposed arm carrier, and 4" center holes. Faucet shall be Delta 516LF-HDF single handle faucet, McGuire stainless steel grid drain and tailpiece, 17 gauge cast brass chrome plated trap with cleanout & McGuire 2165 wheel handle supplies with stops, provide vandal resistant aerator 0.50 GPM, polished chrome finish. Carrier shall be Zurn model Z-1231-AL. Provide point of use thermostatic mixing valve with mounting bracket and integral check valve Leonard model 270-LF-BRKT or approved equal. Required to be installed above ceiling (not shown on plans) for fixtures. Discharge temperature shall be set at 109°F. Insulate the water and waste pipes below the lavatory with Plumberex Pro-Extreme series molded vinyl covering, white finish with reusable snap clip fasteners. Mounting height shall be as directed by the Architect.
- P3 Sink, (ADA Accessible) double bowl: Elkay model LRADQ3321, 33" x 21-1/4" overall dimensions with two 13-1/2" x 16" x 5.5" deep compartments, 18 gauge stainless steel, self rimming, counter mounted, fully undercoated, 3 hole drill. Install with Kohler model K-10430 hi-arc mixing faucet with wing handles and spray, model LK-99 stainless steel strainer, LKADOS offset grid drain, McGuire 2165 wheel handle supplies and stops, 17 gauge cast brass chrome plated trap with cleanout, tailpiece and continuous waste. Coordinate hub connection for connection to the PVC to be tight to the wall for concealment by the bell escutcheon. Trap shall be equipped with a dishwasher connection tailpiece and an above deck air gap installed when installed next to a dishwasher. Provide point of use thermostatic mixing valve with mounting bracket and integral check valve Leonard model 270-LF-BRKT or approved equal. Required to be installed in base cabinet (not shown on plans) for fixtures. Discharge temperature shall be set at 119°F. Furnished and installed with the sink shall be an In-Sink-Erator Evolution Compact garbage disposer with Dura-Drive Induction Motor, 3/4 hp 120 volt, with stainless steel grind chamber and grinding elements, fully insulated outer shell & 1-piece stainless steel stopper. Disposer shall have a 8 year warranty. Trap shall be equipped with a dishwasher connection tailpiece and an above deck air gap installed when installed next to a dishwasher. Machine discharge shall terminate into adjacent sink trap tailpiece

- P4 Shower (ADA Accessible): Shower enclosure shall be as specified on the Architectural Drawings under other Divisions of these specifications. Provide Leonard Series 7600 pressure/temperature balancing control valve, chrome finish with solid brass body and shower head with universal ball joint Model H-14 Low Flow 1.5 GPM, diverter valve D-2L with lever handle and 62001 ADA compliant vertical 24" grab bar with handheld shower. Unit shall be mounted with control valve 42" above the floor. Install all components per manufacturer's recommendations. Floor Drain shall be stainless steel cast integrally and provides for a caulked lead connection not less than 1" deep to a 2" pipe. A removable type stainless steel strainer plate shall be provided. Construction cover shall be provided by the manufacturer to protect the drain assembly during construction. The strainer shall be installed after construction and cleaning is complete. Strainers installed prior to completion of construction that have accumulations of construction debris will be replaced. Floor drain shall be furnished with a ProSet Systems Trap Guard.
- P5 Mop Sink Fiat model TSB-100, 24"x 24" x 12" deep pre-cast terrazzo sink, with stainless steel caps on all curbs, 3" deep seal trap, model 1453-BB stainless steel strainer, model QDC quick drain connector, model MSG-2424 stainless steel wall guard, model 889-CC three-mop hanger & model 832-AA 30" long flexible hose with hose mounting bracket. Seal the sink to the wall and floor with no. 833-AA silicone sealant prior to installing the stainless-steel wall guard. Install with Speakman No. SC-5816 ceramic cartridge type mixing faucet with wall support, wrist blade handles, vacuum breaker, screwdriver stops and threaded hose outlet. Mount the mixing faucet 42" above the floor and as detailed on the drawings. Mount the mop hanger 5' above the floor on the opposite wall of the faucet or as directed by the Architect.
- P6 Sink: Sink provided by other Division of these specifications, installed by this Contractor Division 22. The Plumbing Contractor shall furnish and install T&S Brass Double Ledge Faucet BL-5700-09, single hole deck mount mixing faucet with polished chrome plated brass body, polished chrome plated swivel/rigid nozzle with vacuum breaker and serrated tip with 0.5 GPM flow control, compression cartridges with spring checks, 4-arm handles and 18" flexible stainless steel supply hoses with 1/2" NPSM / 5/8" compression connections. Certified to ASME A112.18.1 / CSA B125.1, NSF 61-Section 9, NSF 372 and ASSE 1001. Meets ADA ANSI/ICC A117.1 requirements. Provide Zurn Z-8804-LR supplies with stops, acid waste trap with tailpiece and continuous waste. Coordinate actual rough-in connection requirements with the Casework drawings. Waste connection riser inside the casework to be a combination waste and vent or island vent. Refer to acid waste piping for waste and vent piping materials. Provide TMV-1 point of use mixing valve with a maximum discharge temperature of 109°F installed inside the base cabinet as detailed.
- P7 Sink: Sink provided by other Division of these specifications, installed by this Contractor Division 22. The Plumbing Contractor shall furnish and install T&S Brass



Double Ledge Faucet BL-5700-09, single hole deck mount mixing faucet with polished chrome plated brass body, polished chrome plated swivel/rigid nozzle with vacuum breaker and serrated tip with 0.5 GPM flow control, compression cartridges with spring checks, 4-arm handles and 18" flexible stainless steel supply hoses with 1/2" NPSM / 5/8" compression connections. Certified to ASME A112.18.1 / CSA B125.1, NSF 61-Section 9, NSF 372 and ASSE 1001. Meets ADA ANSI/ICC A117.1 requirements. Provide Zurn Z-8804-LR supplies with stops, acid waste trap with tailpiece and continuous waste. Coordinate actual rough-in connection requirements with the Casework drawings. Waste connection riser inside the casework to be a combination waste and vent or island vent. Provide TMV-1 point of use mixing valve with a maximum discharge temperature of 109°F installed inside the base cabinet as detailed.

- P8 Emergency Safety Station: Bradley model S19314SPR emergency shower and facewash, stainless steel bowl with HALO spray heads, 1/2" chrome plated brass stay-open ball valve with hand and foot control, stainless steel shower head and 1" chrome plated brass stay-open ball valve. Safety station to be installed with the following devices and as detailed on the drawings:
- a. TMV-2 Navigator S19-2100-EFX25, self-contained emergency water mixing valve with dial thermometer, angle checkstops and flow a minimum of 2 - 37 gpm, wall mounting bracket
  - b. Watts model U5B-GG, 1 1/4" pressure reducing valve with pressure gauge to reduce pressure to 30 PSI or per manufacturer.
- P9 Electric Water Cooler, Dual height (ADA & Standard) with bottle filling station, Elkay Model LZSTLG8WSLK with EZH20 bottle filling station, 120 volt, 370 watts, 8 gallons per hour cold water, with filtration system and stainless-steel basin and Gray Granite cabinet. Bottle filling station shall be sensor operated and cooler shall be push button operated. Install with Zurn model Z1225 dual plate carrier, 17-gauge cast brass chrome plated trap and Zurn Z-8804-CR-LK supply and stop. Unit mounting height shall be as selected by the Architect. Refrigeration system shall have a 5-year warranty. Four (4) additional replacement filters shall be furnished with each cooler system. Coordinate with the Electrical Contractor for the electrical connection to be inside the cabinet. Unit mounting height shall be as selected by the Architect and as the upper crutch accessible ADA height.
- P10 Shower (ADA Accessible): Shower enclosure shall be as specified on the Architectural Drawings under other Divisions of these specifications. Provide Leonard Series 7600 pressure/temperature balancing control valve, chrome finish with solid brass body and shower head with universal ball joint Model H-14 Low Flow 1.5 GPM, diverter valve D-2L with lever handle and 62001 ADA compliant vertical 24" grab bar with handheld shower. Unit shall be mounted with control valve 42" above the floor. Install all components per manufacturer's recommendations. Floor Drain (FD2) shall be installed (Coordinate with Architectural drawings). Construction cover shall be

provided by the manufacturer to protect the drain assembly during construction. The strainer shall be installed after construction and cleaning is complete. Strainers installed prior to completion of construction that have accumulations of construction debris will be replaced. Floor drain shall be furnished with a ProSet Systems Trap Guard.

### 2.03 ELECTRIC WATER HEATERS

Electric water heater, tank type: Furnish and install commercial electric water heater as scheduled on plans. Heaters shall be UL/ULC listed and meet minimum efficiency and standby loss per current ASHRAE standards. Provide and install T & P relief valve and expansion tank - see schedules on plans for expansion tank sizes. Locate controls for ease of maintenance and operation, 3-year warranty is required. Acceptable manufacturers: Rheem, Lochinvar, and Ruud.

## PART 3 – EXECUTION

### 3.01 GENERAL

- A. Obtain exact centerline rough-in dimensions between partitions or walls from the Architectural Drawings. Work shall be roughed-in so that all exposed piping will be straight and true without bends or off-sets. Water supplies shall connect through walls with stops and chrome plated escutcheons with setscrews. Where fixtures are without supporting legs or carriers secure wall hangers to bolts welded to 3/16" steel plates, mounted against walls within chases.
- B. Where backs of fixtures join wainscoting or tile, they shall be ground flat and the joints made close. Run bead of white caulking compound around back of fixture at outside edge before final setting. When fixture is set, wipe compound so that joint is sealed. Remove excess compound with solvent. Caulking compound shall be Porter "Brilliant White", Pittsburgh Glass, Sherwin-Williams, or equal.
- C. Mount fixtures to the heights above finished floor as indicated on the Architectural drawings.
- D. Install trap-seal liquid in dry urinals.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.02 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot-water dispensers and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

### 3.03 CLEANING

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned per manufacturers' recommended cleaning methods and materials.

B. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.

C. Remove sediment and debris from drains.

### 3.04 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

### 3.05 FINAL ACCEPTANCE

A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the plumbing Inspector to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test, sterilization compliance and backflow devices certificates.

### END OF SECTION

**SECTION 226610**  
**ACID WASTE AND VENT PIPING SYSTEM**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    The following described work, materials and equipment shall be furnished and installed as shown on the Drawings and as herein specified.
  - 1.    All acid waste and vent piping throughout the building, below slab and below grade.

1.02    REFERENCES

- A.    All plumbing installation and fabrication shall be in accordance with applicable State and Local Plumbing Codes.

1.03    SUBMITTALS

- A.    Submit catalog data and shop drawings for all materials and equipment listed under this section and per basic mechanical requirements. Include submittal data on related specifications also.
- B.    Materials, fixtures, or equipment installed without review or after rejection shall be replaced by this contractor with acceptable items at the Engineer's direction.
- C.    All materials, equipment, and appliances shall be new, without defect, first line quality unless specifically noted or specified otherwise.
- D.    The supplier, by submitting, certifies the materials and equipment to be satisfactory for the application involved.
- E.    Contractor further agrees that if deviations, discrepancies or conflicts between submittals and specifications are discovered either prior to or after submittals are processed by the engineer, the design drawings and specifications shall control and be followed.

**PART 2      PRODUCTS**

2.01    ACID WASTE AND VENT PIPING SYSTEM

- A.    Above Grade:

1. Polypropylene Pipe: Schedule 40 flame retardant polypropylene pipe Fittings: Flame retardant polypropylene with fused joints. Pipe and compatible fittings shall be Enfield, or equal by Orion, Fuseal or approved equal.

## 2.13 ACID WASTE SYSTEM SPECIALTIES

- A. ANT-1: See schedule on drawings. Acid Neutralization tank, Town and Country HDPE tank with H2O manhole lid/cover(due to adjacent pipe & equipment) and optional vent connection, 4" connections. Coordinate connections with site conditions prior to order. Tank shall be installed in accordance with the factory installation procedures. Complete shop drawing of the installation shall be submitted and approved prior to the installation. Inlet and vent piping to be as specified for acid waste systems. Discharge pipe to be schedule 40 PVC connected to existing cast iron pipe. Media shall be as recommended by the manufacturer and provided by the Plumbing Contractor. Capacity of the media inside the tank shall be in accordance to the manufacturer's requirements.
- B. FD2: Floor Drain (Acid Waste), Orion AWFD STD 3" SF with flashing clamp, polypropylene body with combination invertible membrane clamp and polypropylene strainer and deep seal trap. Coordinate with Architectural drawings of flooring installed for a water-proof floor design. Contractor will be required to test floor water-proofing system integrity by flooding floor.
- C. Cleanouts
  1. Interior, finished floor mounted, flame retardant Polypropylene fitting with adapter. Cleanout cover shall be as specified in Section 2.01 Plumbing Fixtures.
  2. Interior, unfinished areas flame retardant Polypropylene, fitting cleanout adapter with plug.

## PART 3 EXECUTION

### 3.01 ACID WASTE AND VENT SYSTEM

- A. Provide a complete system of acid waste and vent piping including interior and exterior work as indicated.
- B. Piping up to 2" shall be sloped at least 1/4" inch per foot. Piping 3" thru 6"

shall be sloped at least 1/8 inch per foot. Piping 8" and larger shall be sloped at least 1/16 inch per foot. Piping below slabs shall not be sloped less than 1/8" per foot regardless of size.

- C. Buried piping shall be laid in minimum 4 inches of bedding and sloped as specified herein. Bedding shall be accurately and uniformly graded. Bedding shall be fine grain cohesionless soil or crushed stone equal to Alabama Highway Department #9 crushed stone. Bedding shall be free of organic material.
- D. Provide cleanouts as required by Code and as indicated on the Drawings. Cleanouts for piping 4" and smaller shall be line size. Cleanouts for piping 6" and larger shall be 4". Provide dual exterior cleanouts within 5 feet of building. Interior cleanouts in floors shall be flush with finished floors. Interior cleanouts in walls shall be above the flood level of plumbing fixtures. Exterior cleanouts in unpaved areas and areas paved with other than concrete shall be set in concrete pads flush with finished grade as detailed on the drawings.
- E. Vents through a roof shall be at least sized as indicated on the Drawings and shall terminate at least 12 inches above the roof.
- F. This Contractor shall be responsible for locating vents at least 25 feet from outside air intakes, offsetting vents as required.
- G. Drainage piping shall be installed with hubs upstream of each pipe section. Provide reducing fittings where different sizes of pipe are to be connected. Bushings shall not be used. Provide longsweep fittings, sanitary tees and combination wyes with 1/8 bends as applicable.
- H. Fused joints shall be made in strict accordance with manufacturer's recommendations.

### 3.07 TESTING

- A. All piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.
- B. All acid waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head. Piping shall be tested for not less than 4 hours, prior to installing fixtures. Underground piping shall be tested before backfilling.

- C. Provide test report in booklet form showing all field test performed to prove compliance with the specified performance criteria. Booklet shall be submitted prior to submitting for final payment. Booklet shall include the following
  - 1. SYSTEM TESTED (acid waste)
  - 2. Date of test
  - 3. Test medium
  - 4. Persons present
  - 5. Pressure tested
  - 6. Lines tested and location
  - 7. Length of time test pressure was held
  - 8. Pressure drop
  - 9. Water pressure at most remote and highest location
  - 10. Residual chlorine
- D. This Contractor shall conduct all specified tests until approved by the Engineer. All tests shall be repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests inspections have been made and approvals obtained. This Contractor shall notify the Engineer four days prior to testing to allow for scheduling.

### 3.09 CLEANING

- A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.
- B. All strainer screens shall be removed and cleaned.

### 3.10 FINAL ACCEPTANCE

- A. Before final acceptance, the Plumbing Contractor shall furnish a certificate of inspection and final approval from the Engineer to the Owner and be in accordance with the latest revisions of the applicable codes and the Approved Plumbing Drawings and Specifications. Contractor shall also furnish booklet of test, sterilization compliance and backflow devices certificates.

**END OF SECTION**

**SECTION 230500**  
**MECHANICAL GENERAL PROVISIONS**

**PART 1      GENERAL**

**1.01    DESCRIPTION**

- A.    The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

**1.02    SCOPE OF WORK**

- A.    The Work shall include the furnishings of systems, equipment, and materials specified in this Division and as required by Contract Documents to include: supervision, operation, methods, and labor for the fabrication, installation, start-up, and tests for the complete mechanical installation.
- B.    Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as pipe fittings, access panels, and sleeves may not be shown. This Contractor shall be responsible for selecting the equipment to fit the space provided. The location and sizes for ductwork, pipe fittings, sleeves, inserts, and other basic items required by code and other sections shall be coordinated and included for the proper installation of the work.
- C.    Equipment Specification may not deal individually with minute items required such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether specifically called for in the Contract Documents.
- D.    Where the words "provide", "furnish", "include", or "install" are used in the Specification or on the Drawings, it shall mean to furnish, install, and test complete and ready for operation, the items mentioned. If an item is indicated in the Contract Documents, it shall be considered sufficient for including same in the work.
- E.    Where noted on the Drawings or where called for in other Sections of the Project Manual, the Contractor for this Division shall install equipment furnished by Others and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.
- F.    Coordinate with all trades in submittal of shop drawings. Shop drawings shall be prepared clearly indicating all applicable components. Space conditions shall be detailed to the satisfaction of all concerned trades, subject to review and final acceptance by the Engineer. In the event that the Contractor installs his work before coordinating with other trades or so as to cause any interference with work of other trades, the necessary changes shall be made in the work to correct the condition, at no additional cost to the Owner.

**1.03    CODES AND STANDARDS**

- A.    Conform to latest edition of governing codes, ordinances, or regulations of city, county, state, or utility company having jurisdiction. Where local codes are not



## MECHANICAL GENERAL PROVISIONS

applicable, conform to Standard Plumbing Code; Standard Mechanical Code; Standard Fire Prevention Code and National Electrical Code.

### 1.04 CONTRACTOR'S QUALIFICATIONS

- A. The qualifications of the Mechanical Contractor for this project shall be as follows:
  - 1. The Contractor shall have been in the mechanical contracting business for the last five (5) consecutive years and under their current corporation name with essentially the same corporate officers.
  - 2. The Contractor shall have successfully completed at least two projects of comparable size and scope.
  - 3. The Contractor's main office shall be located within 100 miles driving distance of the project. If the Contractor's office is located more than 100 miles from job site, the Contractor shall submit for approval, 10 working days prior to bidding the job, the name of the service company within a 100 mile radius of the job site, who will be responsible for any/all service required during the warranty period. In either case, the Contractor shall be responsible for having a qualified technician on the job site within 4 hours after receiving a service call.
  - 4. When requested, the contractor shall provide substantiating proof of these requirements.

### 1.05 FEES, PERMITS, AND INSPECTIONS

- A. Secure all permits and pay all fees required in connection with the Work.
- B. Coordinate and provide such inspections as are required by the Authorities with jurisdiction over the site.
- C. Where applications are required for procuring of services to the building, prepare and file such application with the Utility Company. Furnish all information required in connection with the application in the form required by the Utility Company.

### 1.06 ACTIVE SERVICES

- A. Existing active services: water, gas, sewer, electric, are to be located and shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities with jurisdiction for determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

### 1.07 SITE INSPECTION

- A. Contractor shall inspect the site to familiarize himself with conditions of the site which will affect his work and shall verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, trees or other obstacles.

## MECHANICAL GENERAL PROVISIONS

- B. Extra payment will not be allowed for changes in the Work required because of Contractor's failure to make this inspection.

### 1.08 OPENINGS, CUTTING, AND PATCHING

- A. Coordinate the placing of openings in the new structure as required for the installation of the Mechanical Work.
- B. When additional patching is required due to failure to inspect work; then provide the patching required to properly close the openings, to include patch painting.
- C. When cutting and patching of the structure is made necessary due to failure to install piping, ducts, sleeves, or equipment on schedule, or due to failure to furnish, on schedule, the information required for the leaving of openings, then provide the cutting and patching as required.

### 1.09 WIRING FOR MECHANICAL EQUIPMENT

- A. Division 26 shall provide power services for motors and equipment furnished by this Contractor to include safety disconnect switches, starters and final connections.
- B. Division 23 shall provide all motors and contactors for equipment furnished under this Division, except where they are an integral part of a motor control center which is provided under another Division.
- C. Provide internal wiring, alarm wiring including for fire protection and/or security, control wiring, and interlock wiring for equipment furnished, to include temperature control wiring.
- D. Coordinate with Division 26 all motors and other mechanical equipment which require electrical services. Provide schedule which shall include the exact location for rough-in, electrical load, size, and electrical characteristics for all services required.
- E. Where motors or equipment furnished require larger services or services of different electrical characteristics than those called for on the Electrical Drawings, this contractor shall coordinate with the electrical contractor and the Electrical Engineer to provide a larger service as required, the cost of which shall be the responsibility of this contractor.
- F. Electrical work provided under Division 23 shall conform to the requirements of Division 26.

### 1.10 SUBSTITUTIONS

- A. Any equipment submitted as "equal" to the basis of design shall be accompanied with a comparison letter from the vendor stating any differences from the equipment being submitted and the basis of design. A letter is also to be submitted from the vendor, on the vendor's letterhead, stating that the vendor has received a copy of the job specifications, all addendums and any necessary drawings.
- B. Substitutions for the scheduled and specified equipment shall only be done with the prior approval of the engineer and shall be obtained in writing. Prior approvals shall be obtained no less than ten working days prior to the bid date. Prior approval shall not

## MECHANICAL GENERAL PROVISIONS

relieve the contractor of supplying equipment that meets the specifications, capacities, efficiencies, physical dimensions, etc.

### 1.11 PROTECTION

- A. Special care shall be taken for the protection of equipment furnished. Equipment and material shall be completely protected from weather elements, painting, plaster, etc. until the project is completed. Damage from rust, paint, scratches, etc. shall be repaired as required to restore equipment to original condition.
- B. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled, or otherwise damaged during the course of such work. Contractor shall arrange with the other Contractors for repairing and refinishing of such areas which may be damaged.
- C. When welding is required inside building, provide one man for a fire watch. Fire watch shall require adequate protection of existing surfaces and observance of lower floors where penetrations exist.

### 1.12 SUBMITTALS

- A. General
  - 1. Submit to Engineer shop drawings and product data required by the drawings and specifications.
  - 2. Contractor shall compile all data including but not limited to ductwork materials and construction details, ductwork layout, manufacturers catalog and product data, controls wiring diagrams and material data, piping, insulation, water treatment, and test and balance.
  - 3. Submit a minimum of 7 copies of data, more if required by the Architect.
- B. Submittal Requirements
  - 1. Prepare submittals compiled in a 3 ring, hard bound, loose leaf binder. The face of the binder shall be clearly marked with the project title and number, the name of the Owner, Architect, Engineer, General Contractor, and this contractor.
  - 2. The first page inside the binder shall provide an index, numerically indicating all sections applicable to this submittal.
  - 3. Separate binders shall be provided for HVAC, plumbing and fire protection trades.
  - 4. Provide tab dividers for each section submitted. In the event an item appears on the drawings not specifically covered by the specifications, provide an additional numeric tab at the end of the index detailing the item and include the submittal data in the binder.

## MECHANICAL GENERAL PROVISIONS

5. All equipment included on the submittal sheets shall be marked to indicate the "Tag" name or number of the equipment as shown on the drawings. The equipment shall be high-lighted, where necessary, to clarify which items are being submitted.
6. For the ductwork submittals, the contractor will be provided with an electronic copy of the mechanical floor plans. Ductwork layout submittals shall consist of one copy on a reproducible medium such as mylar. The drawings shall be on standard size sheets of 24" x 36" or 30" x 42". The reproducible copy shall be returned to the contractor with the engineer's approval stamp and comments.
7. Submit only complete project submittals. Partial submittals or submittals not complying with the above requirements shall be returned to the contractor un-marked and rejected.
8. In the interest of project expediency, the contractor may pre-submit long lead items for pre-approval. However, the contractor shall not be relieved of including the same data as required by submittal binder and shall be included therein.
9. The Contractor may turn in submittals without control drawings if they require a longer production time. All other items shall be included.
10. Provide a tab for items not included and include an explanation of why item is not included in the submittal and the expected submittal date.
11. Review shop drawings and product data prior to submission to Engineer.
12. Verify field measurements, field construction criteria, catalog numbers, and similar data.
13. Coordinate each submittal with work of the project and Contract Documents.
14. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Engineer's review of submittals unless Engineer gives written acceptance of specific deviations.
15. Notify Engineer in writing of deviations from requirements of Contract Documents at time submittals are made. A "deviation" shall be construed to mean a minor change to the sequence indicated on drawings or specification. A "deviation" is not intended to allow substitutions or product options.
16. Do not begin work which requires submittals until submittals have been returned with Engineer's stamp and initials or signature indicating review and approval. Materials and equipment that were installed prior to being not approved shall be removed and replaced with approved items at no additional cost to other parties.
17. Shop Drawings and/or submittals requiring resubmission to the Engineer due to non-compliance with the Contract Documents and/or

## MECHANICAL GENERAL PROVISIONS

incompleteness shall be thoroughly reviewed by the Contractor prior to delivery to the Engineer for review. The Contractor shall ensure the completeness and compliance of the submittal materials and shall reimburse the Engineer at their standard hourly billing rates for review of submittals/shop drawings beyond the second submission.

18. Attention is directed to the fact that Engineer's review is only to check for general conformance with the design concept of the project and general compliance with Contract Documents. No responsibility is assumed by Engineer for correctness of dimensions, details, quantities, procedures shown on shop drawings or submittals.
19. Omission in shop drawings of any materials indicated in Contract Drawings, mentioned in Specifications, or required for proper execution and completion of Work, does not relieve the Contractor from responsibility for providing such materials.
20. Approval of a separate or specified item does not necessarily constitute approval of an assembly in which item functions.

### 1.13 OPERATING AND MAINTENANCE MANUALS

#### A. General

1. Provide three up-to-date copies of shop drawings, product data, and other information described in this Section for use in compiling operating and maintenance manuals.
2. Provide legible submittals made by permanent reproduction copy equipment from typewritten or typeset originals.
3. Pre-punch 8-1/2-inch x 11-inch sheets for standard three ring binders.
4. Submit larger sheets in rolled and protected packages.

#### B. Compilation

1. The Contractor will receive shop drawings, brochures, materials list, technical data of all types, warranties, guarantees, and other pertinent information and will assemble, catalog, and file information in loose-leaf, hardback three-ring binders.
2. Submittal Format: (Provide each of the following items, as applicable, for each required item or system. Requirements will vary, depending on the equipment. Refer to specific Specification section requirements.)
  - a. Item: (Use appropriate Section title.)
  - b. System Description: (Provide a detailed narrative description of each system, describing function, components, capacities, controls, and other data specified, and including the following:
    - (1.) Number of.

## MECHANICAL GENERAL PROVISIONS

- (2.) Sizes.
- (3.) Type of operation.
- (4.) Detailed operating instructions, including start-up and shut-down of each system, with indications for position of all controls, as applicable.
- (5.) Wiring Diagrams: (Complete wiring diagrams for internally wired components including controls.)
- (6.) Operating Sequence: (Describe in detail.)
- (7.) Manufacturers Data: (Provide catalog data sheets, specifications, nameplate data and parts list.)
- (8.) Preventative Maintenance: (Provide manufacturer's detailed maintenance recommendations.)
- (9.) Troubleshooting: (Provide manufacturer's sequence for trouble-shooting procedures for operational problems.)
- (10.) Extra Parts: (Provide a listing of extra stock parts furnished as part of the Contract.)
- (11.) Warranties: (Provide specific manufacturer's warranty. List each component and control covered, with day and date warranty begins, date of expiration, and name, address, and telephone number of persons to contact regarding problems during warranty period.)
- (12.) Directory: (Provide names, addresses and telephone numbers of Contractor, its subcontractors, suppliers, installers and authorized service and parts suppliers. Format as follows:)

Contractor:

Address:

Telephone No.:

Person to Contact:

Subcontractor:

Address:

Telephone No.:

Person to Contact:

Installer:

Address:

Telephone No.:

Person to Contact:

Manufacturer:

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Address:

Telephone No.:

Person to Contact:

Local Service Representative:

Address:

Telephone No.:

Person to Contact:

### 1.14 RECORD DRAWINGS

#### A. Detailed Requirements for Record Drawings

1. During the progress of the work, the Contractor shall require the job superintendent for the plumbing, air conditioning, heating, ventilating, and fire protection subcontractors to record on their field sets of drawings the exact locations, as installed, of all conduits, pipes, and ducts whether concealed or exposed which were not installed exactly as shown on the contract drawings.
2. The Contractor shall submit redline as-built drawings to the Engineer for review.
3. The Engineer shall authorize the Contractor to produce and distribute the redline as-built drawings in PDF format as follows:
  - a. One (1) Computer Disc (CD) to the Engineer.
  - b. One (1) CD to the Architect.
  - c. Three (3) hard copies full size
  - d. Two (2) CD to the Owner.

### 1.15 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
- B. For products specified by naming several products or manufacturers, select any one of products and manufacturers named which complies with specifications.
- C. For products specified by naming several products or manufacturers and stating "or equivalent", "or equal", or "or Engineer approved equivalent", or similar wording, submit a request for proposed substitutions for any product or manufacturer which is not specifically named; for review and approval by the Engineer.
- D. For products specified by naming only one product and manufacturer, there may be an option of an Engineer approval of a product of equal or greater quality or size.

1.16 SUBSTITUTION SUBMISSIONS

- A. Contractor's Base Bid shall be per contract documents.
- B. Submit separate request for each substitution. Support each request with:
  - 1. Complete data substantiating compliance of proposed substitution with requirements stated in contract documents:
    - a. Product identification, including manufacturer's name and address.
    - b. Manufacturer's literature; identify:
      - (1.) Product description.
      - (2.) Reference standards.
      - (3.) Performance and test data.
    - c. Name and address of at least two similar projects on which product has been used, and date of each installation.
    - d. Itemized comparison of the proposed substitution with product specified list significant variations.
    - e. Data relating to changes in construction schedule.
    - f. Any effect of substitution on separate contracts.
    - g. List of changes required in other work or products.
    - h. Designation of availability of maintenance services, sources of replacement materials.
    - i. Provide certification of product compatibility with adjacent materials.
- C. Substitutions will not be considered for acceptance when:
  - 1. They are indicated or implied on shop drawings or product data submittals without a formal request from Contractor or his supplier prior to bid.
  - 2. Acceptance will require substantial revision of contract documents.
  - 3. In judgement of Engineer, do not include adequate information necessary for a complete evaluation.
  - 4. Substitute products shall not be ordered or installed without written acceptance of Engineer.
  - 5. Engineer will determine acceptability of proposed substitutions.

1.17 CONTRACTOR'S SUBSTITUTION RESPONSIBILITIES



## MECHANICAL GENERAL PROVISIONS

- A. In making formal request for substitution, Contractor represents that:
  - 1. He has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.
  - 2. He will provide same warranties or bonds for substitution as for product specified.
  - 3. He will coordinate installation of accepted substitution into the work and will make such changes as may be required for the work to be complete in all respects. This includes revisions due to changes in electrical characteristics, physical size and weight, service requirements, service clearances, etc.
  - 4. He waives claims for additional costs caused by substitution which may subsequently become apparent.
- B. The contractor shall have included all costs associated with the substitution for the specified products or materials, and that no additional cost will be incurred by any other party in order to fully incorporate the substituted item(s).
- C. The contractor agrees to reimburse the Architect/Engineer for any architectural or engineering re-design that is required by the substitution to be fully incorporated. The reimbursement shall be at the Architect/Engineer's standard billing rate.

### 1.18 ENGINEER DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

### 1.19 FINISHING

- A. General: Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.
- B. Cleaning: At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the mechanical construction. All closed off spaces shall be cleaned of all packing boxes, wood frame members, and other waste materials used in the mechanical construction.
- C. The entire system of piping and equipment shall be cleaned internally. The Contractor shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris.
- D. All tanks, fixtures, and pumps shall be drained and proven free of sludge and accumulated matter.

## MECHANICAL GENERAL PROVISIONS

- E. All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.). All HVAC equipment shall have affixed adjacent to the permanent nameplate, the unit identification on an engraved label with permanent adhesive.
- F. Heating and air conditioning equipment, tanks, pumps, etc., shall be thoroughly cleaned and new filters or filter media installed.

### 1.20 TEST AND DEMONSTRATIONS

- A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.
- B. Prior to acceptance of the mechanical installation, demonstrate to the Owner or his designated representatives all essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The contract shall allow for five (5) working days to perform the demonstrations.
- C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.
- D. Dates and times for performing the demonstrations shall be coordinated with the Owner.
- E. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall bear signatures of contractor and owner.
- F. Training shall include audio/video recording in DVD format turned over to the owner as part of closeout documents.

### 1.21 PAINTING AND IDENTIFICATION

- A. Touch-up paint where damaged on equipment furnished with factory applied finish, to match original finish.
- B. Provide engraved, laminated plastic tags for all equipment. Tags shall be attached with permanent adhesive.

### 1.22 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Provide excavation necessary for underground water piping, etc., and backfill such trenches and excavations after work has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to

## MECHANICAL GENERAL PROVISIONS

accommodate the pipe. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe and utility laying, than that which is authorized.

- B. Trenches for piping and utilities located inside foundation walls and to point five (5) feet outside of the wall shall be not less than sixteen (16) inches or more than twenty-four (24) inches wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five (5) feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.
- C. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the barrel will be supported on compacted fill. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell but shall be no larger than necessary for proper jointing. All sewers and piping required for the structure shall be excavated to at least (6) inches below pipe invert.
- D. Immediately after testing and/or inspection, the trench shall be carefully backfilled with earth free from clods, brick, etc., to a depth one-half the pipe diameter and then firmly puddled and tamped in such a manner as not to disturb the alignment or joints of the pipe. Thereafter, the backfill shall be puddled and tamped every vertical foot.

### 1.23 CONCRETE WORK

- A. Provide concrete bases and housekeeping pads for mechanical equipment unless indicated otherwise. Concrete work shall be as specified in the applicable Civil/Site and Structural Sections. Vibration pads, equipment bases, pipe supports and thrust blocks shall be provided by this Contractor.
- B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

### 1.24 ACCESS PANELS

- A. Provide access panels where required and not shown on the drawings for installation by the drywall Contractor. Access panels shall be as specified in the applicable architectural section. All access panel locations which allow access to mechanical equipment shall be approved by the Architect/Engineer.

### 1.25 SLEEVES

- A. Sleeves passing through non-fire rated walls and partitions shall be Schedule 10 black steel.
- B. Sleeves passing through load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 galvanized steel pipe or cast iron pipe.

## MECHANICAL GENERAL PROVISIONS

- C. Sleeves passing through non-load bearing walls, concrete beams, foundations, footings, and waterproof floors shall be Schedule 40 PVC or cast iron.
- D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material.
- E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.
- F. Pipe to wall penetration closures for underground pipe penetrations of walls shall be "Link-Seal" as manufactured by Thunderline Corporation, or equal.

### 1.26 ESCUTCHEONS

- A. Provide chrome plated escutcheons at each sleeved opening into finished and stainless steel to exposed exterior spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve but not to insulation with set screws or other approved devices.

### 1.27 INSULATION PROTECTION

- A. Where exposed insulated piping extends to floor, provide sheet metal guard around insulation.

### 1.28 ANCHORING OF EQUIPMENT

- A. All equipment located on floor slab, that is not mounted on wheels and is capable of being moved shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficient size to prevent equipment from overturning.

### 1.29 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Water piping shall not be installed in electrical rooms or directly above electrical equipment.

### 1.30 CONNECTIONS FOR FIXTURES AND EQUIPMENT UNDER ANOTHER SECTION OR BY OWNER

- A. Rough all equipment requiring connection to systems provided under this Division. Verify requirements and current locations before proceeding with work.
- B. Make all connections to equipment furnished under another Section or by owner as required to obtain complete and working systems.

### 1.31 SYSTEM GUARANTEE

## MECHANICAL GENERAL PROVISIONS

- A. Work required under this Division shall include one-year guarantee. Guarantee by Contractor to Owner to replace for Owner any defective workmanship or material which has been furnished under contract at no cost to the Owner for a period of one year from date of substantial completion. Guarantee shall also include all reasonable adjustments of system required for proper operation during guarantee period. Guarantee shall not include normal preventative maintenance services or filters.
- B. At "Demonstration", one-year guarantee provision by Contractor shall be explained to Owner.
- C. All sealed hermetic refrigeration systems shall be provided with five-year factory warranty from date of substantial completion

**END OF SECTION**

**SECTION 230520  
MOTOR STARTERS**

**PART 1      GENERAL**

**1.01    WORK INCLUDED**

- A.    Provide motor starters for all mechanical motor driven equipment not provided with a starter or contactor.

**1.02    SUBMITTALS**

- A.    Provide catalog cuts per Division 23 for all motor starters. Cut sheets shall be identified as to the equipment it serves, the horsepower rating and accessories provided.

**PART 2      PRODUCTS**

**2.01    GENERAL**

- A.    Supply motor starters when required for any equipment provided in Division 23. Starters shall be adequately sized for the motor.
- B.    Provide labels for each starter.
- C.    Provide starters with enclosures suitable for the associated environment, or as specified elsewhere in the documents.

**2.02    MANUAL MOTOR STARTER**

- A.    Fractional Horsepower  
Provide manually operated toggle switches equipped with melting alloy-type thermal overload protection. Utilize replaceable thermal units of one-piece construction which inhibit starter operation when removed or melted.
- B.    Integral Horsepower
  - 1.    Provide starters equipped with bimetallic or melting alloy-type thermal overload protection, as required.
  - 2.    Provide with operating and indicating equipment as required.
  - 3.    Provide with under-voltage protection if required.

**2.03    MAGNETIC MOTOR STARTERS**

- A.    Provide starters for full voltage starting, sized in accordance with NEMA standard horsepower ratings.
- B.    Provide starters allowing for a maximum of four external auxiliary normally open or closed contacts.
- C.    Provide starters with coils of molded construction, through NEMA size five. All coils shall be replaceable without removing the starter.

## MOTOR STARTERS

- D. Provide starters with bimetallic or melting alloy-type thermal overload protection. Utilize replaceable thermal units of one-piece construction which inhibit starter operation when removed or melted. Three phase starters shall use three thermal units.
- E. Provide starters with replaceable contacts. Contact replacement shall occur without starter or wire removal.
- F. Provide Hand/Off/Auto switches.
- G. Starters shall be manufactured by Culter-Hammer, or approved equals by Square D, ITE-Siemens, or General Electric.

### **PART 3 EXECUTION**

#### 3.01 GENERAL

- A. Provide types of starters as required or specified elsewhere.
- B. Provide with control schemes as specified elsewhere.
- C. Provide overload protection elements sized to the full load current rating of the motor per the motor nameplate.
- D. Install floor mounted units on concrete housekeeping pads in rooms with concrete floors susceptible to flooding.

### **END OF SECTION**

**SECTION 230532**  
**SUPPORTS AND ANCHORS**

**PART 1        GENERAL**

1.01    WORK INCLUDED

- A.     Pipe, duct, and equipment hangers, supports, and associated anchors.
- B.     Equipment bases and supports.
- C.     Sleeves and seals.
- D.     Flashing and sealing equipment and pipe stacks.

1.02    WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

- A.     Furnish hanger and support inserts sleeves to Section for placement into formwork.

1.03    SUBMITTALS

- A.     Submit shop drawings and product data for all items listed under this section.
- B.     Indicate hanger and support framing and attachment methods.

**PART 2        PRODUCTS**

2.01    PIPE HANGERS AND SUPPORTS

- A.     Hangers for Pipe Sizes 1/2 to 4 inches: Carbon steel, adjustable, clevis type with galvanized plating.
- B.     Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.
- C.     Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- D.     Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast-iron roll for hot pipe sizes 6 inches and over.
- E.     Vertical Support: Steel riser clamp with galvanized plating.
- F.     Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support anchored to floor.
- G.     Un-insulated Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- H.     Shield for Insulated Piping 1 1/4 Inches and Smaller: 18 gage galvanized steel saddle over insulation in 180-degree segments, minimum 12 inches long per pipe support.
- I.     Shield for Insulated Water Piping 1 1/2 Inches and Larger: Rigid non-conducting insulation in 180-degree segments, 16-inch minimum length with block thickness the same as insulation thickness and with an inner contour of the supporting pipe. Install with 16 gage galvanized steel saddle per pipe support. See Detail for additional requirements. Wood is not an acceptable blocking material.
- K.     Shields for Vertical Copper Pipe Risers: Sheet lead.



2.02 HANGER RODS

- A. Steel Hanger Rods: Galvanized threaded both ends, threaded one end, or continuously threaded.

2.03 FLASHING

- A. Metal Flashing: galvanized steel.
- B. Lead Flashing: 5 lb/sq ft sheet lead for waterproofing; one lb/sq ft sheet lead for soundproofing.
- C. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- D. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

2.04 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with schedule 80 PVC or Schedule 10 steel pipe.
- B. Sleeves for Pipes Through Non-fire Rated Walls, Footings, and Potentially Wet Floors: Form with schedule 10 steel pipe.
- C. Sleeves through beams shall be Schedule 40 steel; only in locations approved by the Structural Engineer.
- D. Sleeves for Round Ductwork: Form with galvanized steel. Size shall include an allowance for the insulation.
- E. Sleeves for Rectangular Ductwork: Formed or framed for the duct penetration including scheduled/specified insulation. See Detail for packing insulation and metal flashing
- F. Flanges shall be 20 gage galvanized steel.
- G. Sleeves for floor or wall penetrations at rated assemblies shall conform to Specifications Section 23 05 60.

2.05 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.

2.06 FINISH

- A. Prime coat steel hangers and supports at interior spaces. Exterior supports shall be galvanized or primed and painted as directed by Engineer and Architect.
- B. Finish coat in exposed areas and exterior shall be selected by Architect.

## 3.01 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SUPPORT SCHEDULE					
Pipe Size	Support Spacing				Hanger Rod Diameter
	Sched 40 Black Steel	Copper	PVC	Cast Iron Soil Pipe	
1/2"	-	5'-0"	4'-0"	-	3/8"
3/4"	7'-0"	5'-0"	4'-0"	-	3/8"
1"	7'-0"	6'-0"	4'-0"	-	3/8"
1-1/4"	7'-0"	7'-0"	4'-0"	-	3/8"
1-1/2"	9'-0"	8'-0"	4'-0"	-	3/8"
2"	10'-0"	8'-0"	4'-0"	5'-0"	3/8"
2-1/2"	10'-0"	9'-0"	4'-0"	5'-0"	1/2"
3"	10'-0"	10'-0"	4'-0"	5'-0"	1/2"
4"	10'-0"	10'-0"	4'-0"	5'-0"	5/8"
6"	10'-0"	10'-0"	4'-0"	5'-0"	3/4"
8"	10'-0"	10'-0"	4'-0"	5'-0"	7/8"
10"	10'-0"	10'-0"	4'-0"	5'-0"	7/8"

Note: Rods may be reduced one size for double rod hangers, with 3/8" being the minimum diameter.

- B. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2-inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. All hangers, hanger rods, supports, etc. shall be double nutted.

## 3.02 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete type.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

## SUPPORTS AND ANCHORS

- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

### 3.03 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal. Coordinate with Roofing Contractor PRIOR to any work as required to ensure roof warranty as roof systems may vary.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36-inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, and mop sink drains watertight to adjacent materials.
- E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

### 3.04 SLEEVES

- A. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions, and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water. Caulk sleeves full depth and provide floor plate.
- B. Install chrome plated steel escutcheons at finished surfaces.
- C. Install stainless steel escutcheons at finished exterior surfaces.

**END OF SECTION**

## **SECTION 230534 VIBRATION ISOLATION**

### **PART 1        GENERAL**

#### **1.01    WORK INCLUDED**

- A.     Supply necessary equipment such as inertia bases, base rails, vibration isolators, etc. as required to prevent the transmission of excessive noise and vibration to other portions of the building from all HVAC equipment.

#### **1.02    SUBMITTALS**

- A.     Submit shop drawings and product data for all materials listed under this section.
- B.     Shop drawings shall indicate inertia bases, base rails, vibration isolators etc., with static and dynamic load on each. A professional engineer in the employ of the isolator manufacturer shall stamp shop drawings.
- C.     Provide a schedule of vibration isolator type with location and load on each.
- D.     Manufacturers installation instructions, indicating special procedures and setting dimensions.
- E.     Manufacturers certificate, certifying that isolators are properly installed and adjusted to meet or exceed specified requirements.

### **PART 2        PRODUCTS**

#### **2.01    VIBRATION ISOLATION EQUIPMENT AND METHODS**

- A.     Equipment vendors shall furnish the required isolation equipment and installation instructions with each piece of equipment.
- B.     Manufacturers: Vibration Eliminator Co. is specified to establish the standard. Equals by Mason, Iso-flex, Kinetcis Noise Control and VMC will be considered.
- C.     Contractor shall submit for approval of any equal isolation method/materials with supporting documentation for approval by the engineer prior to order or placement.

## 2.02 VIBRATION ISOLATION

A. The following equipment shall be provided with vibration isolation:

EQUIPMENT	TYPE ISOLATION/BASE	MINIMUM DEFLECTION
Chillers	NM	.35"
Cooling Towers	NP	Bolt to Steel W/ 5/8" Bolts
Reciprocating Air Compressors	S/I	.75
Base Mounted Pumps	S/I	.75
Air Handling Units External Motor & Drives	S/B	.75
Internal Motor & Drives (Unless Internally Isolated)	S/B	.75
Packaged AC Equipment Interior	NP	
Exterior	NP	
Utility Fans	S/B	.75
Suspended Fans	H	.75
Condensate Return Set	NP	Bolt to Housekeeping Pad W/ 5/8" Bolts
Boilers	NP	Bolt to Housekeeping Pad W/ 5/8" Bolts
Condensate Pumps	NP	Bolt to Housekeeping Pad W/ 5/8 Bolts

Provide seismic snubbing on all isolated equipment not directly bolted to slab.

B. Materials and systems specified in this section shall be obtained from a single vibration isolation materials manufacturer. The isolation materials manufacturer shall be responsible for the proper selection of isolators to accomplish the specified minimum static deflections, for all spring and pad type isolators, based on the weight distribution of equipment to be isolated.

## VIBRATION ISOLATION

- C. The isolation materials manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases for equipment scheduled to receive a supplementary base.
- D. The Contractor shall furnish the vibration isolation manufacturer a complete set of approved shop drawings, including operating weights and weight distribution. The isolation manufacturer shall then submit drawings for approval showing construction of specific devices to be used on this project including complete design of supplementary bases, tabulation of design data for each isolator including spring O.D.; free, operating and solid heights; and all other data to show that minimum static deflection requirements are met.
- E. Isolator Types - Floor Mounted Equipment:
  - 1. Type NP: Neoprene in-shear isolation pads with crossed double ribs and .25" deflection. Pads shall be molded using oil resistant 25,000 PSI tensile strength neoprene. Cork shall not be allowed.
  - 2. Type NM: Double deflection neoprene mountings shall have minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom, so they need not be bolted to the floor. Bolt holes shall be provided for those areas where bolting is required.
  - 3. Type S:
    - a. Vertically restrained spring isolators with horizontal stiffness not less than 1.3 times the rated vertical spring stiffness. Spring O.D. shall be minimum of 0.8 times rated vertical operating height. Springs shall be selected to provide minimum static deflections tabulated and shall provide a 50 percent overload capacity before reaching a solid state.
    - b. Springs to include drilled and tapped steel top load plates, steel bottom load plate bonded to a 1/4-inch-thick ribbed neoprene noise stop pad, steel leveling bolt, locknuts, and washers for attachment to supported equipment.
- F. Base Types - Floor Mounted Equipment:
  - 1. Type B: Welded structural steel bases with welded support brackets mounted as required to provide the lowest possible mounting height of supported equipment. Beams shall have minimum section depth of 8 percent of the longest span between support isolators, but not less than 6 inches. Anchor bolt holes shall be pre-located and drilled to accept isolated equipment.
  - 2. Type I: Inertia bases shall consist of a concrete slab field cast into a prefabricated inertia based frame of welded steel channels with a depth greater than 8 percent of the longest span, but not less than 6 inches, or as

indicated on the drawings. Frame to include 1/2" steel reinforcing rods on 8-inch centers each way, pre-located equipment anchor bolts fixed into position with steel bolt sleeves to allow minor adjustment. Inertia bases with Type S isolators shall have isolator support brackets welded into corners of the perimeter channel frame. Inertia bases for horizontally split case pumps shall also support the pipe elbows.

G. Hangers:

1. Type F: Shall consist of a Type NM isolator bonded to and encased in a welded steel bracket. Brackets to allow up to 15 degrees rod misalignment without metal to metal contact.
2. Type S: Shall consist of a Type S isolator mounted in a steel bracket as described for Type F.
3. Type H: Shall consist of a Type F isolator and a Type S isolator, in series, encased in a welded steel bracket as described for Type F.

H. Piping isolation, using Type H isolators, shall be for piping over 1-inch O. D. for a distance of 50 feet, or 100 diameters, or inside equipment rooms, from connected isolated equipment, whichever is greater.

I. Piping isolation, using Type F isolators, shall be for all piping over 2" diameter not isolated with Type H isolators.

J. Seismic Snubbers: Each set of seismic snubbers shall restrain machinery motion in x, y and z directions. Snubbers shall be omni-directional type with factor set air gaps between 1/8-inch minimum and 1/4-inch maximum. Load capacity of each snubber at 50 percent neoprene element deflection shall be 1.0g minimum. Neoprene elements shall be 3/4-inch minimum thickness and replaceable. In lieu of snubbers and spring isolators, combination spring/snubbers may be used.

### PART 3 EXECUTION

#### 3.01 VIBRATION ISOLATORS

A. Install in accordance with manufacturer's instructions.

B. Install isolation for motor driven equipment.

C. Bases:

1. Set steel bases for one-inch clearance between housekeeping pad and base.
2. Set concrete inertia bases for one-inch clearance between housekeeping pad and base.
3. Adjust equipment level.

D. Install spring hangers without binding.

E. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

## VIBRATION ISOLATION

- F. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
  - G. Provide pairs of horizontal limit springs on fans with more than 6.0-inch static pressure, and on hanger supported, horizontally mounted axial fans.
  - H. Support piping connections to isolated equipment resiliently as follows:
    - 1. Select three hangers closest to vibration source for static deflection of isolated equipment; the first two hangers shall be the precompressed type. Select remaining isolators for 1/2 static deflection of isolated equipment.
  - I. Connect wiring to isolated equipment with flexible hanging loop.
- 3.02 ACCEPTANCE
- A. The Contractor shall be responsible to take the necessary steps to ensure that no equipment operates with excessive noise or vibration transmission.

**END OF SECTION**



## **SECTION 230536 EQUIPMENT CURBS**

### **PART 1      GENERAL**

#### **1.01    WORK INCLUDED:**

- A.    Provide manufactured equipment curbs for all roof mounted equipment which is not provided with its own curb.
- B.    Coordinate with General Contractor for the required steel installed below the curbs. Installation requirements of the curb to the steel shall be provided by the curb manufacturer on the roof curb shop drawings. Installation shall be done by the Mechanical Contractor.
- C.    Coordinate with roof design and where sloped steel is provided, sloped curbs shall be submitted and installed. Refer to details on drawings to maintain a minimum of 12" to top of curb above finished roof.
- D.    Curbs, attachments and equipment hold down clips shall be designed to be attached to the building structure steel rooftop equipment as a complete component to meet IBC 1609 wind load requirements by a Professional Engineer registered in Alabama. Calculations shall be submitted and sealed/signed by the Engineer. Coordinate with equipment manufacturer as required.
- E.    Final roofing and flashing shall be done by the Roofing Contractor.

#### **1.02    SUBMITTALS**

- A.    Provide manufacturer's product data and cut sheets.
- B.    Shop drawing submittal:
  - 1.    Provide shop drawings showing the physical size and/or slope of each curb.
  - 2.    For curbs supporting multiple pieces of equipment, the shop drawings shall also show where each piece of equipment will be mounted and the clearances between them. The equipment shown, shall be the actual equipment being installed, with the dimensions from the shop drawings used for layout.
  - 3.    The shop drawings shall indicate the curbs relationship to supporting walls and beams below along with sufficient data to accurately locate the curb on the roof.

### **PART 2      PRODUCTS**

#### **2.01    EQUIPMENT CURBS**

- A.    The equipment curbs shall be constructed of reinforced galvanized steel with all welded components and four mitered corners.

- B. The curbs shall be flat sided without a cant strip. Curbs shall have a mounting flange for attaching to the roof.
- C. The curbs shall have factory installed 1 1/2" thick rigid fiberglass board insulation.
- D. The curbs shall have attached pressure treated wood nailers.
- E. The curbs shall have an attached solid plywood top and flashing cap extending to below the wood nailer.
- F. The curbs shall be shipped completely factory assembled.
- G. The curbs shall be designed to support the weight and size of the equipment shown on the drawing. When attached to the roof deck the curb shall extend a minimum of 12 inches above the roof surface.
- H. If indicated on drawings, the equipment curb cap shall include pipe curbs (Refer to section 23 05 37).
- I. When indicated on the plans the curbs shall be factory painted, color to be selected by architect.
- J. The equipment curbs shall be Pate Model PC-2 (sloped curb similar) or Creative Metals Model CSSF (Sloped curb similar).

### **PART 3 EXECUTION**

#### **3.01 EQUIPMENT CURBS**

- A. Contractor shall determine the location for the installation of the curbs for installation by the roofing contractor.
- B. Contractor shall be responsible for determining the overall height of the curb to be provided for each location. Minimum curb height shall be 24.
- C. Equipment curbs shall be installed level and in such a manner to prevent racking, twisting or other deformation.
- D. Equipment curbs shall be fully supported along their perimeter and at any cross bracing meant to be supported by the roof.
- E. Piping curbs, when indicated on the drawings, shall be installed in accordance with the manufacturer's recommendations and shall be completely sealed to prevent leaks.

**END OF SECTION**

**SECTION 230553**  
**MECHANICAL IDENTIFICATION**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    Identification of mechanical piping, ductwork and equipment.
- B.    Painting of exposed mechanical piping.
- C.    Painting of accessible, concealed mechanical piping.

1.02    SUBMITTALS

- A.    Submit manufacturer's data, application instructions, surface preparation techniques and color samples for all paint products.
- B.    Submit samples and manufacturer's installation instructions for all mechanical identification products.
- C.    Submit valve chart and schedule including valve tag number, size, function, location and valve manufacturer's name and model number.
- D.    Submit manufacturer's installation instructions.

**PART 2      PRODUCTS**

2.01    MATERIALS

- A.    Plastic Nameplates: Laminated three-layer plastic with engraved white letters on black background color.
- B.    Metal Tags: Brass with 1/2-inch-high black filled numbers and/or letters, minimum 1-1/2-inch diameter, brass link chain and hooks.
- C.    Engraved Metal Tack Markers: For use of identifying valve locations above acoustical tile ceilings 7/8" diameter head, 7/16" insert point, 7 colors available - yellow, light green, light blue, orange, black, and white. Color to be selected by submittal. Markers shall be numbered consecutively with standard 3/16" characters. Seaton Style ECM or equal.
- D.    Paint: Numbers for paint colors are referenced to Sherwin-Williams brand. Equivalent products by Glidden or Pratt and Lambert are acceptable.
- E.    Stencil Paint: Semi-gloss enamel.
- F.    Snap Around Pipe Markers: Outdoor grade acrylic plastic with UV inhibitors. Color-coded background, color of legend letter size and length of color field shall conform completely to the latest edition of ANSI A13.1. Markers shall indicate direction of flow. Legends shall be alternately reversed and repeated for viewing from any angle. Markers shall be factory formed for the installed diameter. Markers less than 6-inch diameter shall Snap-on. Markers 6-inch diameter and

larger shall be secured with stainless steel spring fasteners provided by the marker manufacturer. Markers shall be Ultra Mark pipe markers by Seton or approved equal

### PART 3 EXECUTION

#### 3.01 GENERAL

- A. Clean surfaces of all construction debris and dust to receive snap around pipe identification markers. These markers shall be installed on piping above ceilings with permanent straps where size requires.
- B. Prepare surfaces in accordance with Section 099100 for painting.
- C. Plastic nameplates shall be installed with corrosion resistant mechanical fasteners.
- D. Metal tags shall be installed with corrosion resistant brass chain.
- E. Engraved metal markers should be identified on as-built drawings.
- F. Stenciling shall produce neat, high contrast markings. Sizes of markings shall be per the following schedule:

Outside Diameter of Insulation or Pipe	Length of Color Field	Size of Markings
3/4" - 1-1/4"	8"	1/2"
1-1/2" - 2"	8"	3/4"
2-1/2" - 6"	12"	1-1/4"
8" - 10"	24"	2-1/2"
Over 10"	32"	3-1/2"
Ductwork and Equipment	--	2-1/2"

#### 3.02 PIPING

- A. Piping shall be identified at maximum 20 feet on center in areas without ceilings and 10' on center in areas with ceilings, at each side of each wall penetration, at each valve and at each connection to equipment. Piping identification shall include type of service and direction of flow.
- B. Exposed mechanical piping shall be painted with gloss enamel paint and identified per the following schedule:

<u>Type of Service</u>	<u>Markings(color)</u>	
<u>Piping Color</u>		
Compressed Air, 120 psig	A-120 (Black)	Yellow
Natural Gas	Natural Gas (Black)	Yellow
LP Gas	LP Gas (Black)	Yellow

Notes:

1. Maximum air pressure shall be listed in the markings. 120 psig has been given as an example.
  2. Natural and LP gas shall be identified as low pressure and high pressure. On high pressure, the pressure shall be listed.
  3. Piping exposed in finished rooms shall be painted to match room finish.
- C. Refrigerant lines shall be labeled using pipe markers.

3.03 VALVES

- A. Valves in main and branch piping shall be identified with metal tags.
- B. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.

3.04 DUCTWORK

- A. Ductwork shall be identified with stenciled painting. Identify as to air handling unit number, and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

3.05 EQUIPMENT

- A. Large equipment such as chillers, boilers, cooling towers, base mounted pumps, fans, etc., shall be identified with stenciled painting.
- B. Air handling units, fans, etc., shall be identified using plastic nameplates.
- C. Small equipment such as in-line pumps shall be identified with metal tags.
- D. Starters for mechanical equipment shall be labeled with the corresponding equipment designation using plastic nameplates.
- E. Control panels, gauges, instruments, and major control components not located at control panels shall be identified with plastic nameplates.

**END OF SECTION**

**SECTION 230560  
THROUGH PENETRATION FIRE STOPPING**

**PART 1        GENERAL**

**1.01    WORK INCLUDED**

- A.    Provide fire stopping for the ALL through penetrations:
  - 1.     Hydronic piping
  - 2.     Refrigerant piping
  - 3.     Conduit for wiring and controls
  - 4.     Ductwork, except where not required to meet UL listing due to fire damper.

**1.02    REFERENCES**

- A.    Underwriters Laboratories (UL)
- B.    American Society for Testing and Materials (ASTM)

**1.03    CONTRACTOR REQUIREMENTS**

- A.    This work shall be performed by a contractor trained in the installation or application of systems similar in complexity to those required for this project. The contractor shall have at least 2 years experience with through penetration fire stopping systems and shall have completed a least 5 comparable scale projects using these systems.

**1.04    SUBMITTALS**

- A.    Product data including the following:
  - 1.     Manufacturers specifications and technical data
  - 2.     Detailed specification of construction and fabrication installation instructions
- B.    Shop drawings
  - 1.     For each standard application of penetration item and surface being penetrated provide a manufacturers UL approved system cut sheet identifying the UL system number, UL classified devices or materials to be used, other materials to be used, anchorages, sleeves, annular space requirements and sizes, dimensions and locations of all items.
  - 2.     For each non-standard application, provide a manufacturer's qualified engineering judgment and drawing. The drawing shall indicate those items specified in "1.1A" above.
  - 3.     All UL approved systems shall be selected based on their "F" rating. All systems shall provide the same ratings as the rating of the floor or wall being penetrated, as shown on the plans.

C. Qualifications

1. Provide list of past projects indicating past experience.
2. Provide statement from manufacturer that installer has to be trained in the proper method of installing fire stop systems.

D. Guarantee

1. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

1.05 STORAGE

- A. Coordinate delivery with scheduled installation date, comply with manufacturers maximum storage requirements. Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing.

1.06 PROJECT CONDITIONS

- A. Contractor shall review Architectural plans prior to bid, to verify wall and floor types to be penetrated. Fire ratings of walls are indicated on the plans. Ratings of the floors are assumed to be two (2) hours unless otherwise indicated on the Architectural Plans.
- B. Contractor shall coordinate with the other trades for any penetrating items (pipe, conduit, etc.) that have to be routed differently than shown on the plans. Contractor shall provide fire stopping for all rerouted items whether different UL approved systems or additional materials are required.

**PART 2 PRODUCTS**

2.01 THROUGH PENETRATION FIRE STOPPING

- A. Acceptable manufacturers and products shall be those listed in the UL fire resistance directory for the UL system involved.
- B. All systems and devices shall be asbestos free.
- C. Systems or devices listed in the UL. Fire resistance directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance and that the system be symmetrical for wall applications.
- D. Fill, void or cavity materials shall be as classified under category XHHW in the UL fire resistance directory.
- E. Forming materials shall be as classified under category XHKU in the UL fire resistance directory.
- F. All fire-stopping products shall be from a single manufacturer.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
- C. Do not proceed until unsatisfactory conditions have been corrected.
- D. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

### **3.02 INSTALLATION**

- A. Install penetration seal materials in accordance with printed instructions of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.
- B. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install fire stopping materials capable of supporting same loading as floor.
- C. Protect materials from damage on surfaces subject to traffic.
- D. Place rock wool or other approved non-flammable material in annular space around fire dampers before installation of damper's anchoring flanges, which are installed in accordance with fire damper manufacturers' recommendations.
- E. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with fire stopping material tested for the application. See U.L. Fire Resistance Directory and Section 2.01 of this document.
- F. Where rated walls are constructed with horizontally continuous air space, double width masonry, or double stud frame construction, provide vertical, 12-inch-wide fiber dams for full thickness and height of air cavity at maximum 15-foot intervals.

### **3.03 ADJUSTING AND CLEANING**

- A. Clean up spills of liquid components.
- B. Neatly cut and trim materials as required.
- C. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

### **3.04 FIELD QUALITY CONTROL**

- A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.



## THROUGH PENETRATION FIRE STOPPING

- B. Keep areas of work accessible until inspection by applicable code authorities.
- C. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

**END OF SECTION**

**SECTION 230590**  
**TESTING, ADJUSTING AND BALANCING**

**PART 1      GENERAL**

**1.01    WORK INCLUDED**

- A.    Provide all labor, equipment, and instrumentation necessary to perform the testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems which shall include, but not be limited to:
  - 1.     Chilled water supply and return systems
  - 2.     Hot water supply and return systems
  - 3.     Condenser water supply and return systems
  - 4.     Glycol-water systems
  - 5.     Supply air systems
  - 6.     Return air systems
  - 7.     Exhaust air systems
  - 8.     Outside air
  - 9.     Mixed air
  - 10.    Adjustment of controls and equipment as required for proper operation of systems
  - 11.    Air leakage testing of ductwork
  - 12.    Heat transfer equipment
  - 13.    Adjust all systems to maintain building pressure design

**1.02    REFERENCES**

- A.    Associated Air Balance Council (AABC)
- B.    National Environmental Balancing Bureau (NEBB)
- C.    American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- D.    Sheet Metal and Air Conditioning Contractor's Association (SMACNA)

**1.03    CONTRACTOR'S QUALIFICATIONS**

- A.    The TAB Contractor shall be an independent contractor from the Mechanical Contractor.
- B.    The TAB Contractor shall be certified by either AABC or NEBB.

## 1.04 THE TAB AGENDA

- A. The TAB Contractor shall prepare a TAB agenda for review and approval by the Engineer. The TAB Agenda shall be provided during the submittal process. The TAB Contractor shall not commence work until the TAB Agenda has been approved by the Engineer.
- B. The Agenda shall include the following detailed narrative procedures, system diagrams and forms for test results.
  - 1. Specific standard procedures required and proposed for each system. Additional procedures for variable flow systems shall be developed by the TAB Contractor and included for review and approval.
  - 2. Specific test forms for recording each TAB procedure and additional test forms for any variable flow systems shall be developed by the TAB Contractor and submitted for review and approval.
  - 3. System diagrams for each air and water system. Diagrams may be single line. In addition to the information recorded for standard AABC or NEBB procedures, report the following information:
    - a. Air handling units: Prepare profile and show design and actual CFM (outside air, return air, supply air). Measure and record each mode (minimum OA and 100% OA) where economizer cycle is specified. Record pressure drops of all components (coils, heat recovery devices, filters, sound attenuators, louvers, dampers, fans) and compare with design values. Pressure profile and component pressure drops are performance indicators and are not to be used for flow measurements. Set and record purge air flow for heat recovery wheels. Record temperatures of outside air, return air, mixed air and supply air.
    - b. Duct distribution systems: Prepare pressure profiles from the air handling units to the extremities of the system. As a minimum, show pressures at each floor, main branch, and air flow-measuring device. Make pitot tube traverses of all trunk lines and major branch lines where required for analysis of distribution system. Air flow measuring devices installed in ductwork may be utilized. Record residual pressures at inlet of volume-controlled terminals at ends of system. Show actual pressures at all static pressure control points utilized for constant or variable flow systems.
    - c. Variable flow systems (air and water): Include specific test forms provisions for measuring and reporting CFM (supply, return, exhaust, outside), GPM (primary, secondary), system pressures, motor loads, other pertinent data, at full unthrottled capacity and at design (100 percent) flows. Record additional flow, pressure, and motor loads for supply and return/exhaust system capacities in 10 percent increments down to a minimum attainable by the system to

verify fan tracking and control. Modulate Systems by varying the supply temperature of the medium or other approved means.

- d. Water systems: Record system fill pressures and expansion tank (level, pressure, and temperature) conditions. Record shut-off heads for all pumps and compare with pump curves to determine if correct pump impellers have been installed. Record entering and leaving water temperatures for all coils, chillers, boilers, heat exchangers, cooling towers, etc., and the ambient temperatures for all chillers, boilers, cooling towers, etc.

- 4. Specific test forms for recording sound and vibration measurements.

#### 1.05 SUBMITTALS

- A. The TAB Contractor shall submit the following items prior to commencing work. All submittals shall be bound in a binder complete with cover sheet, index, and tabs separating specific sections of the submittal.
  - 1. The TAB agenda as detailed in paragraph 1.03-A
  - 2. Warranty information
  - 3. TAB Contractor qualifications including TAB Engineer and company experience on similar projects
  - 4. Submit project supervisor and qualifications
  - 5. Submit TAB equipment and last date of calibration
- B. After completion of all TAB procedures and before warranty period commences, submit complete test reports as provided for by the prior approved TAB agenda, for Engineer review and approval. Where test results differ from specified design conditions, indicating a contract deficiency, include explanatory comments and possible resolutions in the report. After review by the Engineer, the TAB Contractor shall make any adjustments deemed necessary by the Engineer.
- C. Final report shall be submitted for acceptance and record. Submit six (6) copies of final reports.

#### 1.06 WARRANTY

- A. For a period of one year after substantial completion, the TAB Contractor shall, at the request of the Engineer, return to the project to retest and/or rebalance any problem areas. This shall be done within ten (10) working days at no additional expense to the Owner or the Engineer. The purpose of this is to correct a problem, not to retest/rebalance revisions made by the Owner.
- B. During the first year after acceptance by the Owner, the TAB Contractor shall return to the project during the peak heating and cooling seasons to rebalance the applicable hydronic systems to maintain the required discharge air and water temperatures. The TAB report shall be amended to reflect the results.

1.07 COMMISSIONING

- A. TAB will be responsible to carry out the commissioning requirements specified in Section 23 99 50, Section 01 91 13 and other sections referenced in 01 91 13.

**PART 2 EQUIPMENT (NOT APPLICABLE)**

**PART 3 EXECUTION**

3.01 GENERAL

- A. The TAB Contractor shall review and become thoroughly familiar with the job site when the erection of the building is in the early stages. An additional visit shall be made when the rough-in is complete. Prior to any closing in of ductwork and piping, verify that all fittings, dampers, control devices, test devices and valves are properly located and installed.
- B. The TAB Contractor shall examine each air and hydronic distribution system to verify that it is free from obstructions. The TAB Contractor shall determine that all dampers, registers and valves are in a set or full open position; that strainers are clean; that moving equipment is lubricated; and that the required filters are clean and functioning. The TAB Contractor shall request that the installing contractor perform air adjustments necessary for proper functioning of the system.
- C. The TAB Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer (no more than 6 months) and have been checked for accuracy prior to the start of the testing, adjusting and balancing.
- D. The TAB Contractor shall verify that all equipment performs as designed and specified. The TAB Contractor shall adjust all variable type drives, volume dampers, control dampers, balancing valves, control valves, etc., as required by the TAB work.
- E. Coordinate TAB procedures with all construction requirements for the project so that usable increments of finished work may be accepted for beneficial occupancy. Systems serving partially occupied phases of the project may require balancing for each phase prior to final balancing.
- F. Allow sufficient time in construction schedule for TAB prior to final inspection for the project.
- G. Conduct final TAB after system has been completed and is in full working order. Put all HVAC systems into full operation and continue operation of the systems during each working day of TAB. Accomplish TAB in accordance with the Agenda approved by the Engineer.

3.02 AIR BALANCE

- A. Place all interactive systems in operation with all filters installed and automatic control systems completed and operating. Artificially load air filters by partial blanking or other means to produce air pressure drop midway between the clean and dirty condition. Set/reset room thermostats as necessary to check heating and

cooling function, and maximum/minimum flow rates for factory set air terminal units and adjust units if not correct.

- B. Balance systems to design ratings. Adjust fan speeds to provide design flows, including system diversities, at actual system pressures. Coordinate with mechanical contractor to provide additional sheaves and belts as required to achieve design CFM. Coordinate VAV balancing, including supply and return fan volume controls, with the controls Contractor and set supply fan static pressure control as low as practicable and still maintain required pressure at the remote terminal units.
- C. Make pitot tube traverses of all trunk lines and major branches when required to determine proper proportioning of air flows. Air flow measuring devices, where installed, may be utilized for this purpose.
- D. Record pressure drop readings across all major system components and significant drops within duct systems.
- E. Adjust air systems with doors leading outside closed. Balance individual rooms simulating occupied conditions. (Windows and doors closed, etc.)
- F. Log air flows for occupied and unoccupied conditions.
- G. Make flow and pressure measurements at each terminal device, and each supply, return, or exhaust diffuser. Adjust each air outlet unit within plus or minus 10 percent of design requirements, but total air for each system shall be not less than shown. Adjust grilles and diffusers to minimize drafts in all areas. Maintain the building pressure relationships between different zones.
- H. Adjust outside air and return air quantities for all systems to within plus or minus 10 percent. Total supply air quantity for any system shall be not less than shown.
- I. Adjust exhaust systems to CFM requirements.
- J. Test function of automatic dampers and operation of air terminal units. Check all controls for proper operation.

### 3.03 HEAT TRANSFER EQUIPMENT DATA

- A. For all heat transfer equipment, which for the purposes of this specification section shall include coils, chillers, boilers, heat exchangers, cooling towers, evaporative coolers, humidifiers, etc.

The following data shall be measured and included in the TAB report:

- 1. Ambient conditions, dry bulb, wet bulb, relative humidity
- 2. Entering air wet bulb and dry bulb
- 3. Entering relative humidity
- 4. Leaving air wet bulb and dry bulb
- 5. Leaving air relative humidity
- 6. Entering water temperature

7. Leaving water temperature
8. Water flow
9. Air pressure drops (inches) and water pressure drops (feet)

3.04 AIR LEAKAGE TESTING OF DUCTWORK

- A. Ductwork leakage shall be tested in accordance with SMACNA manual, "HVAC Air Duct Leakage Test Manual", latest edition.

3.05 HYDRONIC BALANCE

- A. Perform final hydronic balance after all systems have been flushed, cleaned, and filled.
- B. Hydronic balance includes performance readings on all pumps, coils, heat exchangers, and flow measuring devices. Adjust pump flows to actual system heads by adjustment of balancing valves. Flow measuring devices take precedence over pump head readings. Record discrepancies for evaluation.
- C. Report pressure drop readings across all major system components both for flow determination and deviations between actual and design values.
- D. Record on flow diagrams the flows and pressures obtained in each of the various circuits and modes of operation. Designate the manual rebalancing effort that is necessary for optimum operations. Measure flows in primary and secondary pumping systems when operating independently and jointly. Measure and record flows and power consumption of variable flow systems at maximum flow conditions and in increments of 10 percent reductions to a minimum system condition.

**END OF SECTION**

**SECTION 230710**  
**DUCTWORK INSULATION**

**PART 1      GENERAL**

**1.01    WORK INCLUDED**

- A.    Refer to Ductwork Insulation schedule on Drawing H-3.1 as it takes priority.
- B.    Work of this section shall include providing the thermal insulation for mechanical systems and shall include the following principal items:
  - 1.    Supply, Return, Outside, and Relief Air ductwork concealed.
  - 2.    Supply, Return, Outside, and Relief Air ductwork exposed.
  - 3.    Supply, Return, Outside, and Relief Air ductwork concealed outside of building insulation envelope attic/crawlspace.
  - 4.    Exhaust Air ductwork concealed.
  - 5.    Exhaust Air ductwork exposed.
  - 6.    Lined ductwork.
  - 7.    Exterior exposed ductwork.
- C.    Not all of the insulation types specified herein may be required on this project. The contractor is only to provide those insulation types required for the applications on this project.
- D.    This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years.
- E.    Ductwork shown on the drawings with application specific insulation shall be followed with that application as identified in these specifications.

**1.02    SUBMITTALS**

- A.    Submittals and product literature for each insulation type, finish type, and equipment served. Provide submittals on method of installation for each type of insulation used.

**1.03    DEFINITIONS**

- A.    The following definitions apply to this specification section only and are intended to help clarify insulation applications:
  - 1.    Concealed: above ceilings, in attics or crawlspaces and in spaces not accessed easily through a door.
  - 2.    Exposed: visible from an occupiable space that is easily accessible through a door. This would include mechanical rooms.



3. Interior: inside the exterior building skin, not exposed to weather.
4. Exterior: outside of the exterior building skin, exposed to weather.
5. Outside of building insulation: inside of the exterior building skin, protected from the weather, but in an un-insulated space that is not heated or cooled.

## **PART 2 PRODUCTS**

### **2.01 THERMAL INSULATION**

- A. All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84. Fire rated barriers wrap to be as required per NFPA.
- B. Insulation Types:
  1. FIBERGLASS BLANKET  
Made of flame - attenuated glass fibers, bonded with a thermosetting resin. Reinforced with fiberglass scrim facing laminated to UL rated kraft. FSK facing, .02 perms, .00035" foil thickness per ASTM E-96, procedure A. 2" thick, 1.00 PCF, 7.6 R value, 6.1 R value installed. Equal to CertainTeed Soft Touch Type 100.
  2. RIGID FIBERGLASS  
3 lb. density, .23 k factor. Inorganic glass fibers bonded by a thermosetting resin with an FSK jacket in compliance with NFPA 90A AND 90B standards. Equal to CertainTeed CertaPro CB300, 3 lb density, 8.7 R value, 2" thick with FSK jacket.
  3. FIBERGLASS BLANKET  
Made of flame - attenuated glass fibers, bonded with a thermosetting resin. Reinforced with fiberglass scrim facing laminated to UL rated kraft. FSK facing, .02 perms, .00035" foil thickness per ASTM E-96, procedure A. 3" thick, 3/4 lb., 9.6 R value, 8.0 R Value Installed. Equal to CertainTeed Soft Touch Type 75.
  4. SEMI RIGID FIBERGLASS BOARD  
2-1/2 lb. density, thermal conductivity compliance ASTM C 518, 850 degrees F temperature limit, 1 1/2" thick. High temperature fiberglass bonded to a flexible jacketing. Jacketing is a laminate of white kraft and aluminum foil, reinforced with fiberglass, chemically treated for fire and smoke safety. Equal to CertainTeed Crimp Wrap.
  5. DUCT LINER  
Acoustical and thermal insulation manufactured from long textile, type glass

fibers firmly bonded together with a thermosetting resin. Air stream surface is coated to protect against air erosion. Up to 250 degrees F (ASTM C 411), NFPA 90A and 90B, ASTM C 1071. Air stream surface to contain an EPA registered antimicrobial agent to aid in the prevention of fungal and bacterial growth and shall not promote or support the growth of mold, fungi or bacteria. Liner shall be CertainTeed Tough Gard R Rotary Duct Liner or approved equal.

Interior Duct Systems: Type 150, 1" thick, 0.24 K value, 4.2 R value for up to 6,000 FPM velocity.

Exterior Duct System: Type 150, 2" thick, 0.24 K value, 8.3 R value for up to 6,000 FPM velocity

6. RIGID FIBERGLASS

3 lb. density, .23 k factor. Inorganic glass fibers bonded by a thermosetting resin with a white ASJ jacket in compliance with NFPA 90A AND 90B standards. Equal to CertainTeed CertaPro CB300, 3 lb. density, 1.5" thick with a 6.5 R value.

C. Weather Barrier Mastics

1. An emulsion type material compounded of selected and processed bitumens and mineral fillers. Equal to INSULKOTE ET and INSULKOTE PRIMER E.

D. Duct Tape

1. FSK, glass fiber impregnated with foil facing, 4"wide, 25/50, ASTM E-84.
2. Same as number 1 except with a white ASJ jacket.

E. Adhesives

1. Water based adhesives for attaching low density fibrous insulation and duct liner to metal. Service temperature limits-20 degrees F to 250 degrees F, UL MJAT-2, ASTM C 916, type 11, NFPA 90A and 90B. Equal to Foster Quick Tack Adhesive 85-60. Adhesive shall not support mold or mildew growth.

**PART 3 EXECUTION**

3.01 WORKMANSHIP

- A. All materials shall be applied by Workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.

- D. All insulation of cold surfaces shall be vapor sealed. All joints, laps, breaks and faults in vapor barriers of insulation covering cold surfaces shall be thoroughly sealed.
- E. Insulation that becomes wet for any reason shall be removed, replaced and resealed at the expense of this Contractor.

### 3.02 APPLICATION

- A. Interior, Concealed Square or Round Ductwork  
 Use FIBERGLASS BLANKET as per Part 2, 2.01, B-1. For square ducts with any one dimension not greater than 24". Insulation shall be wrapped around ducts and secured with outward clinching staples at 4 inches o.c. Ducts 24 inches and greater shall have insulation additionally secured with stick clips on 18-inch centers or with 4-inch-wide bands of adhesive applied on 18-inch centers. Insulation shall be lapped a minimum of 4" and all seams and penetrations shall be sealed with FSK Duct tape as per Part 2, 2.01, D-1.
- B. Rectangular, Interior Supply, Return, Outside Relief and Exhaust Air Ductwork, Exposed.  
 Use FIBERGLASS BOARD insulation as per Part 2, 2.01, B-6, and shall be applied to ducts with mechanical fasteners such as stick cups or weld pins at 12-inch centers. Install fiberglass board in full pieces. Joints and seams shall be covered with 4" tape as per Part 2, 2.01, D-1. Where standing seams or angle supports exceed insulation thickness an additional layer of board will be used.
- C. Round, Interior Supply, Return, Outside Air, Exhaust and Relief Ductwork Exposed.  
 Round ductwork use SEMI RIGID FIBERGLASS BOARD as per Part 2, 2.01, B-4. Flexible fiberboard shall be applied to ducts with outward clinching staples. Make any fabrication cuts to accommodate the proper fitting of the insulation before stapling. Joints, seams and any penetrations shall be sealed with matching tape.
- D. Exterior, Exposed Ductwork  
 Use FIBERGLASS LINER as per Part 2, 2.1, B-5 for exterior duct.  
 Installation shall be as listed in 3.02 for internally lined duct. Construction of the duct shall be with Ductmate 35 Connection Systems. See Specification 23 31 10 Galvanized Sheet Metal Ductwork.
- E. Supply, Return, Outside Air, Relief or Exhaust Ductwork Outside of Building Insulation  
 Use FLEXIBLE FIBERGLASS INSULATION as per Part 2, 2.01, B-3. Ductwork shall be wrapped and secured with outward clinching staples at 4 inches o.c. Ducts 24" and wider shall have the insulation additionally secured with stick on clips on 18" centers. Insulation shall be lapped 4" and all seams and penetrations shall be vapor sealed with FSK tape (Part 2, 2.01, D-1).

- F. Supply, Return, Outside Air, Relief and Exhaust Ductwork Indicated on the Plans to be Lined.

Use DUCT LINER (Part 2, 2.01, B-5), and (Part 2, 2.01, E-1). Liner shall be attached to metal using adhesive covering 90% of the metal. Adhesive shall comply with ASTM C 916. All edges of liner facing the direction of airflow and not receiving metal nosing shall be coated with adhesive. Liner shall be neatly butted without gaps at transverse joints and shall be coated with adhesive at such joints.

Liner shall be folded and compressed in the corners of rectangular duct sections or shall be cut and fit to assure butted edge overlapping. Longitudinal joints in duct liner shall not occur except at the corners of ducts unless the size of the duct and standard liner product dimensions make such necessary.

Interior widths of duct not exceeding 8" do not require mechanical fasteners in addition to adhesive.

Interior widths of duct exceeding 8" will require mechanical fasteners as follows

<u>Velocity</u>	Transversely Around		<u>Longitudinally</u>
	<u>Perimeter</u>		
2500 fpm and below	at 4" from corners and at intervals not exceeding 12"		at 3" from transverse joints and at intervals not exceeding 18"
2501 fpm to 6000 fpm	at 3" from corners and at intervals not exceeding 6"		at 3" from transverse joints and at intervals not exceeding 16"

Mechanical fasteners will be applied with an approved mechanical fastening system. Hand driven pins with hammers will not be approved. Weld pins or "Grip Nails" or equal. Fasteners shall not compress the insulation more than 1/8" based on the nominal thickness of the insulation.

Longitudinal joints in liner shall be coated with adhesive at velocities over 2500 fpm.

Metal nosing that is either channel or zee profile or is integrally-formed from the duct wall shall be securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct. In addition, where velocities exceed 4000 fpm metal nosing shall be used on upstream edges of liner at every transverse joint.

Where dampers, turning vane assemblies or other devices are placed inside of lined duct or fittings, the installation must not damage the liner or cause erosion of the liner. The use of metal hat sections or other buildout means is optional; when used, buildouts shall be secured to the duct wall with bolts, screws, rivets or welds.

Any damage to the air stream surface must be repaired by coating the damaged area with adhesive or coating designed for duct liner application. Adhesive or coating shall meet requirements of ASTM C 916

### 3.03 MISCELLANEOUS

- A. Ductwork indicated on the drawings to be internally lined shall not be insulated externally.
- B. All insulating systems described herein shall conform to the latest edition of SMACNA and will comply with NFPA-90A, 90B, 30; TIMA AHC-101; ASTM C390, C167, C553, E84, C177, C423, C411, C916, D903, D93, D1151; ASHRAE; ACGIH; Tested for UL 181.
- C. The engineer will reserve the right to accept or reject any and all work not in compliance with the aforementioned. The engineer will be contacted for inspection during any of the following operations:
  - 1. During installation of any ductwork wrapping.
  - 2. During the installation of ductwork that has been lined.

**END OF SECTION**

**SECTION 230738  
INSULATION FOR REFRIGERANT PIPING**

**PART 1        GENERAL**

**1.01    WORK INCLUDED**

- A.    Work of this section shall include providing the thermal insulation for mechanical systems and shall include the following principal items:
  - 1.     Refrigerant suction line on all systems.
  - 2.     Liquid lines where required by the manufacturer.
- B.    This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years.

**1.02    SUBMITTALS**

- A.    Submittals and product literature for each insulation type, finish type and equipment served, shall be required. Provide submittals on method of installation for each type of insulation used.
- B.    Product samples and installation samples are required and shall be provided at the discretion of the engineer.

**PART 2        PRODUCTS**

**2.01    THERMAL INSULATION**

- A.    All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84.

**2.02    INSULATION TYPES**

- A.    Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing. Equal to Armaflex AP 2000.
- B.    Closed cell, elastomeric thermal insulation tape. Commonly supplied in 2" X 1/8" thick. Equal to Armaflex insulation tape.

**2.03    ADHESIVES**

- A.    An air-drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000 in specification section 2.02-A. Equal to Armstrong 520 adhesive.

**2.04    FINISHES**

- A.    A white, elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel. Equal to WB Armaflex finish.

**PART 3 EXECUTION**

**3.01 WORKMANSHIP**

- A. All materials shall be applied by Workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
- D. All insulation of cold surfaces shall be vapor sealed. All joints, laps, breaks, and faults in vapor barriers of insulation covering cold surfaces shall be thoroughly sealed.
- E. Piping systems requiring tests to be witnessed by the Engineer shall not be insulated until such systems have been tested and approved.

**3.02 APPLICATION**

- A. Insulation shall be butted together and adhered in place with joint adhesive (see Part 2, 2.03, A). All joints and seams shall be sealed with contact adhesive. Where possible insulation shall be slipped on without slitting. Insulation shall be butted firmly to equipment. Short radius elbows shall be mitered, adhesive applied and firmly held together until the adhesive hardens sufficiently to prevent separation.
- B. Paint all exposed insulation with Armaflex white paint (see Part 2, 2.04, A).
- C. Provide PVC tubular supports as detailed on the drawings for all insulated refrigerant piping at pipe supports.
- D. Refrigerant pipe circuits for Ductless Split Systems shall be insulated per 23 81 30 requirements.

**3.03 INSULATION THICKNESS**

- A. Provide 3/4" thick insulation materials for all refrigerant suction line piping.

**3.04 MISCELLANEOUS**

- A. This contractor will contact the engineer at the start of all phases of work, as follows:
  - 1. During installation of any concealed insulation.
  - 2. During installation of above ceiling insulation work.
- B. The engineer will ascertain the continuation of work subject to the requirements aforementioned.

**END OF SECTION**

**SECTION 230740**  
**INSULATION FOR CONDENSATE DRAINS**

**PART 1        GENERAL**

**1.01    WORK INCLUDED**

- A.    Work of this section shall include providing the thermal insulation for mechanical systems and shall include the following principal items:
  - 1.    Condensate Drains
- B.    This work shall be performed by a competent insulation contractor whose primary business is the installation of insulation systems and who has been in this business for a minimum of five years.

**1.02    SUBMITTALS**

- A.    Submittals and product literature for each insulation type, finish type and equipment served, shall be required. Provide submittals on method of installation for each type of insulation used.
- B.    Product samples and installation samples are required and shall be provided at the discretion of the engineer.

**PART 2        PRODUCTS**

**2.01    THERMAL INSULATION**

- A.    All insulating systems shall be tested on a composite basis in accordance with NFPA and UL 723 and shall have a maximum flame spread rating of 25 and a maximum smoke developed rating of 50 under ASTM E-84.

**2.02    INSULATION TYPES**

- A.    Closed cell, flexible elastomeric thermal insulation, black in color, supplied in unslit tubing. Equal to Armaflex AP 2000.
- B.    Closed cell, elastomeric thermal insulation tape. Commonly supplied in 2" X 1/8" thick. Equal to Armaflex insulation tape.

**2.03    ADHESIVES**

- A.    An air-drying contact adhesive specifically designed for joining seams and ends of Armaflex AP-2000 in specification section 2.02-A. Comply with Mil Spec. Mil-A-24179A and Amend-2 as type 11, class 1. Equal to Armstrong 520 adhesive.

**2.04    FINISHES**

- A.    A white, elastomeric, UL classified outdoor grade, vinyl mastic for finished outdoor insulation. Water based latex enamel. Equal to WB Armaflex finish.



**PART 3 EXECUTION**

**3.01 WORKMANSHIP**

- A. All materials shall be applied by Workmen skilled in this trade. Unsightly work shall be cause for rejection.
- B. Mechanical fasteners shall be used whenever possible to assure permanent construction.
- C. Materials shall be applied only after systems have been tested and all surfaces are clean and dry.
- D. Cellular glass block supports or other suitable non-compressible insulation material equal in thickness to the insulation and three times the pipe diameter in length shall be installed at hangers to eliminate through-metal conductance. Provide 16 GA, 180-degree, galvanized sheet metal saddles same length as block supports.
- E. All insulation of cold surfaces shall be vapor sealed. All joints, laps, breaks, and faults in vapor barriers of insulations covering cold surfaces shall be thoroughly sealed.
- F. Insulation that becomes wet for any reason shall be removed, replaced, and resealed at the expense of this Contractor.
- G. Piping systems requiring tests to be witnessed by the Engineer shall not be insulated until such systems have been tested and approved.

**3.02 APPLICATION**

- A. Condensates drain insulation
  - 1. Insulation shall be butted together and adhered in place with joint adhesive (see Part 2, 2.03, A). All joints and seams shall be sealed with contact adhesive. Where possible insulation shall be slipped on without slitting. Insulation shall be butted firmly to equipment. Short radius elbows shall be mitered, adhesive applied and firmly held together until the adhesive hardens sufficiently to prevent separation.
  - 2. Provide removable sections of insulation at all clean outs.
  - 3. Paint all exposed insulation with Armaflex white paint (see Part 2, 2.04, A).
  - 4. Provide sheet metal saddles for all insulated condensate piping at pipe supports.

**3.03 INSULATION THICKNESS**

- A. Provide 1/2" thick insulation materials for all condensate piping.

3.04 MISCELLANEOUS

- A. This contractor will contact the engineer at the start of all phases of work, as follows:
  - 1. During installation of any concealed insulation.
  - 2. During installation of above ceiling insulation work.
- B. The engineer will ascertain the continuation of work subject to the requirements aforementioned.

**END OF SECTION**

**SECTION 230805**  
**PACKAGED UNIT START UP**

**PART 1 - GENERAL**

1.01 WORK INCLUDED

- A. Provide all labor, equipment and instrumentation necessary to perform the start up of the units by factory authorized and trained personnel.

1.02 REFERENCES

- A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- B. Sheet Metal and Air Conditioning Contractor's Association (SMACNA)

1.03 SUBMITTALS

- A. Prior to commencing work submit a sample form to be used for each piece of equipment. The form shall include spaces for project name, project location, tag, model number, serial number, location of equipment, area served by equipment, date inspected and inspector's name.
- B. After completion of all start up procedures, submit six (6) final sets of completed start up reports for Engineer review and approval. The reports shall be submitted in a three ring binder, with the units arranged by "Tag".

**PART 2 - EQUIPMENT (NOT APPLICABLE)**

**PART 3 - EXECUTION**

3.01 GENERAL

- A. The Mechanical Contractor shall coordinate the scheduling of the start up of the units with the manufacturer's representative. The start up shall not be started until:
  - 1. All pieces of equipment have been set in place.
  - 2. All utility connections are complete.
  - 3. All duct connections are complete.
  - 4. All equipment has been tagged.
  - 5. All debris has been cleaned from the equipment interior.
  - 6. New filters have been installed.
  - 7. The unit has been started unless factory startup has been specified.

3.02 START UP

## ROOF TOP UNIT START UP

- A. The following items, when applicable, shall be verified by the factory authorized representative:
1. Unit is sitting on the curb properly.
  2. Visually inspect the unit for damage, installation of accessories, accessibility, etc. and note any discrepancies.
  3. Unit is level on the curb within 1/4" per foot and that the condensate connection is not on the higher side.
  4. Roofing material does not rise above the nailer on the curb.
  5. Weep holes are clear and free of caulking or other blockage.
  6. Drain pan connection has not been cracked due to over tightening of drain pipe.
  7. Drain lines are properly sloped downward away from the unit.
  8. Drain trap is sized according to specifications.
  9. Outside air damper operates correctly.
  10. Outside air damper actuator wiring does not block filter access.
  11. Inside of unit is clean and free of debris.
  12. Filters are in place and are clean.
  13. Filter spacers have been installed in the filter racks to minimize air bypassing the filters.
  14. Coil is clean and free of debris.
  15. Flue box and awning is installed on exterior of unit.
  16. No combustible material has been left in the combustion chamber.
  17. Gas pipe entrance has been sealed between the pipe and the plastic sleeve/cabinet.
  18. Incoming voltage is correct.
  19. Control transformer has been properly tapped (240V vs. 208V) for units shipped for 240V power supply as required per schedule.
  20. PSC indoor motors have correct wire tap when applied to 208V.
  21. Record amp draws.
  22. Field installed accessories have been wired to low voltage pigtail, unless required otherwise.
  23. Proper DIP switch positions for proper evaporator fan speed.
  24. Adequate clearance to adjacent structures, equipment, etc.
  25. Convenience outlet is properly installed, wired and operating.
  26. Economizer has been installed correctly and operates properly.
- B. Report any deficiencies that are the contractor's responsibility to the Mechanical Contractor to be fixed, corrected, cleaned, etc. prior to completion of the start up report.
- C. Any deficiencies that are the responsibility of the Manufacturer shall be corrected prior to completion of the start up report.
- D. Once the start up report has been satisfactorily completed, submit the required number of copies for approval and distribution.

END OF SECTION

**SECTION 232114**  
**CONDENSATE DRAIN PIPING SYSTEMS**

**PART 1 GENERAL**

1.01 WORK INCLUDED

- A. Provide condensate drain piping systems complete with all accessories as specified herein and/or as indicated on the Drawings.

1.02 RELATED WORK

- A. Underground condensate piping.

1.03 REFERENCES

American National Standards Institute (ANSI)  
American Society of Mechanical Engineers (ASME)  
American Society of Testing and Materials (ASTM)

1.04 SUBMITTALS

- A. Submit manufacturer's catalog data for all materials and equipment listed under this section.

**PART 2 PRODUCT**

2.01 PIPING

- A. Condensate drain piping shall be one of the following:
  - 1. (ABOVE SLAB) Type L hard drawn copper per ASTM B-88. Fittings are to be wrought copper or cast brass. Joints are to be soldered with lead free, tin-silver solder.
  - 2. (BELOW SLAB ON GRADE) PVC Pipe and Fittings: Schedule 40 per ASTM D-1785 / ASTM D-2466. Joints: Solvent weld per ASTM D-2855 with solvent per ASTM D-2564. DWV and Foam Core will not be allowed

2.02 OVERFLOW DRAIN PANS

- A. Condensate overflow drain pans are to be fabricated from minimum 20 gauge galvanized steel and shall have joints welded water tight. The drain pan shall be minimum of 1 ½" deep and shall be two inches larger on all sides than the piece of equipment it is under. All drain pans with any dimension greater than 24" shall be cross broken. The top edge of the pan shall be hemmed to remove all exposed sharp edges.

2.03 EQUIPMENT

- A. All vertical units with an auxiliary condensate drain connections shall have a float switch installed in the upper connection. The float switch shall be Kele model SS2AP.

- B. All horizontal units with an auxiliary drain pan shall have a float switch installed on the edge of the pan in an accessible area. The float switch shall be Kele model SS3.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Piping shall be accurately cut to measurements established at the project site, worked into place without springing or forcing, run as directly as possible, run parallel or perpendicular to building lines, located as indicated on the Drawings and supported as specified elsewhere. Parallel piping shall be grouped together as much as practical. Piping shall be supported as high as practical. Piping not located in mechanical rooms shall be concealed unless noted otherwise.
- B. Condensate drains on the roof shall be supported with Miro Industries model 2.5-CS-12, (Coordinate height required in field) polycarbonate base with threaded risers and adjustable roller support. Adjustments shall be from 3.5" to 12" to achieve slope of the drain. All metal components will be stainless steel. Condensate drains shall be supported at proper intervals and at all elbows to prevent sagging refer to Specification 230532. Provide stainless steel strut clamp attached to support.
- B. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
- C. Provide sleeves for all piping penetrations of floors and walls. Sleeves for insulated piping above grade shall be sized for the insulation diameter.
- D. Provide escutcheon plates at each exposed piping penetration of walls and ceilings. Escutcheon plates for insulated piping shall be sized for the insulation diameter.

#### **3.02 CONDENSATE DRAIN PIPING**

- A. Provide condensate drain trap with a depth at least two inches greater than the fan total static pressure as measured from the invert of unit connection to the discharge invert.
- B. Condensate drains on the roof shall be supported with Miro Industries model 3-RAH-7, polycarbonate base with threaded risers and adjustable roller support. Adjustments shall be from 3.5" to 7" to achieve slope of the drain. All metal components will be stainless steel. Condensate drains shall be supported at proper intervals and at all elbows to prevent sagging
- C. Provide a vent on the trap if the discharge height is ten feet or greater.
- D. Slope piping at a uniform slope of at least 1/4" inch per foot to ensure proper drainage.
- E. Condensate drain lines shall be adequately supported to prevent low points which could cause double trapping. Copper and PVC piping shall be supported as indicated in Specification Section 23 05 32

## CONDENSATE DRAIN PIPING SYSTEMS

- F. Condensate drain lines indicated to be terminated at floor drains with an elbow. Provide piping support from floor as required.
- G. Pre-formed condensate drain traps will not be allowed.
- H. Minimum condensates drainpipe size on the roof shall be 1 ¼".

### 3.03 DRAIN PANS

- A. Drain pans shall be installed under the following equipment conditions:
  - 1. All horizontal equipment located in rooms without floor drains or above ceilings.
  - 2. All vertical equipment without auxiliary drain connections and located in rooms without floor drains.
- B. Horizontal units shall be held up off the bottom of the drain pans with rubber in shear isolators. The isolators shall be located above rigid supports beneath the pan.
- C. Drain pans for vertical units shall be place beneath the equipment stand with the stand held up off of the bottom of the pan with rubber in shear isolators. This condition shall only apply when the unit has a side return duct connection.
- D. All drain pans shall have a liquid switch attached to or inside the pan which shall break the control circuit if activated by the presence of water.
- E. All vertical units with an auxiliary drain connection shall have a float switch installed in the upper connection.

### 3.04 VERTICAL EQUIPMENT

- A. All vertical units with an auxiliary drain connection shall have a float switch installed in the upper cooling coil condensate drain connection. The switch shall break the control circuit if activated by the presence of water
- B. All horizontal units not required to have auxiliary drain pans will have a float switch installed in the upper cooling coil condensate drain connection. The switch shall break the control circuit if activated by the presence of water.

**END OF SECTION**

**SECTION 232310**  
**REFRIGERANT PIPING SYSTEMS**

**PART 1      GENERAL**

1.01    WORK INCLUDED

- A.    Provide refrigerant piping systems complete with all accessories as specified herein and/or as indicated on the Drawings.
- B.    Pressure test all refrigerant piping systems as specified herein.

1.02    REFERENCES

American National Standards Institute (ANSI)  
American Society of Mechanical Engineers (ASME)  
American Society of Testing and Materials (ASTM)

1.03    SUBMITTALS

- A.    Submit manufacturer's catalog data for all materials and equipment listed under this section.

**PART 2      PRODUCTS**

2.01    PIPING

- A.    Refrigerant Piping shall be copper ACR tubing Type L hard drawn or Type K per ASTM B280 and shall be cleaned, dehydrated, charged with gaseous nitrogen, and sealed. Fittings shall be forged or wrought copper. Joints shall be brazed silver.

2.02    ACCESSORIES

- A.    Filter/dryers in sizes 1/2" and larger shall be the full-flow, replaceable-core type. Sizes smaller than 1/2" shall be the sealed type. Cores shall be of a suitable desiccant that will not plug, cake, dust, channel, or break down but shall remove water, acid, and foreign material from the refrigerant. The dryer shall be constructed so that no desiccant will pass into the refrigerant lines. A filter/dryer shall be provided in the liquid line to each evaporator and shall be piped with two isolation valves. Pressure drop through the dryer shall not exceed 2 psi when operating at full connected evaporator capacity.
- B.    Liquid Sight Glasses. Sight glasses shall be double glass, see-through type, with cover cap on each side. Sight glass shall be provided in liquid line immediately preceding each expansion valve. Glass shall be furnished with a color-change-type moisture indicator.



## SYSTEMS

- C. Moisture Indicators. Color-change moisture indicators shall be provided downstream from each filter/dryer and bypass or shall be combined as a single unit in the liquid sight glasses.
- D. Shutoff Valves. Shutoff valves shall be pack less diaphragm (in sizes commercially available), with packed, ground-finish stem, key operated, back seating, sealed-cap type; otherwise, angle pattern valves shall be used whenever possible.
- E. Solenoid Valves. Valves shall be brass or steel body, packless type, with corrosion-resistant steel trim, rated for continuous-duty service, direct-or pilot-operated, provided with manual lift stems, and designed for use with type of refrigerant used. The valve capacities shall be sufficient for the requirements of the installation at a pressure drop not in excess of 2 psi. Valves in suction lines shall be sized in accordance with temperature rise and superheat normal to the system.
- F. Expansion Valves. Shall be thermal-expansion type to suit specific system refrigerant, designed to fit coil distributors, and capable of operating from 40 to 100 percent of full load at system head pressure without hunting or liquid hammer. Valves shall have external equalizer connections and external superheat adjustments with seal caps. Joint connections shall be mechanical threaded or flanged type. Valves shall require not over 4 degrees F. superheat change to move from fully open to fully closed position. Superheat setting shall be 10 degrees F. at full load. Expansion valves shall be balanced double seated or pilot operated, capable of stable operation at 15 percent design load. Each valve shall be provided with external strainer.

**PART 3 EXECUTION**

## 3.01 GENERAL

- A. Piping shall be accurately cut to measurements established at the project site, worked into place without springing or forcing, run as directly as possible, run parallel or perpendicular to building lines, located as indicated on the Drawings and supported as specified elsewhere. Parallel piping shall be grouped together as much as practical. Piping shall be supported as high as practical. Piping not located in mechanical rooms shall be concealed unless noted otherwise.
- B. Piping shall be run as directly as possible, avoiding all unnecessary fittings and joints. Changes in routing of piping due to field conditions shall be at the expense of this Contractor.
- C. Provide sleeves for all piping penetrations of floors and walls. Sleeves for insulated piping above grade shall be sized for the insulation diameter.
- D. Provide escutcheon plates at each exposed piping penetration of walls and ceilings. Escutcheon plates for insulated piping shall be sized for the insulation diameter.

## SYSTEMS

## 3.02 REFRIGERANT PIPING SYSTEMS

- A. Provide a complete refrigerant tubing system as indicated herein and on the Drawings.
- B. All refrigerant piping shall be ACR Type L hard drawn tubing except for exposed piping in public areas which shall be ACR Type K tubing.
- C. All refrigerant lines shall be sized in accordance with the equipment manufacturers recommendations.
- D. All elbows in refrigerant piping systems shall be long radius elbows.
- E. Joints shall be silver brazed using a continuous flow of nitrogen inside the piping to prevent oxidation.
- F. All piping shall be rigidly supported.
- G. Provide filter driers, sight glasses, moisture indicators, shutoff valves, solenoid valves and expansion valves when not provided as standard or as an option on equipment. Components shall be specifically designed for refrigeration service.
- H. Pressure test each piping system at 150 psig using dry nitrogen. Test each joint for leaks by spraying with soapy water. Joints that leak shall be disassembled, cleaned to bare copper and silver brazed again. Pressure test shall be repeated until all joints pass.
- I. Vacuum test each piping system after pressure test is completed. Piping shall be drawn to 500 microns of HG and tested for 12 hours without additional pumping. If piping system fails vacuum test repeat pressure test.
- J. Charge each piping system after vacuum test is completed. Charge each system per manufacturer's instructions. Halide torch test each joint after charging.

**END OF SECTION**

**SECTION 233110**  
**GALVANIZED SHEET METAL DUCTWORK**

**PART 1        GENERAL**

1.01    WORK INCLUDED

- A.     Provide a galvanized sheet metal ductwork system as indicated on the drawings, complete with all accessories specified herein and as required for proper system operation and balance.

1.02    REFERENCES

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Underwriters Laboratories, Inc. (UL)

1.03    SUBMITTALS

- A.     Submit catalogue data and shop drawings for all materials and equipment listed under this section.

**PART 2        PRODUCTS**

2.01    GENERAL

- A.     All sheet metal ductwork shall be fabricated and installed in accordance SMACNA standards unless more stringent requirements are stated herein.

2.02    GALVANIZED SHEET METAL DUCTWORK

A.     Sheet Metal Ductwork

1.     Galvanized steel ductwork shall be carbon steel, of lock-forming quality, hot dip galvanized, with regular spangle-type zinc coating, conforming to ASTM A-527/A527M-G90.
2.     In addition to the above, all rectangular ductwork exposed in occupied areas shall also have a paint grip finish that will readily accept a field painted finish. This also applies to all fabricated sheet metal accessories including hangers, drives, etc.
3.     Sheet metal gauges and reinforcement shall conform to the latest edition SMACNA HVAC duct construction standards, with the exception that 26 gauge will be the lightest gauge allowed for rectangular ductwork.
4.     Round sheet metal ducts shall use the gauges recommended by SMACNA in

Tables 3-2A and 3-2B, HVAC Duct Construction Standards, 1998 edition, with the exception that 26-gauge duct shall be the lightest gauge allowed. All round sheet metal duct exceeding 14" diameter shall be spiral. See Specification Section 23 31 11 for requirements.

5. Exterior ductwork and any duct specifically called for on the drawings shall be assembled with Ductmate Industries type 35, rectangular duct connection system with roll-formed flanges, corner pieces, gasket and metal cleat. The system shall be self-sealing. Assembly and installation shall conform to the manufacturer's requirements.

#### 2.03 DUCTWORK SEALANT

- A. Sealant shall be non-flammable when wet, fire resistive when dry, and suitable for use in high velocity ductwork. Shall meet NFPA 90A and 90B and be UL classified. Sealant shall have a maximum 25 flame spread and 50 smoke developed (dry state) compound specifically for sealing ductwork.
- B. Tape for use with duct sealant shall be specifically designated by the manufacturer for ductwork sealing. See Specification Section 23 07 10 for requirements

#### 2.04 DUCTWORK ACCESSORIES

- A. General  
Provide duct accessories as indicated on the drawings and as required for proper system operation and balance.
- B. Flexible Duct Connections  
Flexible duct connections shall be UL listed fire retardant neoprene coated woven glass fiber fabric connections, shall conform to NFPA 90A and 90B and have a maximum flame spread rating of 25 and a maximum smoke development rating of 50.
  1. For static pressures up to 3", flexible connection fabric shall be 22 oz./sq. yard and 3" wide with 3" metal on either side of fabric. Equal to Duro Dyne #10105.
  2. For static pressures 3" or greater, flexible connection fabric shall be 30 oz./sq. yard and 3" wide with 3" wide metal on either side of fabric. Equal to Duro Dyne #10003.

C. Manual Balancing Dampers

1. Dampers in round ductwork (low pressure) shall be single blade type with a 20-gauge beaded frame. The blade is to be two layers of galvanized steel with the equivalent thickness of 14 gauge. A neoprene seal shall be sandwiched between the two blades. The damper axle shall be ½" diameter and extend 6" beyond the frame for the damper quadrant or motorized operator and shall be installed in stainless steel or oil impregnated bronze bearings.

The damper shall be Ruskin model CDRS25, American Warming and Ventilating model VC-25 or Air Balance Inc. Model AC-530.

2. Dampers in rectangular ductwork greater than 8" x 10" shall be the opposed blade type, complete with concealed linkage and extended shaft for the damper quadrant or motorized operator, 16 gauge frame and double skin airfoil blades with the equivalent thickness of 14 gauge. The axle is to be ½" plated hex steel with stainless steel or oil impregnated bearings. The blades shall have neoprene edge seals and compression jamb seals.

The damper shall be Ruskin model CD-60, American Warming model VC-27 with optional bronze bearings or Air Balance Inc. Model AC-516 with optional bronze bearings. Dampers listed as 8" x 10" or smaller shall be single blade.

3. All dampers shall have an operable blade area equal to the duct net area. No blank off plates will be allowed in place of non-standard blade widths.

D. Damper Quadrants

Damper Quadrants shall have indicators showing open and closed positions, and shall be Ventfabrics, "Ventlock", as follows:

1. Dampers with shaft length 12" or less - No. 627 for base ductwork and No. 637 for insulated ductwork.
2. Dampers with shaft length longer than 12" - No. 637.

E. Motorized Dampers

Motorized dampers shall be the same as the manual dampers with the addition of a motorized operator, specified as follows:

1. If Specification Section 23 09 20, DDC Building Controls, is included in this project, that section shall be used for specifying the actuator.
2. If Specification Section 23 09 20 is not included in this project, then the actuator shall be as follows:
  - a. Motorized dampers shall be controlled with Belimo model AFB24-SR, direct coupled, 24 volt, 180 in-lb torque with 75 second run time, spring return and built in auxiliary switch. Actuators shall be factory mounted to the dampers.

F. Splitter Dampers and Adjustable Volume Extractors

Rectangular duct mounted splitter dampers and adjustable volume extractors shall be fabricated from 16-gauge steel with a hemmed leading edge. The trailing edge shall be pivoted on a rod or hinges. Install in accordance with the latest edition of SMACNA's Low Velocity Manual and as detailed on the drawings. Secure rod to leading edge of damper and extend rod through side of ductwork using Ventlock #603 ball joint bracket with set screw.

G. Turning Vanes

1. All turning vanes shall be double thickness with a 2" radius, installed on runners with 2-1/8" blade spacing. Blades shall be 26 gauge.

H. Access Doors

1. Duct Access Doors shall be UL labeled, galvanized steel, double panel construction, internally insulated with minimum 1-inch thick fiberglass insulation complete with gaskets.
2. Access doors held in place with sheet metal screws are not acceptable.
3. The location of the access doors shall be coordinated for easy access to the fire damper fusible links.
4. The following access doors are specified to establish the quality of the products. Other products by prior approved manufacturers will be considered.
  - a. Rectangular, low pressure duct.  
United Air, Series ADH, 24 gauge with hinged frame connection and cam lock closures. Doors shall be 16" x 16" or large as possible.
  - b. Rectangular, high pressure duct.  
Kees Incorporated, Series ADC-HP, 24 gauge galvanized panel, 22 gauge frame with camlock closures on all sides. Provide safety chain.
  - c. Round, low pressure duct.  
United Air, Series ADC, 22 gauge, spiral compression with conical springs and hand knobs.
  - d. Round, high pressure duct.  
Ductmate Industries, Inc., sandwich access doors with conical springs and hand wheels.

2.05 45 DEGREE, SQUARE-TO-ROUND TAKEOFF FITTINGS

- A. All branch duct takeoffs to a single air distribution device, shall be made using a rectangular, 45-degree takeoff that transitions to the round duct size shown on the plans.
- B. The takeoff shall be fabricated from hot dipped galvanized steel sheets of lock forming quality per ASTM-A653. The longitudinal seam shall have a continuous weld for no air leakage at 2" W.G. static pressure.
- C. Takeoff shall have a 1" wide gasketed flange with pre-drilled screw holes.
- D. All sizes shall have a 3/8" solid or square shaft, U-bolt retainers from the dampers to the shafts and nylon bushings.
- E. All sizes shall be fabricated with a 2" damper handle insulation standoff and Duro Dyne KR-3 locking quadrant.
- F. Flexmaster Model STOD-B03 is specified to establish the product quality. For take offs shown at 45° angles, provide Flexmaster STO45D-B03. Equals by Crown or requested prior approval will be considered 10 working days prior to project bid date.

2.06 INSULATED FLEXIBLE DUCTWORK

- A. Insulated flexible duct shall be listed under UL standard 181 as class 1 air duct and shall comply with NFPA standards 90A and 90B. The duct shall be 25/50 rated for flame spread/smoke developed.
- B. The duct shall be constructed with an acoustically transparent PE film mechanically locked to a corrosion resistant galvanized steel wire helix.
- C. The duct shall be insulated with a factory applied fiberglass blanket.
  - 1. Insulation R value for duct inside the building insulation envelope shall be R-6.0.
  - 2. Insulation R value for duct outside the building insulation envelope shall be R-8.0.
- D. The vapor barrier shall be a fire retardant, reinforced, metalized outer jacket with a permeance of 0.05 perm.
- E. Flexible ductwork shall be rated for 6 inches W.G. positive pressure and 1 inches W.G. negative pressure through 16" diameter. Flexible duct on sizes greater than 16" shall not be used. The rated temperature range shall be -20 to +200 degrees F. The UL rated velocity shall be 5000 fpm.
- F. Insulated flexible duct shall be Thermaflex Type M-KE, Flexmaster Type 1M or ATCO #039.

2.07 DUCT SUPPORTS

- A. General
  - 1. Duct supports shall be placed within two feet on either side of each elbow.
  - 2. Duct supports shall be placed within four feet on every side of each branch intersection.
  - 3. If spacing of the building structure components is greater than the maximum allowed for duct supports, additional structural members (unistrut, steel angles, etc.) shall be placed to span the building components to provide support points for the ducts.

- B. Rectangular ductwork
  - 1. Rectangular ductwork shall be supported at a maximum of every five (5) feet using a pair of 1" straps fabricated from 20 gauge sheet metal or two-3/8" rods. The supports shall be attached to the duct and the building in accordance with SMACNA standards. This shall apply to all rectangular ducts up to a maximum half of duct perimeter of 120".
  - 2. For ducts with a half of duct perimeter greater than 120", the gauge of the support straps and size of the rods shall be in accordance with SMACNA standards.
- C. Round ductwork
  - 1. Round ductwork up to 36" diameter shall be supported at a maximum of every eight (8) feet using a single 1" strap fabricated from 20 gauge sheet metal or 3/8" rod. The supports shall be attached to the duct and the building in accordance with SMACNA standards.
  - 2. Round ducts greater than 36" diameter, shall be supported by straps or rods sized in accordance with SMACNA standards.
- D. Flexible ductwork
  - 1. Flexible duct shall be supported by materials in accordance with SMACNA or the Flex duct manufacturer's recommendations. Where 90 degree bends occur for duct or diffuser connections are made, the bend shall be reinforced with a Flex Right Elbow as manufactured by Titus or approved equal.

### **PART 3 EXECUTION**

#### **3.01 GALVANIZED SHEET METAL DUCTWORK**

- A. Sheet Metal Ductwork shall be fabricated and installed per the latest edition of the SMACNA HVAC duct construction standards and ASHRAE Handbook.
- B. All ductwork shall be supported in accordance with SMACNA standards. All threaded rod supports shall be double nutted.
- C. Duct transitions shall be gradual, the angle of the side of the transition piece shall not exceed 15 degrees from the straight run of duct extended.
- D. All rectangular duct elbows shall be fabricated in accordance with either of the following:
  - 1. Radius Elbow - All radius elbows shall have a centerline radius equal to 1.5 times the width of the duct. This results in an inside radius equal to the width of the duct. Under no circumstances will radius elbows with a centerline radius of 0.5 times the duct width and an inside radius of 0.0 (90 degrees angle throat and radius heel) be allowed.



- 2. Mitered Elbow (Square Throat - Square Heel) - All mitered elbows with an angle over 45 degrees shall be provided with turning valves.
- E. All duct sizes shown on plans are net free area.
- F. All duct sections and fittings shall be fabricated with the ASTM stamp side of the sheets used for the exterior surfaces.

### 3.02 DUCT SEALANT

- A. All duct systems shall be sealed to meet SMACNA Seal Class B. Seal per SMCNA recommended methods with sealant or sealant plus tape as appropriate. All transverse and longitudinal seams in all positive pressure and negative pressure ducts shall be sealed.

### 3.03 DUCTWORK ACCESSORIES

- A. Flexible duct connection shall be installed on all ductwork required to be attached to motor driven equipment.
  - 1. The ends of the flexible connection shall be overlapped and sealed, to prevent air leakage, per the manufacturer's recommendations. If manufacturer does not have recommended method of sealing, the following method shall be used. Both ends of the flexible connection shall be extended three inches and turned inward (into air stream). Silicone caulking shall be applied between the overlap and outward clinching staples shall be used to fasten the lap.
- B. Manual Balancing Dampers, Splitter Dampers, Quadrant Dampers
  - 1. All dampers shall be installed so that damper blades have a full range of movement without interference or binding. Damper quadrant shall be located to provide easy access.
- C. Turning Vanes
  - 1. Turning vanes shall be installed in all mitered (Square Toe-Square Heel) elbows with an angle greater than 45 degrees. This shall include all supply, return, exhaust, transfer, etc. ducts.
  - 2. The trailing edge of the turning vanes shall be installed tangent to the air stream.
  - 3. All individual vanes shall be installed on the vane rails, i.e., omitting every other blade will not be allowed.

### 3.04 RECTANGULAR TO ROUND TAKE-OFFS

- A. Rectangular to round take-offs shall be installed in accurately cut openings in the sheet metal duct work.
- B. Rectangular to round take-offs shall be suitably sealed for the pressure class required.

- C. The quadrant damper shall be checked for free movement and left in the full open position after the take-off and insulation is installed.

### 3.05 INSULATED FLEXIBLE DUCTWORK

- A. For run outs to air distribution devices, the length of flexible duct work shall not exceed 5 feet. For lengths of duct required over 5 feet, the remainder shall be galvanized steel round duct. Flexible ductwork shall only be used on supply ducts, return ducts and transfer duct. All other aspects of the installation of flexible ductwork shall follow SMACNA guidelines.
- B. Bends in flexible duct shall be made with not less than 1 duct diameter centerline radius. Extend flexible duct a few inches beyond end of sheet metal connection before bending.
- C. Flexible duct shall be secured to sheet metal duct with a draw band and be independent of flexible duct insulation. The insulation shall be secured with a separate draw band. A band of tape shall be applied to the end of the outer jacket and the sheet metal duct or air distribution device.

### 3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct Leakage Tests:
  - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  - 2. Medium Pressure Ductwork: All supply air ductwork from AHU or MAU discharge to VAV/Terminal boxes will be considered medium pressure ductwork.
  - 3. Test the following systems:
    - a. Medium Pressure Ducts with a Pressure Class 3-Inch wg or Higher: Test all duct sections installed for each designated pressure class indicated.
  - 4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  - 5. Test for leaks before applying external insulation.
  - 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  - 7. Give seven days advance notice for testing.

### END OF SECTION

**SECTION 23 31 15**  
**FUME HOOD DUCTWORK**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED**

- A. Provide ductwork system for the fume hood as indicated on the drawings, complete with all accessories specified herein and as required for proper system operation and balance.

**1.02 REFERENCES**

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Underwriters Laboratories, Inc. (UL)

**1.03 SUBMITTALS**

- A. Submit sheet metal shop drawings for fume hood duct work.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

- A. All sheet metal ductwork shall be fabricated and installed in accordance SMACNA standards unless more stringent requirements are stated herein.

**2.02 DUCTS SERVING FUME HOODS**

- A. All ductwork for fume hoods (for collecting and removing noxious or toxic vapors) shall be constructed of type 316L stainless steel not less than 0.044 inch in thickness (No. 18 Gage). Horizontal ducts shall be sloped down towards the fume hood.
- B. All joints' seams of fume ducts shall be made with a continuous liquid-tight weld made on the external surface of the duct system.
- C. Duct joints shall be butt joints or overlapping duct joints of either the telescoping or bell type. Overlapping joints shall be installed to prevent ledges and obstructions. The difference between the inside cross-sectional dimensions of overlapping sections of duct shall not exceed 0.25 inch. The length of overlapping duct joints shall not exceed 2 inches.

- D. The duct connections to the hood shall be made with a duct connection collar furnished by the hood manufacturer. The collar may be factory mounted or loose supplied with the hood.
  - 1. When supplied loose, the Contractor will be required to field locate the connection required at the top of the hood and fully weld the collar in place before welding the new exhaust duct system.
  - 2. When factory mounted, the Contractor will be required to field weld the exhaust duct directly to the collar.
- E. The fan connection shall be flanged and gasketed at the base of the fan on top of the factory fabricated curb.

### **PART 3 - EXECUTION**

#### **3.01 FUME HOOD DUCT**

- A. Ductwork shall take the straightest route to the roof, minimizing bends and horizontal runs. Increased distances and bends create resistance to airflow and require evaluation of fan performance. When elbows are necessary, they shall have proper centerline radius ( $1\frac{1}{2}$  times the diameter of the ducts) to minimize eddying and resistance to air flow.

#### **3.02 TESTING**

- A. Prior to the use or concealment of any portion of a fume hood duct system, a leakage test shall be performed in the presence of the code official and Engineer. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the duct work from being visually inspected on all sides.
- B. The mechanical contractor shall be responsible for scheduling, providing equipment for, and performing the leakage test.
- C. The leakage test shall be performed where a smoke test is utilized. All exhaust ducts at the fume hood shall be completely sealed. The entire duct system will then be introduced to a pungent, thick smoke produced by one or more smoke machines or introducing a white/gray non-toxic smoke emitter. When the smoke appears at the exhaust fan curb opening on the roof, the duct shall be closed and a pressure equivalent to a 1-inch water column shall be held for a test period of not less than 15 minutes.
- D. The ductwork may be tested in sections as long as every joint is tested.

### **END OF SECTION**

**SECTION 233410**  
**CEILING AND CABINET FANS**

**PART 1 GENERAL**

1.01 WORK INCLUDED

- A. Provide fans as indicated on the drawings and as specified herein with all accessories required for proper system balance.

1.02 REFERENCES

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

Underwriters Laboratories, Inc. (UL)

1.03 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials and equipment listed under the section.

**PART 2 PRODUCTS**

2.01 CEILING AND CABINET FANS

- A. Cabinet Mounted Centrifugal Fans shall be UL listed and bear the AMCA Seal for air and sound performance. Housings shall have an integral backdraft damper, be acoustically insulated, convertible to either horizontal or vertical discharge and equipped with a white intake grille. Fan wheel shall be direct driven, dynamically balanced, forward curved type. Motors shall have internal thermal overload protection, be compatible with speed controllers, mounted on vibration isolators and factory wired for easy disconnect for inspection and service.
- B. Fans shall be equipped with mounting brackets readily adapted to various mountings.
- C. The following accessories shall be provided when indicated in the fan schedule:
  - 1. Vibration Isolation
  - 2. Speed Control mounted to fan
  - 3. Deluxe aluminum architectural grille
- D. Cook units are specified to establish quality of equipment. Equals by Penn, Twin City and Greenheck will be considered.

2.02 GENERAL

## FANS

- A. Provide and install fans and accessories as scheduled on the Drawings and specified in this Section.
- B. Fan air performance ratings shall be in accordance with AMCA Standard 210.
- C. Fan sound performance ratings shall be in accordance with AMCA Standard 300. Sound levels shall not exceed specified level at specified air delivery conditions.
- D. Fan performance based on sea level conditions.
- E. Equivalent fan selections shall not decrease motor horsepower wattage), increase noise level, increase tip speed by more than 10 percent, or increase inlet air velocity by more than 10 percent, from that specified.
- F. Provide fans capable of accommodating static pressure variations of plus or minus 10 percent.
- G. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas of the building.
- H. Fan wheels and housings not of aluminum or stainless steel shall be factory primed inside and outside.

**PART 3 EXECUTION**

## 3.01 CEILING AND CABINET FANS

- A. Set and install in line fans as specified and indicated on the drawings.
- B. Equipment installation shall be such that filters, motors, bearings can be easily serviced.
- C. Provide flexible connectors (specified in 233110) at inlet and outlet of in line fans.
- D. All fans shall be checked for proper rotation and be lubricated before start up.

**END OF SECTION**

**SECTION 233411**  
**CENTRIFUGAL IN LINE CABINET FANS**

**PART 1 - GENERAL**

1.01 WORK INCLUDED

- A. Provide fans as indicated on the drawings and as specified herein with all accessories required for proper system balance.

1.02 REFERENCES

Air Diffusion Council (ADC)

Air Movement and Control Association (AMCA)

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

National Fire Protection Association (NFPA)

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

Underwriter's Laboratories, Inc. (UL)

1.03 SUBMITTALS

- A. Submit catalog data and shop drawings for all materials and equipment listed under this section.

**PART 2 PRODUCTS**

2.01 CENTRIFUGAL IN LINE CABINET FANS

- A. Inline Centrifugal Fans shall be UL listed and bear the AMCA Seal for air and sound performance. Housings shall be constructed of galvanized steel panels with structural members for rigidity. Housings shall have access panels for full access to all components, inlet and outlet duct connection flanges and a deep spun venturi inlet. Direct drive fans be provided with motor. Fan wheels shall be constructed of aluminum, be statically and dynamically balanced and backward curved, non-overloading type. Drives of belt drive fans shall have shafts mounted with heavy duty, permanently lubricated, sealed ball bearings and be equipped with variable pitch, cast iron pulleys. Drives shall be sized for a minimum of 150 percent of driven power. Motors shall have permanently lubricated, sealed ball bearings and be factory wired with flexible leads and disconnect switches to permit service without disconnecting field wiring.

## CENTRIFUGAL IN LINE CABINET FANS

- B. The following accessories shall be provided when indicated in the fan schedule:
  - 1. Hanging or base mounted vibration isolators
  - 2. Motor Cover/Belt Guard with or without insulation, as scheduled.
  - 3. Insulated housing with fiberglass duct liner
  - 4. Backdraft Dampers
  - 5. Protective Coating
- C. Cook units have been specified to establish quality of equipment. Equals by Penn, Twin City and Greenheck will be considered.

### 2.02 GENERAL

- A. Provide and install fans and accessories as scheduled on the Drawings and specified in this Section.
- B. Fan air performance ratings shall be in accordance with AMCA Standard 210.
- C. Fan sound performance ratings shall be in accordance with AMCA Standard 300. Sound levels shall not exceed specified level at specified air delivery conditions.
- D. Fan performance based on sea level conditions.
- E. Equivalent fan selections shall not decrease motor horsepower (wattage), increase noise level, increase tip speed by more than 10 percent, from that specified.
- F. Provide fans capable of accommodating static pressure variations of plus or minus 10 percent.
- G. Provide balanced variable sheaves for all motors with the size selected at midpoint in the adjustment.
- H. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas of the building.
- I. Provide belt guards on belt driven fans and safety screens where inlet or outlet is exposed.
- J. Fan wheels and housings not of aluminum or stainless steel shall be factory primed inside and outside.



## CENTRIFUGAL IN LINE CABINET FANS

### **PART 3        EXECUTION**

#### **3.01    CENTRIFUGAL IN LINE CABINET VENTILATORS**

- A.    Set and install in line fans as specified and indicated on the drawings.
- B.    Equipment installation shall be such that filters, motors, bearings and belts can be easily serviced.
- C.    Provide flexible connectors (specified in 233110) at inlet and outlet of in line fans.
- D.    All fans shall be checked for proper rotation and be lubricated before start up.

**END OF SECTION**

**SECTION 237433**  
**MAKE UP AIR UNIT**

**PART 1 GENERAL**

1.01 Section Includes:

- A. Commercial Packaged Rooftop air conditioners.

1.02 REFERENCES

- A. AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
- B. AMCA 99 – Standards Handbook
- C. AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes
- D. AMCA 300 – Test Code for Sound Rating Air Moving Devices
- E. AMCA 500 – Test Methods for Louver, Dampers, and Shutters.
- F. ARI 340/360 – Unitary Large Equipment
- G. ARI 430 – Central-Station Air-Handling Units.
- H. ARI 435 – Application of Central-Station Air-Handling Units.
- I. IBC 2000 – International Building Code
- J. NEMA MG1 – Motors and Generators
- K. National Electrical Code.
- L. NFPA 70 – National Fire Protection Agency.
- M. SMACNA – HVAC Duct Construction Standards – Metal and Flexible.
- N. UL 900 – Test Performance of Air Filter Units.

1.03 SUBMITTALS

- A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.
- B. Product Data:
  - 1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
  - 2. Manufacturer's Installation Instructions.

1.04 OPERATION AND MAINTAINENCE DATA

- A. Maintenance Data: Provide instructions for installation, maintenance and service

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

## MAKE UP AIR UNIT

- B. Startup must be done by trained personnel experienced with rooftop equipment.
- C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site.
- B. Accept products on site and inspect for damage.
- C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

## PART 2: PRODUCTS

### 2.01 MANUFACTURERS

- A. The following manufacturers will be considered provided they comply with the contract documents.
  - 1. Daikin Applied
  - 2. Trane
  - 3. Carrier

### 2.02 GENERAL DESCRIPTION

- A. Furnish as shown on plans, Daikin Applied Packaged Systems, Singlezone Heating and Cooling Unit(s) model MPS. Unit performance and electrical characteristics shall be per the job schedule.
- B. Configuration: Fabricate as detailed on prints and drawings:
  - 1. Return plenum / economizer section
  - 2. Filter section
  - 3. Cooling coil section
  - 4. Supply fan section
  - 5. Condensing unit section
- C. The complete unit shall be cULus listed. Gas furnace units shall be UL listed and classified in accordance with ANSI-Z 21.47.
- D. Unit will comply with ASHRAE 90.1-2016 Standard for efficiency and EER.
- E. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final balancing of the supply fan assemblies, a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
- F. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

## MAKE UP AIR UNIT

G. Performance: All scheduled capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

H. Warranty: Provide 12-month. Defective parts will be repaired or replaced during the warranty period at no charge. The warranty period shall commence at substantial completion.

I. The manufacturer shall provide extended 48-month, parts only, warranty on the compressor. Defective parts will be repaired or replaced during the warranty period at no charge. The warranty period shall commence at substantial completion.

### 2.03 CABINET, CASING, AND FRAME

A. Panel construction shall be 18 GA single wall construction with a baked powder coat finish. Insulation shall be a minimum of 1/2" thick fiberglass with a foil face surface. Insulation shall be glued to the panel as well as mechanically fastened. In lieu of foil face insulation with mechanical fasteners, double wall construction may be substituted. Panel design shall not have any exposed insulation edges.

B. Exterior surfaces shall be constructed of 18 GA, G90 galvanized, with a baked powder coat finish of a neutral beige color. Finished panel surfaces to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance

C. Base frame shall be 14 GA galvanized steel and be a full perimeter design. The base frame shall have integral forklift slots and rigging holes. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weather tight seal.

D. The full unit base pan shall be a one-piece stamped design. The base pan shall have a stamped 1 1/8" flange around the supply and return air openings to prevent any water to penetrate into the building. The base pan shall be insulated with foil face insulation with mechanical fasteners on the underside of the pan. The rooftop base pan shall not have insulation on the air stream side of the equipment

E. Service doors shall be provided on the filter section, supply fan section and the electrical control panel section. All service access doors shall be mounted on multiple hinges and shall be secured by a 1/4 turn latch system. Removable panels secured by multiple mechanical fasteners are not acceptable.

### 2.04 SUPPLY FAN

A. Supply fan shall be a double width double inlet (DWDI) forward curved centrifugal fan. The supply fan shall be mounted using solid-steel shafts and wheel hubs with mating keyways

B. The fan assembly shall have adjustable sheaves on the motor. Bushings shall be used on all sheaves to allow for easy removal of the pulleys from the fan and motor shaft. Fixed bore

## MAKE UP AIR UNIT

pulleys fastened to the shaft with setscrews will not be allowed. The drives shall be selected with a 1.2 service factor.

C. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. All fan assemblies shall employ solid steel fan shafts. Bearings shall be sized to provide a L-50 life of 250,000 hours.

D. Fan motors shall be heavy-duty, 1800 rpm, open drip-proof (ODP). Motors efficiencies shall meet EPart efficiencies. Motors shall be mounted on an adjustable base that provides for proper alignment and belt tension adjustment.

### 2.05 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power connection for main power connection. A terminal board shall be provided for low voltage control wiring. Each compressor and condenser fan motor shall be furnished with contactors and thermal overload protection. Supply fan motors shall have a factory installed and wired control contactor. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

### 2.06 INDOOR COIL SECTION

A. Direct expansion (DX) cooling coils shall be an all aluminum microchannel coil. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. All coils shall be factory leak tested with high pressure air under water

B. A non-corrosive, positively sloped drain pan shall be provided with the cooling coil. The drain pan shall extend beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1 The drain pan shall be connected to a threaded drain connection extending through the unit base.

### 2.07 FILTERS

A. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" filter. The unit design shall have a hinged access door for the filter section.

### 2.08 OUTDOOR / RETURN AIR SECTION

A. A return air plenum shall be provided with the option of a factory installed vertical connection 0-100% economizer. Damper blades shall be galvanized steel with metal gears. Plastic or composite blades on intake or return shall not be acceptable. Economizer shall

## MAKE UP AIR UNIT

include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints. Economizer dampers shall be equipped with low-leakage dampers not to exceed 2% leakage at 1 in. wg pressure differential. Outside air dampers shall be designed to close during loss-of-power situation with a spring return built into the motor.

### 2.09 OUTDOOR COIL SECTION

- A. Condenser coils shall be multi-row and fabricated from high efficiency rifled copper tubing mechanically bonded to high efficiency aluminum fins. Each condenser coil shall be factory leak tested with high-pressure air under water.
- B. Outdoor coil fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Condenser fan rpm shall be 1140 rpm maximum. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, non-reversing type with permanently lubricated ball bearing and thermal protection. Motor design shall be totally enclosed air over (TEAO) to protect the motors from rain and damage by water.
- C. Low ambient cooling shall be allowed to 40 degrees F.
- D. Refrigeration circuit shall be complete with a thermal expansion valve and liquid line filter drier.
- E. Refrigerant gauge ports shall be external to the cabinet for both low and high pressure for ease of service.
- F. Each unit shall have multiple, heavy-duty scroll compressors. Each compressor shall be complete with gauge ports, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.

### 2.010 ROOF CURB

- A. A prefabricated 14-gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

## PART 3:

### 3.01 EXAMINATION

- A. Contractor shall verify that roof is ready to receive work.
- B. Contractor shall verify that proper power supply adequate to supply the unit.

3.02 INSTALLATION

- A. Contractor shall install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Unit start-up and commissioning shall be completed by a OEM Manufacturer technician.
- B. Manufacturer must have factory-authorized and factory-trained technicians within a 50 mile radius of job site.
- C. The contractor shall furnish manufacturer complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

**END OF SECTION**

**SECTION 238129**  
**VARIABLE REFRIGERANT VOLUME HVAC SYSTEM**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:

1. Outdoor/Condensing unit(s):
  - a. Size Range: 6 to 38 Tons Nominal
  - b. Daikin Model Number - REYQ96XAYD\*
2. Branch Selector Boxes
  - a. BS4Q54TVJ
  - b. BS4Q54TVJ
3. Indoor Units
  - a. FXZQ
  - b. FXAQ

1.02 RELATED REQUIREMENTS

A. N/A

1.03 REFERENCES

A. N/A

1.04 SUBMITTALS

A. N/A

1.05 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:

1. The units shall be tested by a National Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 - Heating and Cooling Equipment and bear the Listed Mark.
2. All wiring shall be in accordance with the National Electric Code (NEC).
3. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
4. The condensing unit will be factory charged with R410A.

1.06 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.



## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

### 1.07 WARRANTY

#### A. STANDARD LIMITED WARRANTY

1. Complete warranty details available from your local Daikin representative or at [www.daikincomfort.com](http://www.daikincomfort.com).
2. Daikin North America LLC warrants original owner of the non-residential building, multifamily residence or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the "installation date" which is one of the two dates below:
  - a. The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.
  - b. If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

#### A. DESIGN BASIS:

1. The HVAC equipment basis of design is Daikin North America. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Appendix A HVAC Equipment Alternate General Information). In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation.

### 2.02 HVAC SYSTEM DESIGN

#### A. SYSTEM DESCRIPTION:

1. The variable capacity heat recovery air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat or cool model) system as specified.
2. The system shall consist of multiple evaporators, branch selector boxes, REFNET™ joints and headers, a three-pipe refrigeration distribution system using PID control and Daikin VRV® condenser unit.

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

3. The condenser shall be a direct expansion (DX), air-cooled heat recovery, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant.
4. The condensing unit may connect an indoor evaporator nominal capacity up to 200% of the condensing unit nominal capacity. All zones are each capable of operating separately with individual temperature control.
5. A dedicated hot gas pipe shall be required to ensure optimum heating operation performance.
  - a. Two-pipe, heat recovery systems utilizing a lower temperature mixed liquid/gas refrigerant to perform heat recovery are not acceptable due to reduced heating capabilities.
6. The Daikin condensing unit shall be able to connect to indoor unit models CXTQ, FXFQ, FXHQ, FXMQ, FXLQ, FXNQ, FXSQ, FXTQ, FXDQ, FXZQ, FXUQ, FXEQ, FXAQ and FXMQ\_MF, and shall range in capacity from 5,800 Btu/h to 96,000 Btu/h in accordance with Daikin's engineering data book detailing each available indoor unit.
  - a. The indoor units shall be connected to the condensing unit utilizing Daikin's REFNET™ specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable for a variable refrigerant system.
7. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously or all of the indoor units associated with each branch of the cool/heat selector box (BSQ\_T / BS\_Q54T). Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.
8. Branch selector boxes:
  - a. The branch selector boxes shall have the capacity to control up to 290 MBH (cooling) downstream of the branch selector box.
  - b. Each branch of the branch selector box shall consist of three electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the box and main processor and between the box and indoor units.
  - c. The branch selector box shall control the operational mode of the subordinate indoor units. The use of three EEV's ensures continuous heating during

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

defrost (multiple condenser systems), no heating impact during changeover and reduced sound levels.

- d. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.
9. The REYQ\_XA condensing unit model numbers and the associated number of connectable indoor units per REYQ\_XA condensing unit is indicated in the following table. Each indoor unit or group of indoor units shall be independently controlled.

MODEL NUMBER	NOMINAL CAPACITY (Tons)	MAXIMUM NUMBER OF INDOOR UNITS
REYQ96XAYD*	8	16

### B. VRV IV X FEATURES AND BENEFITS

1. Voltage Platform - Heat pump condensing units shall be available with a 460V/3ph/60 Hz power supply.
2. Gas Furnace Connectivity – Heat Pump condensing units shall be connectable to Daikin Communicating gas furnaces with AFUE ranging from 80% to 97%.
3. System shall be capable of connecting to multiple VRV A-coils (CXTQ) paired with Daikin Communicating gas furnaces allowing for options of gas or heat pump heating to optimize operational costs based on changing utility costs.
4. The system shall be able to switch between heat pump heating and gas furnace heating at a field selectable change-over temperature which can be configured via condensing unit field settings.
5. Each system shall be able to enlarge from single to dual module or dual to triple module without the need for installed main pipe size changes. The manufacturer shall provide predefined pipe sizes and design rules ensuring reliable system operation and offering design flexibility in phased installation applications.
6. Stable Operation – System shall provide stable inverter operation at varied ambient conditions.
7. No Drain Pan Heater – System shall be capable of heating operation without the need for a drain pan heater. If alternate manufacturer is chosen, an additional drain pan heater shall be provided by the manufacturer.
8. Auto Changeover – System shall, below the field selected outdoor ambient temperature provide signal to initiate auxiliary or back up heat.
9. Advanced Zoning - A single system shall provide for up to 64 zones.

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

10. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve with up to 2000 positions for independent control.
11. VFD Inverter Control and Variable Refrigerant Temperature - Each condensing unit shall use high efficiency, variable speed all “inverter” based flash vapor injection compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant volume for the needs of the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions.
  - a. Indoor shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency.
12. Configurator software - Each system shall be available with configurator software package to allow for remote configuration of operational settings and also for assessment of operational data and error codes.
  - a. If this software is not provided by an alternate manufacturer, for each individual outdoor unit the contractor shall do the settings manually and keep detailed records for future maintenance purposes.
13. Defrost Heating – Multiple condenser VRV systems shall maintain continuous heating during defrost operation. Reverse cycle (cooling mode) defrost operation shall not be permitted due to the potential reduction in space temperature.
14. Oil Return Heating – VRV systems shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.
15. Low Ambient Cooling - Each system shall be capable of low ambient cooling operation to -4°FDB (-20°CDB).
16. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve for independent control.
17. Flexible Design –
  - a. Systems shall be capable of up to 540ft (165m) [623 ft. (190m) equivalent] of linear piping between the condensing unit and furthest located indoor unit.
  - b. Systems shall be capable of up to 3,280ft (1,000m) total “one-way” piping in the piping network.
  - c. Systems shall have a vertical (height) separation of up to 295ft between the condensing unit and the indoor units.

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

- d. Systems shall be capable of up to 295ft (90m) from the first REFNET™ / branch point.
  - e. The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit nominal capacity.
  - f. Systems shall be capable of 98ft (30m) vertical separation between indoor units.
  - g. Condensing units shall be supported with a fan motor ESP up to 0.32" WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.
- 18. Oil return - Each system shall be furnished with a centrifugal oil separator and active oil recovery cycle.
  - 19. Simple wiring - Systems shall use 16/18 AWG, 2 wire, stranded, non-shielded and non-polarized daisy chain control wiring.
  - 20. Outside Air - Systems shall provide outside air capability.
  - 21. Space saving - Each system shall have a condensing unit module footprint no larger than 66-11/16" x 48-7/8" x 30-3/16" (1694mm x 1242mm x 767mm).
  - 22. Each condensing unit shall include a multi-functional digital display that can provide system operation status such as operating refrigerant temperatures, pressures, outdoor electronic expansion valve opening and compressor operation time.
  - 23. Each condensing unit shall include a service window that can provide easy access to system field settings and operation status without completely removing the condensing unit panel.
  - 24. Advanced diagnostics - Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.
  - 25. Each condensing unit shall incorporate contacts for electrical demand shedding with optional 3 stage demand control with 12 customizable demand settings.
  - 26. Advanced controls - Each system shall have at least one remote controller capable of controlling up to 16 indoor units.
  - 27. Each system shall be capable of integrating with open protocol BACnet, LonWorks and Modbus building management systems.
  - 28. Low sound levels - Each system shall use indoor and condensing units with quiet operation as low as 27 dB(A).
- C. PERFORMANCE:
- 1. The VRV IV REYQ\_XA system shall perform as indicated below:

# VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

MODEL NUMBER	SYSTEM SCHE (Ducted)	SYSTEM SCHE (Non-Ducted)
REYQ96XAYD*	21.10	26.40

MODEL NUMBER	SYSTEM EER (Ducted)	SYSTEM EER (Non-Ducted)
REYQ96XAYD*	12.50	14.60

MODEL NUMBER	SYSTEM COP@47°F (Ducted)	SYSTEM COP@47°F (Non-Ducted)
REYQ96XAYD*	3.56	4.23

MODEL NUMBER	SYSTEM COP@17°F (Ducted)	SYSTEM COP@17°F (Non-Ducted)
REYQ96XAYD*	2.31	2.63

1. Performance Conditions:
  - a. Cooling: Indoor temperature of 80°FDB (26.7°CDB), 67°FWB (19.5°CWB) and outdoor temperature of 95°FDB (35°CDB).
  - b. Heating: Indoor temperature of 70°FDB (21.1°CDB) and outdoor temperature of 47°FDB (8.3°CDB), 43°FWB (6.1°CDB).
  - c. Equivalent piping length: 25ft (7.5m)
2. Cooling or Cooling Dominant Operation:
  - a. The standard operating range in cooling or cooling dominant simultaneous cooling/heating will be 23°FDB (-5°CDB) ~ 122°FDB (50°CDB).
  - b. Cooling mode indoor room temperature range will be 57-77°FWB (13.8 - 25°CWB).
  - c. Each system as standard shall be capable of onsite reprogramming to allow low ambient cooling operation down to -4°FDB (-20°CDB).
3. Heating or Heating Dominant Operation:
  - a. The standard operating range in heating or heating dominant simultaneous cooling/heating will be -13° - 61°FWB (-25 - 16°CWB).
    - 1) If an alternate equipment manufacturer is selected, the mechanical contractor shall provide, at their own risk and cost, all additional material and labor to meet low ambient operating condition and performance

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

- b. Heating mode indoor room temperature range will be 59°FDB - 80°F DB (15°CDB - 26.7°CDB).

### 2.03 EQUIPMENT

#### A. ELECTRICAL:

1. The power supply to the condensing unit shall be:

POWER SUPPLY VOLTAGE	VOLTAGE RANGE
460V / 3ph / 60 Hz	416V - 508V (±10%)

MODEL	MCA	MOP	COMPRESSOR RLA
REYQ96XAYD*	21.1	25	10.5

#### B. WIRING:

- The control voltage between the indoor and condensing unit shall be 16VDC non-shielded, stranded 2 conductor cable.
- The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.
- The control wiring maximum lengths shall be as shown below:

	CONDENSER TO INDOOR UNIT	CONDENSER TO CENTRAL CONTROLLER	INDOOR UNIT TO REMOTE CONTROL
CONTROL WIRING LENGTH	6,560ft (2,000m)	3,280ft (1,000m)	1640 ft. (500m)
WIRE TYPE	16/18 AWG, 2 wire, non-polarity, non-shielded, stranded		

#### C. REFRIGERANT PIPING:

- The system shall be capable of refrigerant piping up to 540ft (165m) actual or 623ft (190m) equivalent from the condensing unit to the furthest indoor unit, a total combined liquid line length of 3,280ft (1,000m) of piping between the condensing and indoor units with 295 feet maximum vertical difference, without any oil traps or additional components.
- REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance.
  - T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.

# VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

## D. PAINT/CORROSION RESISTANCE:

1. Paint and corrosion resistance shall be at a minimum per the table below:

COMPONENT	VRV IV X		
	BASE MATERIAL	SURFACE TREATMENT	COATING THICKNESS
			External & Internal Surface
EXTERNAL PANEL BASE	Galvanized steel	POLYESTER	≥1.5 mils
EXTERNAL FRONT PANEL	Galvanized steel	POLYESTER	≥1.5 mils
PILLAR	Galvanized steel	POLYESTER	≥1.5 mils
COMPRESSOR COVER	ASTM material	Resin Paint	≥0.78 mils
FIN GUARD	Iron wire	Resin Paint	≥0.79 mils
FAN GUARD AND DRUM	Polypropylene	No treatment required	N/A
FAN	Acrylonitrile - glass	No treatment required	N/A
FAN MOTOR FRAME	Resin	No treatment required	N/A
FAN MOTOR SHAFT	Carbon steel	No treatment required	N/A
FAN MOTOR SUPPORT	Galvanized steel	POLYESTER	≥1.5 mils
HEAT EXCHANGERS (FIN ONLY)	Aluminum	Polymer Anti-corrosion surface treatment	Salt Spray 1000 hours, blister rating 10
ELECTRICAL PARTS BOX	Hot-dip zinc-coated steel	No treatment required	N/A
ELECTRICAL PARTS BOARD	Glass cloth / Glass nonwoven cloth material	Insulation Varnish	No specific thickness
SCREWS	Carbon steel wire rods	High corrosion resistance treatment	≥0.28 mils



2.04 OUTDOOR/CONDENSING UNIT

A. GENERAL:

1. The condensing unit is designed specifically for use with VRV series components.
2. The condensing unit shall be factory assembled in the USA and pre-wired with all necessary electronic and refrigerant controls.
3. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver and suction accumulator.
4. High/Low pressure gas line, liquid and suction lines must be individually insulated between the condensing and indoor units.
5. The condensing unit can be wired and piped with access from the left, right, rear or bottom.
6. The connection ratio of indoor units to condensing unit shall be permitted up to 200% of nominal capacity.
7. Each condensing system shall be able to support the connection of up to 64 indoor units dependent on the model of the condensing unit.
8. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The condensing unit shall be capable of operating automatically at further reduced noise during night time or via an external input.
9. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
10. The condensing unit shall be modular in design and should allow for side-by-side installation.
11. The following safety devices shall be included on the condensing unit; high pressure sensor and switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
12. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

13. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation. Each system shall maintain continuous heating during oil return operation.
14. The condensing unit shall be capable of heating operation at -13°F (-25°C) wet bulb ambient temperature without additional low ambient controls or an auxiliary heat source.
15. The multiple condenser VRV systems shall continue to provide heat to the indoor units in heating operation while in the defrost mode.

### B. UNIT CABINET:

1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed galvanized steel panels coated with a baked enamel finish.

### C. FAN:

1. The condensing unit shall consist of one or more propeller type, direct-drive 600W fan motors that have multiple speed operation via a DC (digitally commutating) inverter. Reference table below.

MODEL NUMBER	FAN MOTOR OUTPUT (W) & QUANTITY
REYQ96XAYD*	600 x 2

2. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.
3. The condensing unit shall have configurable settings for intermittent fan operation to help minimize snow accumulation on fan blades when the system is off.
4. The fan shall be a vertical discharge configuration with a nominal airflow maximum range of 7,283 CFM to 28,440 CFM dependent on model specified.
5. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
6. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

### D. SOUND:

1. Nominal sound pressure levels shall be as shown below.

MODEL NUMBER	SOUND PRESSURE LEVEL dB(A)
REYQ96XAYD*	61

2. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps.

OPERATION SOUND dB(A)	NIGHT MODE SOUND PRESSURE LEVEL dB(A) APPROX.
Level 1	55

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Level 2	50
Level 3	45

### E. CONDENSER COIL:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
4. The fins shall be coated with an anti-corrosion hydrophilic blue coating as standard from factory with a salt spray test rating of 1000hr per ASTM B117 test standards.
5. The outdoor coil shall have three-circuit heat exchanger design eliminating the need for a drain pan heater. The lower part of the coil shall be used for inverter cooling and be on or off during operation enhancing the defrost operation.
  - a. An alternate manufacturer must provide a drain pan heater to enable adequate defrosting of the unit in defrost operation.
6. The condensing unit shall be factory equipped with condenser coil guards on all sides.

### F. COMPRESSOR:

1. The Daikin inverter Flash Vapor injection scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit.
  - a. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value.
    - 1) Non -inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.
2. The inverter driven compressors in the condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll "K-type".

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3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type.
  - a. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
4. The capacity control range shall be as low as 3% to 100%.
5. The compressor's motor shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.
6. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
7. Oil separators shall be standard with the equipment together with an intelligent oil management system.
8. The compressor shall be mounted on vibration dampening rubber grommets to minimize the transmission of vibration, eliminating the standard need for external spring isolation.
9. In the event of compressor failure, the remaining compressors, if applicable, shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be manually activated to specifically address this condition for single module and manifold systems.
10. In the case of multiple condenser modules, combined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours. When connected to a central control system sequential start is activated for all system on each DIII network.
11. Compressor configurations:

MODEL NUMBER	COMPRESSOR MOTOR OUTPUT (W)	QUANTITY	COMPRESSOR TYPES
REYQ96XAYD*	5,400	1	Inverter controlled

### 2.05 BRANCH SELECTOR UNITS

#### A. GENERAL:

1. STANDARD MULTI-PORT T-SERIES BRANCH SELECTOR BOX

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- a. The BS4Q54TVJ, BS6Q54TVJ, BS8Q54TVJ, BS10Q54TVJ and BS12Q54TVJ, are designed specifically for use with VRV IV, VRV IV X, and RWEQ series heat recovery system components.
  - b. These branch selector boxes shall provide individual control and changeover for multiple groups of indoor units.
  - c. These selector boxes shall be factory assembled, wired, and piped.
  - d. These selector boxes must be mounted indoors.
  - e. When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.
2. The number of connectable indoor units shall be in accordance with the table below:

BRANCH SELECTOR TYPE	MODEL NUMBER	MAXIMUM CONNECTABLE COOLING CAPACITY	MAXIMUM NUMBER OF CONNECTABLE INDOOR UNITS PER BRANCH
MULTI-POR T-SERIES	BS4Q54TVJ	144,000 Btu/h	5
	BS6Q54TVJ	216,000 Btu/h	5
	BS8Q54TVJ	290,000 Btu/h	5
	BS10Q54TVJ	290,000 Btu/h	5
	BS12Q54TVJ	290,000 Btu/h	5

\* For multiple branch selector box connected in series, refer to the engineering manual for details.

### B. UNIT CABINET

1. These units shall have a galvanized steel plate casing.
2. Each cabinet shall house 3 electronic expansion valves for refrigerant control per branch.
3. The cabinet shall contain one subcooling heat exchanger per branch.
4. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.
5. Nominal sound pressure levels shall be measured and published on the submittals by the manufacturer. The sound levels must not exceed the values below.

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- a. If an alternative manufacturer is selected, the mechanical contractor shall provide, at their own cost and expense, any additional material and labor to meet the below published sound levels

BRANCH SELECTOR TYPE	MODEL NUMBER	SOUND LEVEL dB(A) OPERATION	SOUND LEVEL dB(A) MAX
MULTI-PORT STANDARD T- SERIES	BS4Q54TVJ	38	45
	BS6Q54TVJ	39	47
	BS8Q54TVJ	39	47
	BS10Q54TVJ	40	48
	BS12Q54TVJ	40	48

### DIMENSIONS:

- b. The branch selector units shall not exceed dimensions stated in the table below.

BRANCH SELECTOR TYPE	MODEL NUMBER	HEIGHT Inches (mm)	WIDTH Inches (mm)	DEPTH Inches (mm)
MULTI-PORT STANDARD T- SERIES	BS4Q54TVJ	11-3/4 (298)	14-9/16 (370)	18-15/16 (480)
	BS6Q54TVJ	11-3/4 (298)	22-13/16 (580)	18-15/16 (480)
	BS8Q54TVJ	11-3/4 (298)	22-13/16 (580)	18-15/16 (480)
	BS10Q54TVJ	11-3/4 (298)	32-5/16 (820)	18-15/16 (480)
	BS12Q54TVJ	11-3/4 (298)	32-5/16 (820)	18-15/16 (480)

### 6. REFRIGERANT VALVES:

- a. The unit shall be furnished with 3 electronic expansion valves per branch to control the direction of refrigerant flow. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.
- b. The refrigerant connections must be of the braze type.
- c. In multi-port units, each port shall have its own electronic expansion valves. If common expansion/solenoid valves are used, redundancy must be provided.
- d. Multiple indoor units may be connected to a branch selector box with the use of a REFNET™ joint provided they are within the capacity range of the branch selector.

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- e. These branch selector boxes shall support up to the maximum capacity per port shown in the table below

BRANCH SELECTOR TYPE	MODEL NUMBER	MAXIMUM CAPACITY PER PORT
MULTI-PORT T-SERIES	BS4Q54TVJ	54,000 Btu/h
	BS6Q54TVJ	54,000 Btu/h
	BS8Q54TVJ	54,000 Btu/h
	BS10Q54TVJ	54,000 Btu/h
	BS12Q54TVJ	54,000 Btu/h

### CONDENSATE REMOVAL:

- f. The unit shall be hermetically sealed to prevent condensation build up inside the unit, and not require use of a secondary condensate collection pan. A safety device or secondary drain pan shall be installed by the mechanical contractor to comply with the applicable mechanical code, if an alternate manufacturer is selected.

### 7. ELECTRICAL:

- a. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
- b. The unit shall be capable of operation within the limits of 187 volts to 255 volts.
- c. The minimum circuit amps (MCA) shall be 0.1 and the maximum overcurrent protection amps (MOP) shall be 15.
- d. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded 2 conductor cable.

### 2.06 FXZQ-TAVJU -VISTATM 2x2 CASSETTE UNIT

- A. General: Daikin indoor unit model FXZQ-TAVJU shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with a decoration panel grille. It shall be available in capacities from 5,800 Btu/h to 18,000 Btu/h. Model numbers are FXZQ05TAVJU, FXZQ07TAVJU, FXZQ09TAVJU, FXZQ12TAVJU, FXZQ15TAVJU, FXZQ18TAVJU to be connected to outdoor unit model REYQ heat recovery model. The decoration panel shall be a four-way air distribution type, with fresh white (Munsell N9.5) color, impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM

unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote controls. The indoor units sound pressure shall range from 25.5 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.

- B. Performance: Each unit's performance is based on nominal operating conditions:

<b>Model Number</b>	<b>Cooling</b>  (Indoor 80°F DB / 67°F WB,  Outdoor 95°F DB, 25 ft pipe length)	<b>Heating</b>  (Indoor 70°F DB / 60°F WB,  Outdoor 47°F DB, 25 ft pipe length)
FXZQ05TAVJU	5,800	6,500
FXZQ07TAVJU	7,500	8,500
FXZQ09TAVJU	9,500	10,500
FXZQ12TAVJU	12,000	13,500
FXZQ15TAVJU	15,000	17,000
FXZQ18TAVJU	18,000	20,000

C. Indoor Unit:

1. The Daikin indoor unit FXZQ-TAVJU shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.



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3. Both refrigerant lines shall be fully insulated from the outdoor unit or nearest branch connection into the refrigerant network.
  4. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
  5. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
  6. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 24-13/16" of lift, measured from the drain outlet, and has a built in safety shutoff and alarm.
  7. The indoor units shall be equipped with a return air thermistor.
  8. The indoor unit will be powered with 208~230V/1-phase/60Hz.
  9. The voltage range will be 253 volts maximum and 187 volts minimum.
- D. Unit Cabinet:
1. The cabinet shall be space saving and shall be located into the ceiling.
  2. Three auto-swing positions shall be available to choose from via field setting.
  3. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
  4. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
  5. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
- E. Decoration Panel:
1. VISTA Decoration panel – white (BYFQ60C3W1W).
    - i. The decoration panel shall be a four-way air distribution type and constructed of impact resistant polymer.
    - ii. The decoration panel dimensions shall measure 24-7/16" x 24-7/16" and shall fit into a standard 2x2 ceiling grid with no overlap of adjacent tiles.
    - iii. The four air discharge outlet louvers shall be independently motorized and controllable. Each louver shall have a visual indicator to easily identify the louver and simplify the airflow configuration.
    - iv. The louver outlets shall be capable of closure to allow for 3-way and 2-way air distribution.
    - v. The decoration panel shall be a low profile design, extending 5/16" below the ceiling.
    - vi. The decoration panel shall be compatible with the optional space and presence sensor kit, model BRYQ60A2W.
    - vii. The decoration panel color shall be fresh white (Munsell N9.5).

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- F. Optional Space and Presence sensor kit:
  - 1. The space and presence sensor shall be color matched to the decoration panel.
  - 2. The sensor kit shall be capable of sensing occupancy within the space and automatically controlling the indoor unit set point in response to the detection of occupancy.
  - 3. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the detection of occupants in the vicinity of the unit.
  - 4. The sensor kit shall be capable of automatically adjusting the direction of individual air discharge outlet louvers in response to the sensed floor temperature.
- G. Fan:
  - 1. The fan shall be driven by a direct-drive DC motor with statically and dynamically balanced impeller and shall have three user-selectable speeds available: high, medium, and low.
  - 2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output of 50W.
  - 3. The airflow rate shall be available in high, medium, and low settings.
  - 4. When FXZQ-TAVJU is connected with either the BRC1E73 Navigation Remote Controller or the DCM601A71 I-Touch Manager, the Auto fan mode shall be selectable.
- H. Filter:
  - 1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.
- I. Coil:
  - 1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
  - 2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
  - 3. The coil shall be a 2-row cross fin copper evaporator coil with 22 FPI design completely factory tested.
  - 4. The refrigerant connections shall be flare connections and the condensate will be 1 -1/32 inch outside diameter PVC.
  - 5. A condensate pan shall be located under the coil.
  - 6. A condensate pump with a 24-13/16" lift, measured from the drain outlet, shall be located below the coil in the condensate pan with a built in safety alarm.
  - 7. A thermistor will be located on the liquid and gas line.

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### J. Electrical:

1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

### K. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

### L. Optional Accessories Available:

1. VISTA Decoration panel - white (BYFQ60C3W1W)
2. VISTA Decoration panel - silver & white (BYFQ60C3W1S)
3. Legacy FXZQ decoration panel (BYFQ60B3W1)
4. Space and Presence sensor kit - white (BRYQ60A2W)
  - a. Sensor kit shall be color matched to pair with the VISTA decoration panel BYFQ60C3W1W. Space and presence sensor kit is not compatible with BYFQ60B3W1.
5. Space and Presence sensor kit - silver (BRYQ60A2S)
  - a. Sensor kit shall be color matched to pair with the VISTA decoration panel BYFQ60C3W1S. Space and presence sensor kit is not compatible with BYFQ60B3W1.
6. Sealing member of air discharge outlet (BDBHQ44C60)
7. Panel spacer (KDBQ44BA60A)
  - a. Panel spacer is compatible only with BYFQ60B3W1.
8. Direct fresh air intake kit (KDDQ44XA60).
9. Infrared remote controller and receiver - white (BRC082A42W)
  - a. Receiver shall be color matched
10. Infrared remote controller and receiver - silver (BRC082A42S)
11. Infrared remote controller and receiver (BRC082A41W)
12. Wired remote controller (BRC1E73)
13. Adaptor for wiring (KRP1C75)
14. Wiring adaptor for electrical appendices (KRP4A74)
15. Installation box for adaptor PCB (KRP1BA101)
16. Remote "in-room" sensor kit (KRCS01-4B).
  - i. The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The

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sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

### 2.07 FXAQ - WALL MOUNTED UNIT

- A. General: Daikin indoor unit FXAQ shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. This compact design with finished white casing shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Model numbers are FXAQ07PVJU, FXAQ09PVJU, FXAQ12PVJU, FXAQ18PVJU and FXAQ24PVJU to be connected to outdoor unit model REYQ heat recovery model. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.
- B. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB Outdoor 47F / 43F, 25 ft pipe length)
FXAQ07PVJU	7,500	8,500
FXAQ09PVJU	9,500	10,500
FXAQ12PVJU	12,000	13,500
FXAQ18PVJU	18,000	20,000
FXAQ24PVJU	24,000	26,500

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### C. Indoor Unit:

1. The Daikin indoor unit FXAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from either left or right sides.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. The indoor units shall be equipped with a condensate pan.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
8. The voltage range will be 253 volts maximum and 187 volts minimum.

### D. Unit Cabinet:

1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

### E. Fan:

1. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.054 to 0.058 HP.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

### F. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.

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4. The refrigerant connections shall be flare connections and the condensate will be 1 1/16 inch outside diameter PVC.
  5. A thermistor will be located on the liquid and gas line.
  6. A condensate pan shall be located in the unit.
- G. Electrical:
1. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
  2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
  3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.
- H. Control:
1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
  2. The unit shall be compatible with interfacing with a BMS system via optional BACnet gateways.
  3. The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.
- I. Optional Accessories Available:
1. Remote "in-room" sensor kit KRCS01-1B.
  2. A condensate pump (DACA-CP3-1)

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Ductless split systems shall be installed in accordance with the manufacturer's recommendations.
- B. Route the condensate piping as shown on the drawings.
- C. Refrigerant lines shall be sized in accordance with the manufacturer's recommendations.
- D. Both refrigerant lines shall be insulated independently. Both suction and liquid lines will not be installed together in one insulation barrier.

**END OF SECTION**

APPENDIX A

HVAC EQUIPMENT ALTERNATE (GENERAL INFORMATION)

- 1) The alternate equipment supplier shall provide to the bidding mechanical contractor a complete equipment data package.
  - a) This package shall include, but is not limited to, equipment capacities at the design condition, power requirements, indoor units CFM/static pressures, fan curves, installation requirements, and physical dimensions. Nominal performance data is not acceptable.
  - b) The mechanical contractor shall request and receive the equipment data package 10 days prior to bid date and submit this package with the alternate bid.
  - c) The mechanical contractor shall list the equipment supplier and submit the required data package with the bid detailing a complete comparison of the proposed alternate equipment to the specified equipment and the associated cost reduction of the alternate equipment. The contractor bids an alternate manufacturer with full knowledge that that manufactures product may not be acceptable or approved.
  - d) All equipment must have visible and permanent label clearly identifying the original manufacturer of the equipment. These labels shall have original manufacturer's name and contact information and be located both inside and outside the equipment and on all equipment-related literature. Submittals shall include the above statement as confirmation by supplier that all conditions are agreed to and complied to. Failure to comply with these requirements shall be sufficient cause for rejection of the submittal and product with no further consideration.
- 2) The alternate equipment supplier shall furnish a complete drawing package to the mechanical contractor 10 days prior to bid day for bidding and installation.
  - a) The drawing format shall be .dxf or equivalent, on 30"x42" sheets.
  - b) The HVAC and electrical series design documents will be made available in electronic format for use by the equipment supplier in preparing their drawings.
  - c) The alternate equipment supplier shall prepare the following drawings:
    - i) XXX HVAC Floor Plan
    - ii) XXX HVAC Refrigerant Piping Plan
    - iii) XXX HVAC Refrigerant Piping/Controls Details
    - iv) XXX HVAC Details
    - v) XXX HVAC Schedules
  - d) The alternate equipment supplier shall draft all piping circuits, components, overall building control schematic, detailed control wiring diagrams, system details and

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- schedules for their system. The drawings shall convey all requirements to successfully install the alternate equipment suppliers system.
- e) Provide (2) drawing package sets plotted on 20 lb. vellum. Provide (1) drawing package in electronic format (.dxf files) on CD.
  - f) The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.
- 3) The equipment supplier shall submit, as part of the equipment data package, condensing unit data sheets. Data sheets to include the following:
- a) COOLING capacities at project design conditions:
    - i) Cooling (Btu/h)
    - ii) Cooling Input Power:
      - (1) Ducted (kW)
      - (2) Ductless (kW)
      - (3) Mixed (kW)
    - iii) Part Load IEER:
      - (1) Ducted
      - (2) Ductless
      - (3) Mixed
    - iv) SCHE
    - v) Full Load EER:
      - (1) Ducted
      - (2) Ductless
      - (3) Mixed
  - b) HEATING capacities at project design conditions:
    - i) Heating (Btu/h)
    - ii) Heating Input Power:
      - (1) Ducted (kW)
      - (2) Ductless (kW)
      - (3) Mixed (kW)
    - iii) Full Load COP @ 47°F:
      - (1) Ducted
      - (2) Ductless
      - (3) Mixed
    - iv) Full Load COP @ 17°F:
      - (1) Ducted
      - (2) Ductless



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- (3) Mixed
- c) The submitted capacity and efficiency performance must meet or exceed the listed performance on the schedule at the designed space conditions including de-rate factors for defrost if applicable and refrigerant piping losses.
  - i) OPERATING TEMPERATURE RANGE:
    - (1) Cooling
    - (2) Heating
  - ii) POWER SUPPLY:
    - (1) Maximum Circuit Amps (MCA)
    - (2) Maximum Overcurrent Protection Amps (MOP)
    - (3) Maximum Starting Current (MSC)
    - (4) Condenser Fan Motor
  - iii) REFRIGERANT:
    - (1) Refrigerant type and charge details including field charge for piping to ensure code compliance.
    - (2) Control of refrigerant temperature based on weather and load or alternative function.
  - iv) UNIT DATA:
    - (1) Max. number of indoor units
    - (2) Sound pressure level at 3ft (dBA)
    - (3) Weight (lbs)
    - (4) Dimensions
    - (5) Demand limit function description
    - (6) Details on sequential start functionality
    - (7) Coil anticorrosion data
- 4) The equipment supplier shall guarantee the performance of their system and all published data submitted. Performance shall be based on the design criteria below.
  - a) Room Temperature (Cooling)
  - b) Room Temperature (Heating)
  - c) Ambient Temperature (Summer)
  - d) Ambient Temperature (Winter)
  - e) Defrost De-rate Factor
  - f) Refrigerant Piping Loss
- 5) The alternate equipment supplier shall submit with bid, indoor unit data sheets. Data sheets to include the following:
  - a) Capacities at project design conditions:

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- i) Cooling (Btu/h)
- ii) Cooling Input Power (kW)
- iii) Part Load IEER
- iv) SCHE
- v) Full Load EER
- vi) Heating (Btu/h)
- vii) Heating Input Power (kW)
- viii) Full Load COP@47°F
- ix) Full Load COP@17°F
- x) Air Flow (CFM)
- b) External Static Pressure (ESP)
- c) Electrical Data (MAC, MOP, MSC, RLA)
- d) Weight (lbs)
- e) Dimensions
- 6) The equipment supplier shall provide a certificate which states that the equipment has a minimum salt spray resistance of 1000 hours.
- 7) The equipment supplier shall submit the warranty certificate to the mechanical contractor.

End of Section

**SECTION 238130**  
**VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM**  
**Advanced Multi-zone Controller**

**Part 1 - General**

1.01. Physical characteristics

A. General:

The advanced multi-zone controller shall be made from plastic materials with a neutral color. Each control shall have a LCD (Liquid Crystal Display) that shows On/Off, setpoint, room temperature, mode of operation (Cool/Heat/Dry/Fan/Auto), louver position, and fan speed.

1.02. Electrical characteristics

A. General:

The advanced multi-zone controller will require 24 VAC to power the controller. The advanced multi-zone controller shall supply 16 VDC to the communication bus on the F1F2 (out-out) terminal of the outdoor unit. The voltage may rise or fall in relation to the transmission packets that are sent and received.

B. Wiring:

The advanced multi-zone controller communication wiring shall be terminated in a daisy chain design at the outdoor unit, which is then daisy chained to branch selector (Heat Recovery system), then daisy chained to each indoor unit in the system and terminating at the farthest indoor unit. The termination of the wiring shall be non-polar. The remote control wiring shall run from the indoor unit control terminal block to the remote controller connected with that indoor unit.

C. Wiring size:

Wiring shall be non-shielded, 2-conductor sheathed vinyl cord or cable, and 18 AWG stranded copper wire.

1.03. VRV Controls Network

The VRV Controls Network is made up of local remote controllers, multi-zone controllers, advanced multi-zone controllers, and open protocol network devices that transmit information via the communication bus. The VRV Controls Network shall also have the ability to be accessed via a networked PC. The VRV Controls Network supports operation monitoring, scheduling, error e-mail distribution, general user software, tenant billing, maintenance support, and integration with Building Management Systems (BMS) using open protocol via BACnet® interface, Lonworks® interface or Modbus® adapter; all of which blend to provide the optimal control strategy for the best HVAC comfort solution.

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### Part 2 - Products

#### 2.01. Advanced Multi-zone Controllers

The Daikin AC VRV advanced multi-zone controllers are compatible with all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. The advanced multi-zone controller wiring consists of a non-polar two-wire connection to the outdoor unit. The advanced multi-zone controllers may be wall-mounted and can be adjusted to maintain the optimal operation of up to 64 connected indoor unit groups and 128 indoor units. Set temperatures can be adjusted in increments of 1°F. In the cases where a system or unit error may occur, the VRV controllers will display a two-digit error code and the unit address.

##### **A. DCM601A71: intelligent Touch Manager (iTM) V2.XX.XX**

The intelligent Touch Manager (version 2.06) shall provide control for all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of controlling a maximum of 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The intelligent Touch Manager shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.

The controller wiring shall consist of a non-polar two-wire connection to the indoor unit at terminals F1F2 (out-out) of the outdoor unit. The intelligent Touch Manager is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s).

The intelligent Touch Manager can be used in conjunction with the BRC1E73 (Navigation Remote Controller), the BRC2A71 (Simplified Remote Controller), or the BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller), BACnet interface, Lonworks interface, and Modbus adapter to control the same indoor unit groups. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together. Manual addressing is required of each remote controller group associated with the intelligent Touch Manager. DIII-NET address can be set for one (1) indoor unit or each indoor unit in the remote controller group. No more than 2 remote controllers can be placed in the same group.

The intelligent Touch Manager shall be equipped with two RJ-45 Ethernet ports for 100 Mbps network communication to support interconnection with a network PC via the Internet, Local Area Network (LAN), or connection with a non-networked PC after completed installation.

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Web access functions shall be available so that facility staff can securely log into each Intelligent Touch Manager via the PC's web browser to support monitoring, scheduling, error recognition, downloading of system operation data (trend log (refer to pints list under bacnet server)) and general user functions. Error emails are also sent to designated email addresses. An additional optional software function Power Proportional Distribution (PPD) tenant billing shall also be available. The optional software shall require advanced purchase and can only be activated upon receipt of a license activation key from Daikin AC.

1. Mounting:

The intelligent Touch Manager shall be mounted on the wall or into the mounting fixtures included with the intelligent Touch Manager.
2. Display Features:
  - a. The intelligent Touch Manager shall be approximately 11.42" x 9.57" x 1.97" in size with a backlit 10.4" LCD display.
  - b. Display information shall be selectable from English, French, Italian, Korean, Dutch, Portuguese, Chinese, Japanese, German, or Spanish.
  - c. Featured backlit LCD with auto off after 30 minutes (default) is adjustable between 1 to 60 minutes, or the choice of 3 different screen savers.
  - d. Area and Group configuration
    - 1) Area contains one (1) or more Area(s) or Group(s)
    - 2) A Group may be an indoor unit, Di, Dio point that has a DIII-NET address
    - 3) A Group may be an external management point such as a Di, Do, Bi, Bo, Bv, Ai, Ao, Av, Mi, Mo, Mv that does not have a DIII-NET address
  - e. An Area is a tiered group where management points (indoor unit, digital input/output, and analog input/output groups) can be monitored and controlled by global settings. Up to 650 Areas can be created. Area hierarchy can have up to 10 tiered levels (ex. top level: 1<sup>st</sup> floor West, 2<sup>nd</sup> level: offices, hallways, 3<sup>rd</sup> level: Office 101, 102, and 103, etc.). Area configuration shall classify levels of monitoring and control for each management point
    - 1) Areas and Groups may be assigned names (ex. Office 101, Lobby, North Hallway, etc.)
  - f. The Controller shall display On/Off, Operation Mode, Setpoint, Space Temperature, Louver Position, Fan Speed for each Area or Group.
  - g. The Controller shall display Date (mm/dd/yyyy, yyyy/mm/dd, or dd/mm/yyyy format selectable) and day of the week along with the time of day (12hr or 24hr display selectable).
  - h. The Controller shall adjust for daylight savings time (DST) automatically.
  - i. Display information shall be updated every 3 seconds to show the latest status of the indoor unit groups.

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- j. System status icons shall display On/Off (color coded), Malfunction/Error (color coded), Forced Stop, Setback, Filter, Maintenance, and Screen Lock.
- k. The controller shall display the temperature setpoint in one degree increments with a range of 60°F – 90°F, 1°F basis (16°C – 32°C, 0.1°C basis).
  - 1) Display of temperature setpoint information shall be configurable for Fahrenheit or Celsius
- l. Display shall reflect room temperature in one tenth degree increments with a range of -58°F – 248°F, 0.1°F basis (-50°C – 120°C, 0.1°C basis) with 0.1°C accuracy.
  - 1) Display of room temperature information shall be configurable for Fahrenheit or Celsius
- m. The Menu List shall be used to configure options and display information for each Area or Group.
- n. Error status shall be displayed in the event of system abnormality/error with one of three color coded icons placed over the indoor unit icon or lower task bar.
  - 1) System errors are generated when the intelligent Touch Manager system with other VRV controls systems are combined incorrectly or power proportional distribution calculation errors occur. The intelligent Touch Manager shall display the error with a red triangle placed on the lower task bar.
  - 2) Unit errors occurring within the VRV system shall be displayed with a yellow triangle placed over the indoor unit icon
  - 3) Limit errors are based upon preconfigured analog input upper and lower limit settings and are generated when the limits have been met. When limit error is generated a yellow triangle will be placed over the unit icon.
  - 4) Communication errors between the intelligent Touch Manager and the indoor units shall be displayed with a blue triangle placed over the indoor unit icon
  - 5) Error history shall be available for viewing for up to 500,000 errors/abnormality events with operation events.
- o. Layout View
  - 1) Capable of displaying site floor plan or graphical user interface (GUI) as the background for visual navigation. Indoor unit, DIII-Net Di and Dio, and External Di, Do, Ai, Ao, Av, Mi, Mo, Mv icons with operational status can be placed on the floor layout or GUI
    - i) Up to 4 status points can be assigned to the indoor unit icon (room name, room temperature, setpoint, and mode)
    - ii) Digital input and output icons will display On/Off status
    - iii) Analog icons will display Ai, Ao and Av.
    - iv) Multistate icons will display Mi, Mo and Mv.
  - 2) Up to 60 floor layout sections can be created

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3. Basic Operation:
  - a. Capable of controlling by Area(s) or Group(s)
  - b. Controller shall control the following group operations:
    - 1) On/Off
    - 2) Operation Mode (Cool, Heat, Fan, Dry, and Auto)
    - 3) Independent Cool and Heat dual Setpoints or single Setpoint for current mode in the occupied period
    - 4) Controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating based upon the Area or Group configurations
    - 5) Independent Setup (Cooling) and Setback (Heating) setpoints in the unoccupied mode adjustable to 50 - 95°F
      - i) Setup and Setback setpoints can only be set outside of the occupied setpoint range
      - ii) The Setup and Setback setpoints will automatically maintain a 2°F fixed differential from the highest possible occupied setpoints
      - iii) The recovery differential shall be 4°F (default) and adjustable between 2 - 10°F
      - iv) Settings shall be applied based upon the Area or Group configurations
    - 6) Fan Speed
      - i) Up to 3 speeds (dependent upon indoor unit type)
    - 7) Airflow direction (dependent upon indoor unit type)
      - i) 5 fixed positions or oscillating
    - 8) Remote controller permit/prohibit of On/Off, Mode, and Setpoint
    - 9) Lock out setting for Intelligent Touch Manager display
    - 10) Indoor unit Group/ Area assignment
  - c. Capable of providing battery backup power for the clock at least 1 year when no AC power is applied.
    - 1) The battery can last at least 13 years when AC power is applied
    - 2) Settings stored in non-volatile memory
4. Programmability:
  - a. Controller shall support weekly schedule settings.
    - 1) 7 day weekly pattern (7)
    - 2) Weekday + Weekend (5 + 2)
    - 3) Weekday + Saturday + Sunday (5 + 1 + 1)
    - 4) Everyday (1)
    - 5) The schedule shall have the capabilities of being enabled or disabled
    - 6) 100 independent schedules configurable with up to 20 events settable for each days schedule
      - i) Each scheduled event shall specify time and target Area or Group
      - ii) Each scheduled event shall include On/Off, Optimum Start, Operation Mode, Occupied Setpoints, Setback Setpoints, Remote

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Controller On/Off Prohibit, Remote Controller Mode Prohibit, Remote Controller Setpoint Prohibit, Timer Extension Setting, Fan Speed, and Setpoint Range Limit

- Setpoint when unit is On (occupied)
  - Configurable Setup (Cooling) and Setback (Heating) setpoints when unit is Off (unoccupied)
- iii) Time setting in 1-minute increments
  - iv) Timer Extension shall be used for a timed override (settable from 30 – 180 minutes) to allow indoor unit operation during the unoccupied period
- 7) A maximum of 40 exception days can be schedule on the yearly schedule (repeats yearly)
- i) Exception days shall be used to override specified days on the weekly schedule based upon irregular occupied/unoccupied conditions
  - ii) Exception days can be configured on a set date (Jan 1) or floating date (1<sup>st</sup> Monday in September)
- b. Controller shall support auto-changeover.
- 1) Auto-change shall provide Fixed (default), Individual, Averaging, and Vote changeover methods for both Heat Pump and Heat Recovery systems based upon the changeover group configuration. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat in accordance with the room temperature and setpoint. The following changeover scheme shall be applicable to the Fixed, Individual, and Averaging methods.
- i) Changeover to cooling mode shall occur at cooling setpoint + 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
    - Configurable from 1 – 4°F (0.5 – 2°C)
  - ii) Changeover to cooling mode shall occur at the primary changeover deadband to cooling + 1°F (0.5°C) as the secondary changeover deadband.
    - Configurable from 1 – 4°F (0.5 – 2°C)
  - iii) Changeover to heating mode shall occur at heating setpoint - 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
    - Configurable from 1 – 4°F (0.5 – 2°C)
  - iv) Changeover to heating mode shall occur at the primary changeover deadband to heating - 1°F (0.5°C) as the secondary changeover deadband.
    - Configurable from 1 – 4°F (0.5 – 2°C)
  - v) A weighted demand shall be configurable for the Averaging and Vote methods.
- 2) Fixed Method



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- i) Changeover evaluated by room temperature and setpoint of the representative indoor unit (first registered indoor unit in changeover group) in the changeover group even when it is not operating (must be in Cool, Heat, or Auto mode)
- ii) Changeover affects all indoor unit groups in the changeover group.
- 3) Individual method (recommended for Heat Recovery Systems)
  - i) Changeover evaluated by room temperature and setpoints of the individual indoor unit group in the changeover group
  - ii) Changeover affects individual indoor unit group in the changeover group
- 4) Average method
  - i) Changeover evaluated by the average of all indoor unit group's room temperatures and setpoints operating in Cool, Heat, or Auto mode in the changeover group list
  - ii) If none of the indoor units in the group meet the above requirements the Fixed method of changeover will be applied
  - iii) A weighted demand (0 - 3) can be configured for each indoor unit in the changeover group.
  - iv) Changeover affects all indoor unit groups in the changeover group.
- 5) Vote Method
  - i) In each indoor unit, the cooling demand is calculated based upon the difference between the room temperature and cooling setpoint. If the room temperature falls below the primary cool changeover point (cool setpoint plus the primary changeover deadband) the cooling demand is considered as 0 (zero). Then the total cooling demand is calculated as the sum of each indoor unit's cooling demand
  - ii) The opposite is true for the total heating demand
  - iii) A weight (0-3) can be added to each indoor unit's demand in the changeover group. The default setting is 1
  - iv) The weight 0 (zero) means the indoor unit's demand is not added in the total demand, so the indoor unit's demand is considered to be 0 (zero)
  - v) The weight 2 or 3 means the indoor unit's demand is added 2 or 3 times in the total demand, respectively
  - vi) Changeover to cooling mode shall occur when the total cooling demand is greater than the total heating demand.
  - vii) The opposite is true for changeover to heating
  - viii) Vote supports a Heating Override option, which prioritizes switching to the heating mode if at least one room temperature falls below the secondary heat changeover point (heat setpoint minus the secondary changeover deadband) even if the total cooling demand is greater than the total heating demand.
  - ix) Changeover affects all indoor unit groups in the changeover group.

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- 6) Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained to the same outdoor unit in the Heat Pump system or branch selector box in the Heat Recovery system.
  - 7) Guard timer
    - i) Upon changeover, guard timer will prevent another changeover during the guard timer activation period (15, 30, 60 (default) min).
    - ii) Guard timer is ignored by a change of setpoint manually from either intelligent Touch Manager or Remote Controller, by schedule, or the room temperature meets or exceeds the secondary changeover deadband of the mode opposite of the current mode setting
  - c. Controller shall support Interlock
    - 1) Interlock feature for use with 3<sup>rd</sup> party equipment (DOAS, dampers, occupancy sensing, etc...) to automatically control Groups or Areas corresponding to the change of the operation states or the On/Off states of any Group.
    - 2) WAGO I/O unit - Di, Do, Ai, Ao
      - i) On/Off based monitoring and control of equipment
      - ii) Manual or scheduled operation of equipment
      - iii) Operation based upon interlock with management points (group(s))
      - iv) Monitor equipment error/alarm status
      - v) WAGO I/O operation data for every minute in the last 5 days are stored and can be downloaded from Web access or USB
    - 3) Digital Input/Output (DEC102A51-US2) unit or Digital Input (DEC101A51-US2) unit
      - i) On/Off based monitoring and control of equipment
      - ii) Manual or scheduled operation of equipment
      - iii) Operation based upon interlock with management points (group(s))
      - iv) Monitor equipment error/alarm status
  - d. Controller shall support force shutdown of associated indoor unit groups.
5. Web/Email Function
- a. Each intelligent Touch Manager shall be capable of monitoring, operating, and scheduling a maximum of 64 indoor unit groups (up to 512 indoor unit groups with the addition of the iTM Plus Adapter) from a networked PC's web browser. It shall also be capable of creating general user access and sending detailed error emails to a customized distribution list (up to 10 email addresses).
  - b. All PCs shall be field supplied
  - c. The following operation data stored in iTM every minute for the last 5 days can be accessed and downloaded through ITM web function:
    - 1) Indoor and outdoor unit (applied model only) operation data.

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- 2) BACnet Client management data points (AI, AO, AV, BI, BO, BV, MI, MO and MV).
  - 3) WAGO IO system data points (External DI, DIO, PI, AI and AO).
6. Operational Data History
- a. Operation data are stored in the iTM every minute for the last 5 days:
    - 1) VRV indoor and outdoor unit (if supported) operation data.
    - 2) BACnet Client management data points (AI, AO, AV, BI, BO, BV, MI, MO and MV).
    - 3) WAGO IO system data points (External DI, DIO, PI, AI and AO).
  - b. The operation data can be exported through the iTM web function or USB output with a user specified time period.
  - c. Airnet addressing required for both indoor units and outdoor units to enable the operation data on the iTM.
7. Optional Software
- Licensed per option, per intelligent Touch Manager shall be required.
- a. DCM002A71: Power Proportional Distribution (PPD)

The tenant billing option shall be capable of calculating VRV Controls Network equipment energy usage in kWh based on the energy consumption of the outdoor unit(s) divided among the associated indoor units. This software is used in conjunction with the intelligent Touch Manager and a Watt Hour Meter (WHM). A maximum of 3 Watt Hour Meters can be connected to the intelligent Touch Manager. Up to 4 additional Watt Hour Meters can be connected to each iTM Plus Adapter, and up to 7 iTM Plus Adapters can be connected to the intelligent Touch Manager.

The Power Proportional Distribution results data can be saved to a USB flash drive, or on a PC with the use of the web access. Data is saved in the CSV format. Results can be stored up to 13 months in the intelligent Touch Manager.
  - b. DCM009A51: BACnet Client Option
    - 1) The iTM BACnet Client Option shall be capable of making the intelligent Touch Manager work as a BACnet client using the BACnet/IP protocol. A BACnet client machine is able to send service requests to a BACnet server machine that then performs the services and reports the results to the client. By registering equipment and sensors connected to a BACnet server as management points, equipment and sensors can be monitored and controlled by the intelligent Touch Manager. The BACnet Client option must be enabled/ activated in each intelligent Touch Manager to be used.
    - 2) System Capacity
      - i) A maximum of 50 BACnet servers can be monitored and/or controlled by one intelligent Touch Manager.

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- ii) A maximum of 1536 objects can be monitored and/or controlled by one intelligent Touch Manager.
- iii) A maximum of 512 management points, including BACnet management points, external management points, internal Ai management points, AHU management points, and Chiller management points, can be registered in one intelligent Touch Manager.
- 3) Objects that can be used in BACnet management points are:
  - i) Analog Input (Object Type Number 0)
  - ii) Analog Output (Object Type Number 1)
  - iii) Analog Value (Object Type Number 2)
  - iv) Binary Input (Object Type Number 3)
  - v) Binary Output (Object Type Number 4)
  - vi) Binary Value (Object Type Number 5)
  - vii) Multi-State Input (Object Type Number 13)
  - viii) Multi-State Output (Object Type Number 14)
  - ix) Multi-State Value (Object Type Number 19)
- c.DCM014A51: BACnet Server Gateway Option
  - 1) The iTM BACnet Server Gateway Option shall be capable of making the intelligent Touch Manager work as a BACnet gateway using the BACnet/IP protocol. The iTM BACnet Server Gateway Option shall be capable of exposing indoor unit management points and indoor/outdoor unit operation data as BACnet objects to the BMS. The iTM BACnet Server/Gateway Option shall be capable of allowing the BMS to monitor and/or control indoor units and outdoor units via BACnet objects.
  - 2) The iTM BACnet Server Gateway Option shall support VRV, SkyAir, Outdoor Air Processing Unit, Mini-Split system with use of KRP928, and FFQ indoor unit for Multi-split system.
  - 3) The iTM BACnet Server Gateway Option shall support operation data for VRV IDUs only (requires Airnet addressing)
  - 4) The iTM BACnet Server Gateway Option shall support operation data for the following VRV IV outdoor units: RXYQ\_TATJU, RXYQ\_TAYDU, REYQ\_TATJU, REYQ\_TAYDU (requires Airnet addressing).
  - 5) Functions:
    - i. The iTM BACnet Server Gateway Option shall be capable of supporting Change of Value (COV) notification.
    - ii. The iTM BACnet Server Gateway Option shall communicate to BMS using port number 47808 (configurable).
    - iii. The iTM BACnet Server Gateway Option shall function as BACnet router to provide unique virtual BACnet device identification number (ID) for every indoor unit group address and every outdoor unit device.

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- iv. The iTM BACnet Server Gateway Option shall provide configurable BACnet Network number.
  - v. The iTM BACnet Server Gateway Option shall be capable of being configured as a foreign device. It shall be capable of communicating across BACnet Broadcast Management Devices (BBMD) in different subnet networks.
  - vi. The iTM BACnet Server Gateway Option shall be run in environments with BACnet communication traffic up to 100 packets/second.
  - vii. The iTM BACnet Server Gateway Option functions shall be configurable through CSV file which shall be downloaded from iTM and configured by trained personnel.
- 6) System Capacity
- i. A maximum of 128 device IDs (including indoor units groups outdoor units) and a maximum of 4000 BACnet objects can be monitored and/or controlled from a BMS
  - ii. Max of 8 DIII-Net ports shall be connected to iTM.
- 7) The Building Management System shall monitor and control the following BACnet objects for indoor units
- i. Indoor unit ON/OFF status.
  - ii. Alarm status with error description
  - iii. Room temperature.
  - iv. Indoor Unit ON details
    - Off
    - Normal [ON]
    - Override
    - Setback
  - v. Filter sign status.
  - vi. Fan status.
  - vii. Communication status.
  - viii. Thermo-on status.
  - ix. Compressor status
    - On
    - Off
    - Defrost
  - x. Aux heater status.
  - xi. Occupancy Mode
    - Unoccupied,
    - Occupied
    - Standby
  - xii. Operation Mode (Cool, Heat, Fan, and Dry)
  - xiii. Cooling and Heating setpoints during occupied mode.
  - xiv. Cooling and Heating setpoints during unoccupied mode.
  - xv. Maximum and minimum cooling setpoint.
  - xvi. Maximum and Minimum heating setpoint

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- xvii. Minimum cooling and heating setpoint differential.
  - xviii. Fan Speed
    - Up to 3 speeds (dependent upon indoor unit type)
  - xix. Vane direction (dependent upon indoor unit type)
    - 5 fixed positions or swing position
  - xx. Remote controller permit/prohibit
    - On/Off
    - Mode,
    - Setpoint
  - xxi. Filter sign reset for indoor units
  - xxii. Forced indoor units off.
  - xxiii. Return air temperature
  - xxiv. Discharge air temperature
  - xxv. Liquid pipe temperature
  - xxvi. Gas pipe temperature
  - xxvii. EV position
  - xxviii. Freeze protection (For FXEQ\_P, FXFQ\_T, FXTQ\_TA, FXUQ\_P, FXZQ\_TA, FXSQ\_TA, CXTQ\_TA indoor unit only).
- 8) The Building Management System shall monitor the following BACnet objects (if available) for outdoor unit devices:

Point Name	Point Description
Communication Status	Monitors and displays the communication status <i>(General)</i>
Operation Mode	Monitors and displays the operation mode (Cool, Heat, Fan or Heat &Cool) <i>(General)</i>
Outdoor Unit Alarm Status	Monitors whether or not the outdoor unit is operating normally. <i>(General)</i>
Defrost Mode	Monitors if the defrost mode is active. <i>(General)</i>
Oil Return Mode	Monitors whether or not the outdoor unit is in oil return operation. <i>(General)</i>
Electric Power	Monitors and displays the electric power (calculated). <i>(General)</i>
Electric Current	Monitors and displays the electric current (calculated). <i>(General)</i>
System Capacity Code	Monitors and displays the system capacity code. <i>(General)</i>
Outdoor Air Temperature	Monitors and displays the outdoor air temperature. <i>(General)</i>
M_Condensing Pressure	Monitors and displays the condensing pressure <i>(Master Module)</i>
M_Evaporating Pressure	Monitors and displays the evaporating pressure <i>(Master Module)</i>
M_Condensing Temperature	Monitors and displays the condensing temperature <i>(Master Module)</i>

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M_Evaporating Temperature	Monitors and displays the evaporating temperature ( <i>Master Module</i> )
M_Inverter Compressor 1 Speed	Monitors and displays the speed of the inverter compressor1 ( <i>Master Module</i> )
M_Inverter Compressor 2 Speed	Monitors and displays the speed of the inverter compressor2 ( <i>Master Module</i> )
M_Fan Step	Monitors and displays the fan step ( <i>Master Module</i> )
M_EV Position 1	Monitors and displays the position of the expansion valve1 ( <i>Master Module</i> )
M_EV position 2	Monitors and displays the position of the expansion valve2 ( <i>Master Module</i> )
M_Hot Gas Temperature (Compressor 1)	Monitors and displays the hot gas temperature of the compressor1 ( <i>Master Module</i> )
M_Hot Gas Temperature (Compressor 2)	Monitors and displays the hot gas temperature of the compressor2 ( <i>Master Module</i> )
M_Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature ( <i>Master Module</i> )
M_Liquid Pipe Temperature (HX Upper)	Monitors and displays the liquid pipe temperature for the upper HX ( <i>Master Module</i> )
M_Liquid Pipe Temperature (HX Lower)	Monitors and displays the liquid pipe temperature for the lower HX ( <i>Master Module</i> )
M_Liquid Pipe Temperature (De-Icer)	Monitors and displays the liquid pipe temperature for the de-icer ( <i>Master Module</i> )
M_Gas Pipe Temperature (HX Upper)	Monitors and displays the gas pipe temperature for the upper HX ( <i>Master Module</i> )
M_Gas Pipe Temperature (HX Lower)	Monitors and displays the gas pipe temperature for the lower HX ( <i>Master Module</i> )
M_Suction Temperature	Monitors and displays the suction temperature ( <i>Master Module</i> )
M_Compressor Suction Temperature	Monitors and displays the compressor's suction temperature ( <i>Master Module</i> )
M_Subcool Inlet Temperature	Monitors and displays the subcool inlet temperature ( <i>Master Module</i> )
M_Subcool Outlet temperature	Monitors and displays the subcool outlet temperature ( <i>Master Module</i> )
M_Subcool EV	Monitors and displays the subcool expansion

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Position	valve position ( <i>Master Module</i> )
S1_Condensing Pressure	Monitors and displays the condensing pressure ( <i>Sub Module1</i> )
S1_Evaporating Pressure	Monitors and displays the evaporating pressure ( <i>Sub Module1</i> )
S1_Condensing Temperature	Monitors and displays the condensing temperature ( <i>Sub Module1</i> )
S1_Evaporating Temperature	Monitors and displays the evaporating temperature ( <i>Sub Module1</i> )
S1_Inverter Compressor 1 Speed	Monitors and displays the speed of the inverter compressor1 ( <i>Sub Module1</i> )
S1_Inverter Compressor 2 Speed	Monitors and displays the speed of the inverter compressor2 ( <i>Sub Module1</i> )
S1_Fan Step	Monitors and displays the fan step ( <i>Sub Module1</i> )
S1_EV Position 1	Monitors and displays the position of the expansion valve1 ( <i>Sub Module1</i> )
S1_EV position 2	Monitors and displays the position of the expansion valve2 ( <i>Sub Module1</i> )
S1_Hot Gas Temperature (Compressor 1)	Monitors and displays the hot gas temperature of the compressor1 ( <i>Sub Module1</i> )
S1_Hot Gas Temperature (Compressor 2)	Monitors and displays the hot gas temperature of the compressor2 ( <i>Sub Module1</i> )
S1_Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature ( <i>Sub Module1</i> )
S1_Liquid Pipe Temperature (HX Upper)	Monitors and displays the liquid pipe temperature for the upper HX ( <i>Sub Module1</i> )
S1_Liquid Pipe Temperature (HX Lower)	Monitors and displays the liquid pipe temperature for the lower HX ( <i>Sub Module1</i> )
S1_Liquid Pipe Temperature (De-Icer)	Monitors and displays the liquid pipe temperature for the de-icer ( <i>Sub Module1</i> )
S1_Gas Pipe Temperature (HX Upper)	Monitors and displays the gas pipe temperature for the upper HX ( <i>Sub Module1</i> )
S1_Gas Pipe Temperature (HX Lower)	Monitors and displays the gas pipe temperature for the lower HX( <i>Sub Module1</i> )
S1_Suction Temperature	Monitors and displays the suction temperature ( <i>Sub Module1</i> )



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S1_Compressor Suction Temperature	Monitors and displays the compressor's suction temperature ( <i>Sub Module1</i> )
S1_Subcool Inlet Temperature	Monitors and displays the subcool inlet temperature ( <i>Sub Module1</i> )
S1_Subcool Outlet temperature	Monitors and displays the subcool outlet temperature ( <i>Sub Module1</i> )
S1_Subcool EV Position	Monitors and displays the subcool expansion valve position ( <i>Sub Module1</i> )
S2_Condensing Pressure	Monitors and displays the condensing pressure ( <i>Sub Module2</i> )
S2_Evaporating Pressure	Monitors and displays the evaporating pressure ( <i>Sub Module2</i> )
S2_Condensing Temperature	Monitors and displays the condensing temperature ( <i>Sub Module2</i> )
S2_Evaporating Temperature	Monitors and displays the evaporating temperature ( <i>Sub Module2</i> )
S2_Inverter Compressor 1 Speed	Monitors and displays the speed of the inverter compressor1 ( <i>Sub Module2</i> )
S2_Inverter Compressor 2 Speed	Monitors and displays the speed of the inverter compressor2 ( <i>Sub Module2</i> )
S2_Fan Step	Monitors and displays the fan step ( <i>Sub Module2</i> )
S2_EV Position 1	Monitors and displays the position of the expansion valve1 ( <i>Sub Module2</i> )
S2_EV position 2	Monitors and displays the position of the expansion valve2 ( <i>Sub Module2</i> )
S2_Hot Gas Temperature (Compressor 1)	Monitors and displays the hot gas temperature of the compressor1 ( <i>Sub Module2</i> )
S2_Hot Gas Temperature (Compressor 2)	Monitors and displays the hot gas temperature of the compressor2 ( <i>Sub Module2</i> )
S2_Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature ( <i>Sub Module2</i> )
S2_Liquid Pipe Temperature (HX Upper)	Monitors and displays the liquid pipe temperature for the upper HX ( <i>Sub Module2</i> )
S2_Liquid Pipe Temperature (HX Lower)	Monitors and displays the liquid pipe temperature for the lower HX ( <i>Sub Module2</i> )
S2_Liquid Pipe Temperature (De-Icer)	Monitors and displays the liquid pipe temperature for the de-icer ( <i>Sub Module2</i> )
S2_Gas Pipe	Monitors and displays the gas pipe temperature

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ADVANCE MULTI-ZONE CONTROLLER**

Temperature (HX Upper)	for the upper HX ( <i>Sub Module2</i> )
S2_Gas Pipe Temperature (HX Lower)	Monitors and displays the gas pipe temperature for the lower HX( <i>Sub Module2</i> )
S2_Suction Temperature	Monitors and displays the suction temperature ( <i>Sub Module2</i> )
S2_Compressor Suction Temperature	Monitors and displays the compressor's suction temperature ( <i>Sub Module2</i> )
S2_Subcool Inlet Temperature	Monitors and displays the subcool inlet temperature ( <i>Sub Module2</i> )
S2_Subcool Outlet temperature	Monitors and displays the subcool outlet temperature ( <i>Sub Module2</i> )
S2_Subcool EV Position	Monitors and displays the subcool expansion valve position ( <i>Sub Module2</i> )

9) The Building Management System may choose to monitor and control the following BACnet objects linked to iTM control logic:

- i. Enable/Disable iTM Schedule operation.
- ii. Enable/Disable iTM Auto Changeover Operation.
- iii. Set Timed Override Minutes.
  - Monitor and configure timer extension on iTM (30, 60, 90, 120, 150, 180 minutes)
- iv. System forced off
  - Enable/Disable all emergency stop programs that are registered on the iTM.

10) Schedule

The BMS shall utilize iTM schedule function or support weekly schedule settings through its programming.

- i. BMS schedule shall support the indoor unit:
  - Each scheduled event shall specify time and target group address.
  - Each scheduled event shall include Occupancy Mode, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, and Unoccupied cooling setpoint, Unoccupied heating setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit, and Timed Override Enable.
  - An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BMS programming.

11) Auto Changeover

The BMS shall utilize iTM Auto changeover function or support auto-changeover through its programming.

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- i. Auto-change shall provide changeover for both Heat Pump and Heat Recovery systems based upon the group configurations. This will allow the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat in accordance with the room temperature and setpoint temperature.
  - ii. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or the same branch selector box in the Heat Recovery system.
  - iii. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint
    - Differential to be determined by BACnet building management system programming
  - iv. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint.
    - Differential to be determined by BACnet building management system programming
  - v. Guard timer
    - Upon changeover, guard timer will prevent another changeover during this period.
    - Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule.

Guard timer to be configured by BMS programming (30 minute minimum recommended)
- 12) Setpoint limitation
- The BMS shall utilize maximum and minimum cooling and heating setpoint to configure upper and lower setpoints range.
- 13) System shutdown:
- BMS should utilize System forced off point to execute emergency stop program registered on the iTM.
- 14) Restricted functions:
- The following iTM functions shall be prohibited when the BACnet Server Gateway option enabled:
- i. Interlocking Control.
  - ii. Emergency Stop (Emergency stop manual release).
  - iii. Power Proportional Distribution (PPD) option.
  - iv. BACnet Client option.
  - v. D-Net Service.
  - vi. External Management Point Registration

## VARIABLE REFRIGERANT VOLUME HVAC SYSTEM ADVANCE MULTI-ZONE CONTROLLER

### **B. DCM601A72: iTM Plus Adapter**

The iTM Plus Adapter shall provide control for all VRV, SkyAir indoor units, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of handling a maximum of 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The iTM Plus Adapter is to be used in conjunction with intelligent Touch Manager. Up to 7 iTM Plus Adapters can be connected to a single intelligent Touch Manager. This combination will provide intelligent Touch Manager monitoring and control of up to 512 indoor unit groups, 1024 indoor units, and 80 outdoor units. The iTM Plus Adapter shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.

The controller wiring shall consist of a non-polar two-wire connection to the outdoor unit at terminals F1F2 (out-out). The iTM Plus Adapter is wall mounted and is used in conjunction with the intelligent Touch Manager to maintain the optimal operation of the connected indoor unit(s). The iTM Plus Adapter is connected to the intelligent Touch Manager via a polarity sensitive 18-2 AWG stranded non-shielded wire (field supplied).

The iTM Plus Adapter can be used in conjunction with the BRC1E73 (Navigation Remote Controller), the BRC2A71 (Simplified Remote Controller), or the BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller), BACnet interface, Lonworks interface and Modbus Adapter to control the same indoor unit groups. No more than 2 remote controllers can be placed in the same group. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together. Manual addressing is required of each indoor unit group associated with the iTM Plus Adapter.

1. Mounting:

The iTM Plus Adapter can be mounted on the wall or in a standard enclosure (field supplied).
2. Features:
  - a. The iTM Plus Adapter shall be approximately 6.30" x 5.87" x 2.41" in size.
3. Basic Operation:
  - a. Control of all associated indoor unit groups shall be done via the connected intelligent Touch Manager.
4. Programmability:
  - a. Programming of all associated indoor unit groups shall be done via the connected intelligent Touch Manager.

**END OF SECTION**

**SECTION 238131**  
**VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM**  
**REMOTE CONTROLLERS**

**Part 1 - General**

1.1. Physical characteristics

A. General:

The local remote control shall be made from plastic materials with a neutral color. Each controller shall have a LCD (Liquid Crystal Display) that shows set point, room temperature, mode of operation (on/off/cool/heat), and fan speed.

1.2. Electrical characteristics

A. General:

Each indoor unit control circuit board shall supply 16 volts DC to the local remote controller. The voltage may rise or fall in relation to the transmission packets that are sent and received.

B. Wiring:

The control wiring shall be terminated in a daisy chain design from outdoor unit, to branch selector, then daisy chaining to each indoor unit in the system and terminating at the farthest indoor unit. The remote control wiring shall run from the indoor unit control board terminal block to the remote controller connected to that indoor unit.

C. Wiring size:

Wiring shall be non-shielded, 2-conductor sheathed vinyl cord or cable, and 18 AWG stranded copper wire.

1.3. VRV Controls Network

- A. The VRV Controls Network is comprised of local remote controllers, multi-zone controllers, advanced multi-zone controllers, and open protocol software devices that transmit information via the high-speed communication bus and may also be controlled via a network PC. The VRV Controls Network supports operation monitoring, scheduling, error e-mail distribution, general user software, tenant billing, maintenance support, and integration with Building Management Systems (BMS) using open protocol via BACnet® or Lonworks® interfaces; all of which blend to provide the optimal control strategy for the best HVAC comfort solution.

## Part 2 - Products

### 2.1. Remote Controllers

Daikin VRV local remote controllers are compatible with all VRV indoor units. The remote controller wiring consist of a non-polar two-wire connection to the indoor unit. The local remote controllers may be wall-mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s). Temperature setpoint can be adjusted in increments of 1°F/°C. In the cases where a system or unit error may occur, the VRV controllers will display a two-digit error code and the unit address. The local remote controllers do not need to be addressed.

#### A. Navigation Remote Controller

1. BRC1E73

2. BRC1E72

#### B. Simple Remote Controller

1. BRC2A71

#### C. Wireless Remote Controller

1. BRC4C82

2. BRC7E83

3. BRC7C812

4. BRC7E818

#### D. Remote Temperature Sensor

1. KRCS01-1B

#### E. Wi-Fi Adaptor

1. AZAI6WSCDKA

### Part 3 – Specifications

#### 3.1. Navigation Remote Controller

##### A. BRC1E73: Navigation (NAV) Remote Controller

The NAV Remote Controller can provide control for all VRV indoor units. The remote controller wiring consist of a non-polar two-wire connection to the indoor unit at terminals P1/P2. The NAV Remote Controller is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s). The NAV Remote Controller does not need to be addressed.

The NAV Remote Controller can be used in conjunction with the BRC2A71 (Simplified Remote Controller) or another NAV Remote Controller to control the same indoor unit group. No more than 2 remote controllers can be placed in the same group.

##### 1. Mounting:

The NAV Remote Controller shall be mounted into a standard 2" x 4" junction box.

##### 2. Display Features:

- a. The NAV Remote Controller shall be approximately 4.75" x 4.75" in size with a 2.75" x 1.75" LCD display.
- b. Backlit LCD display with contrast adjustment and auto off after 30 seconds.
- c. Display language shall be selectable from English, French or Spanish.
- d. Selectable display – Detailed, Standard and Simple
  - 1) Detailed display
    - i. Shall display Operation Mode, Cool, Heat and Setback setpoints, Fan Speed, Louver position, Room Temperature, Time and Day of the Week
  - 2) Standard display
    - i. Shall display Operation Mode, Cool, Heat and Setback setpoints and Fan Speed
  - 3) Simple display
    - i. Shall display Operation Mode, Cool, Heat and Setback setpoints, Fan Speed and Room Temperature
    - ii. The room temperature shall be displayed with a large 11/16" font
- e. All displayed items configurable
  - 1) Configure "Off" to be displayed when unit is turned off (field setting required)
    - i. Prevents mode adjustment
  - 2) Setpoint can be removed from display when unit is turned Off (field setting required)

VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM  
REMOTE CONTROLLERS

- i. Prevents setpoint adjustment
- 3) Fan speed display removable (field setting required)
  - i. Prevents fan speed adjustment
- f. System Status icons.
- g. The controller shall display temperature setpoint in one degree increments with a range of 60-90°F (16-32°C)
- h. Detailed and Simple display will reflect room temperature (0-176°F/-18-80°C range in one degree increments).
  - 1) Display of temperature information shall be configurable for Fahrenheit or Celsius
- i. On/Off status shall be displayed with an LED.
- j. Error codes will be displayed with a two digit code in the event of system abnormality/error.
  - 1) A blinking LED will also signal system abnormality/error
- k. The following system temperatures can be displayed to assist service personnel in troubleshooting:
  - 1) Return Air Temperature
  - 2) Liquid Line Temperature
  - 3) Gas Line Temperature
  - 4) Discharge Air Temperature (depending on unit),
  - 5) Remote Controller Sensor Temperature
  - 6) Temperature used for Indoor Unit Control

3. Basic Operation:

- a. Capable of controlling a group of up to 16 indoor units.
- b. Controller shall control the following group operations:
  - i. On/Off, Operation Mode (Cool, Heat, Fan, Dry and Auto\* (\*with VRV Heat Recovery & Heat Pump Systems))
    - i. Configure only the essential modes to be selectable – remove unnecessary mode selection(s) from display
  - ii. Independent Cooling and Heating setpoints in the occupied mode
    - i. Dual setpoints (individual Cool and Heat setpoints with minimum setpoint differential 0 – 7°F (0 – 4°C) default 2°F (1°C)) or Single setpoint
  - iii. Independent Cooling Setup and Heating Setback setpoints in the unoccupied mode
  - iv. Fan Speed
    - ii. Up to 5 speeds (dependent on indoor unit type)
  - v. Vane direction and oscillation (dependent on indoor unit type)
    - iii. Airflow direction
      - 1. Up to 5 louver positions and auto swing
    - iv. Individual airflow
      - 1. Provides individual control of up to four (4) louvers on an indoor unit
    - v. Dual airflow



VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM  
REMOTE CONTROLLERS

1. Provides control of both internal and external louver positions
  - vi. Automatic draft protection
    1. Automatically prevents air flow from blowing directly on occupants
  - b. The controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating in the occupied period
  - c. Function button lockout (On/Off, Mode, Fan Speed, Up/Down, Left, Right Arrows)
  - d. Optional Controller Face Decal (BRC1E72RM, BRC1E72RF, BRC1E72RMF, BRC1E72RM2, BRC1E72RF2, BRC1E72RMF2 ) to hide unnecessary (locked out) buttons
  - e. Indoor Unit group assignment
  - f. Filter indicator
    - 1) Filter service indicator shall be displayed after 100, 1250 or 2500 (default) hours of run time configurable via field setting
  - g. Clock (12/24 hour) and Day display
  - h. Automatic adjustment for Daylight Savings Time (DST)
    - 1) Set changeover period (second Sunday in March / first Sunday in November)
4. Programmability:
- a. Controller shall support schedule settings with selectable weekly pattern options.
    - 1) 7-day
    - 2) Weekday + Weekend
    - 3) Weekday + Saturday + Sunday
    - 4) Everyday
    - 5) The schedule shall support unit On/Off
    - 6) Independent settings for Cooling and/or Heating setpoints when unit is on (occupied)
    - 7) Independent Setup (Cooling) and Setback (Heating) setpoints when unit is off (unoccupied)
    - 8) A maximum of 5 operations can be schedulable per day
    - 9) Time setting in 1-minute increments
  - b. The Controller shall support Auto-changeover mode for both Heat Pump and Heat Recovery systems, therefore, allowing the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat according to the room temperature and temperature setpoint.
    - 1) Changeover to cooling mode shall occur at cooling setpoint + 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
      - i. Configurable from 1 – 4°F (0.5 – 2°C)
    - 2) Changeover to cooling mode shall occur at the primary changeover deadband to cooling + 1°F (0.5°C) as the secondary changeover deadband.

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- i. Configurable from 1 – 4°F (0.5 – 2°C)
- 3) Changeover to heating mode shall occur at heating setpoint - 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
  - i. Configurable from 1 – 4°F (0.5 – 2°C)
- 4) Changeover to heating mode shall occur at the primary changeover deadband to heating - 1°F (0.5°C) as the secondary changeover deadband.
  - i. Configurable from 1 – 4°F (0.5 – 2°C)
- 5) 1 hour guard timer
  - i. Upon changeover, guard timer will prevent another changeover during this period.
  - ii. Guard timer is ignored by a change of setpoint manually from either the Multi-zone Controller, Remote Controller, or by schedule.
  - iii. The Guard timer is also ignored if the space temperature reaches the secondary changeover deadband (configurable from 1 - 4°F (0.5 – 2°C)) from the primary changeover deadband, and the guard timer has been activated
  - iv. 60 minutes as default, configurable to 15, 30, or 90 minutes
- c. The controller shall support the Auto-setback by sensor function (dependent on indoor unit type)
  - 1) The cooling and heating setpoints shall gradually relax (configurable) internally when the room is determined to be unoccupied
    - i. The internal setpoint shall return to the original setpoint when room occupancy is detected
- d. The controller shall support the Auto-off by sensor function (dependent on indoor unit type)
  - 1) The indoor unit shall turn off when it is determined that the room is unoccupied after a specified time has elapsed
    - i. The indoor unit shall be turned on manually when occupancy is detected
- e. The controller shall support the Filter Auto Clean function to be performed once a day (dependent on indoor unit type)
  - 1) Eight (8) time periods (00:00-03:00, 03:00-06:00, 06:00-09:00, 09:00-12:00, 12:00-15:00, 15:00-18:00, 18:00-21:00, 21:00-00:00) shall be available to select from to enable the automatic filter cleaning function
    - i. Default time period (00:00 to 3:00) shall be used if the period for filter auto cleaning is not specified
  - 2) The indoor unit shall be stopped during auto filter cleaning function operation
- f. The Controller shall support an Auto Off Timer for temporarily enabling indoor unit operation during the unoccupied period.
  - 1) When the Off Timer is enabled and when the unit is manually turned on at the remote controller

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- 2) The controller shall shut off the unit after a set time period
- 3) The time period shall be configurable in the controller menu with a range of 30-180 minutes in 10 minute increments
- g. The room temperature shall be capable of being sensed at either the NAV Remote Controller, the Indoor Unit return air temperature sensor (default), or Remote Temperature Sensor (KRCS01-1B) configured through the field settings.

**B. BRC1E72: Navigation (NAV) Remote Controller**

The NAV Remote Controller can provide control for all VRV indoor units. The remote controller wiring consist of a non-polar two-wire connection to the indoor unit at terminals P1/P2. The NAV Remote Controller is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s). The NAV Remote Controller does not require addressing.

The NAV Remote Controller can be used in conjunction with the BRC2A71 (Simplified Remote Controller) or another NAV Remote Controller to control the same indoor unit group. No more than 2 remote controllers can be placed in the same group.

1. Mounting:

The NAV Remote Controller shall be mounted into a standard 2" x 4" junction box.

2. Display Features:

- a. The NAV Remote Controller shall be approximately 4.75" x 4.75" in size with a backlit 2.75" x 1.75" LCD display.
- b. Feature Backlit LCD Display with contrast adjustment and auto off after 30 seconds.
- c. Display information shall be selectable from English, French, or Spanish.
- d. Configurable display mode – Detailed, Standard, and Simple
  - 1) Large 11/16" room temperature displayed in Simple display
- h. The controller shall display Operation Mode, Setpoint, and Fan Speed.
  - 1) Displayed items configurable
  - 2) Configure "Off" to be displayed when unit is turned off (field setting required)
    - i. Prevents mode adjustment
  - 3) Setpoint can be removed from display when unit is turned Off (field setting required)
    - i. Prevents setpoint adjustment
  - 4) Fan speed display removable (field setting required)
    - i. Prevents fan speed adjustment
- i. System Status icons.
- j. The controller shall display temperature setpoint in one degree increments with a range of 60-90°F (16-32°C)
- k. Detailed and Simple display will reflect room temperature (0-176°F/-18-80°C range in one degree increment).

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- 1) Display of temperature information shall be configurable for Fahrenheit or Celsius
  - l. On/Off status shall be displayed with an LED.
  - m. Error codes will be displayed in the event of system abnormality/error with a two digit code.
    - 1) A blinking LED will also signal system abnormality/error
  - n. The following system temperatures can be displayed to assist service personnel in troubleshooting:
    - 1) Return Air Temperature
    - 2) Liquid Line Temperature
    - 3) Gas Line Temperature
    - 4) Discharge Air Temperature (depending on unit),
    - 5) Remote Controller Sensor Temperature
    - 6) Temperature used for Indoor Unit Control
3. Basic Operation:
- a. Capable of controlling a group of up to 16 indoor units.
  - b. Controller shall control the following group operations:
    - 1) On/Off, Operation Mode (Cool, Heat, Fan, Dry and Auto\* (\*with VRV Heat Recovery & Heat Pump Systems))
      - i. Configure only the essential modes to be selectable – remove unnecessary mode selection(s) from display
    - 2) Independent Cooling and Heating setpoints in the occupied mode
      - i. Dual setpoints (individual Cool and Heat setpoints with minimum setpoint differential 0 – 8°F (0 – 4°C) default 2°F (1°C)) or Single setpoint
  - c. Independent Cooling Setup and Heating Setback setpoints in the unoccupied mode
  - d. Fan Speed
  - e. Airflow direction (dependent on indoor unit type).
  - f. The controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating in the occupied period
  - g. Function button lockout (On/Off, Mode, Fan Speed, Up/Down, Left, Right Arrows)
  - h. Optional Controller Face Decal (BRC1E72RM, BRC1E72RF, BRC1E72RMF, BRC1E72RM2, BRC1E72RF2, BRC1E72RMF2 ) to hide unnecessary (locked out) buttons
  - i. Indoor Unit group assignment
  - j. Filter indicator
    - 1) Filter service indicator displayed after 100 or 2500 (default) hours of run time configurable via field setting
  - k. Clock (12/24 hour) and Day display
  - l. Automatic adjustment for Day Light Savings Time (DST)
    - 1) Set changeover period (second Sunday in March / first Sunday in November)

4. Programmability:

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- a. Controller shall support schedule settings with selectable weekly pattern options.
  - 1) 7-day
  - 2) Weekday + Weekend
  - 3) Weekday + Saturday + Sunday
  - 4) Everyday
  - 5) The schedule shall support unit On/Off
  - 6) Independently settable Cooling and/or Heating setpoints when unit is on (occupied)
  - 7) Setup (Cooling) and Setback (Heating) setpoints when unit is off (unoccupied)
  - 8) A maximum of 5 operations can be schedulable per day
  - 9) Time setting in 1-minute increments
- b. The Controller shall support auto-changeover mode for both Heat Pump and Heat Recovery systems allowing the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat according to the room temperature and temperature setpoint.
  - 1) Changeover to cooling mode shall occur at cooling setpoint + 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
    - i. Configurable from 1 - 4°F (0.5 - 2°C)
  - 2) Changeover to cooling mode shall occur at the primary changeover deadband to cooling + 1°F (0.5°C) as the secondary changeover deadband.
    - i. Configurable from 1 - 4°F (0.5 - 2°C)
  - 3) Changeover to heating mode shall occur at heating setpoint - 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
    - i. Configurable from 1 - 4°F (0.5 - 2°C)
  - 4) Changeover to heating mode shall occur at the primary changeover deadband to heating - 1°F (0.5°C) as the secondary changeover deadband.
    - i. Configurable from 1 - 4°F (0.5 - 2°C)
  - 5) 1 hour guard timer
    - i. Upon changeover, guard timer will prevent another changeover during this period.
      - 1. Guard timer is ignored by a change of setpoint manually from either the Multi-zone Controller, Remote Controller, or by schedule.
      - 2. The Guard timer is also ignored if the space temperature reaches the secondary changeover deadband (configurable from 1 - 4°F (0.5 - 2°C)) from the primary changeover deadband, and the guard timer has been activated
      - 3. 60 minutes as default, configurable to 15, 30, or 90 minutes

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- c. The Controller shall support an Auto Off Timer for temporarily enabling indoor unit operation during the unoccupied period.
  - 1) When the Off Timer is enabled and when the unit is manually turned on at the remote controller
  - 2) The controller shall shut off the unit after a set time period
  - 3) The time period shall be configurable in the controller menu with a range of 30-180 minutes in 10 minute increments
- d. The room temperature shall be capable of being sensed at either the NAV Remote Controller, the Indoor Unit return air temperature sensor (default), or Remote Temperature Sensor (KRCS01-1B) configured through the field settings.

### 3.2. Simplified Remote Controller

#### A. BRC2A71: Simplified Remote Controller

The Simplified Remote Controller can provide control for all VRV indoor units. The remote controller wiring consists of a non-polar two-wire connection to the indoor unit at terminals P1/P2. The Simplified Remote Controller is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s). The Simplified Remote Controller does not require addressing.

The Simplified Remote Controller can be used in conjunction with the BRC1E71 (Navigation Remote Controller) or another Simplified Remote Controller to control the same indoor unit group. No more than 2 remote controllers can be placed in the same group.

#### 1. Mounting:

The Simplified Remote Controller shall be mounted into a standard 2" x 2" junction box.

#### 2. Display Features:

- a. The Simplified Remote Controller shall be approximately 4.75" x 2.75" in size with a 1" x 1.75" LCD display.
- b. The controller shall display Operation Mode, Setpoint, and Fan Speed.
- c. The controller shall be able to display temperature setpoint in one degree increments with a range of 60-90°F (16-32°C).
- d. On/Off status shall be displayed with an LED.
- e. Error codes will be displayed in the event of system abnormality/error with a two digit code.
  - 1) A blinking LED will also signal system abnormality/error

#### 3. Basic Operation:

- a. Capable of controlling a group of up to 16 indoor units.
- b. Controller shall control the following group operations:
  - 1) On/Off, Operation Mode (Cool, Heat, Fan, Dry and Auto\* (\*with VRV Heat Recovery System))

VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM  
REMOTE CONTROLLERS

- 2) Independent Cooling and Heating setpoints in the Occupied mode
- 3) Independent Cooling Setup and Heating Setback setpoints in the Unoccupied mode,
- 4) Set fan speed
- 5) The controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating in the occupied period
- 6) Indoor unit group assignment
- 7) Function key lockout (Mode / Fan Speed) via Optional Controller Face Plates (BRC2A71RU / BRC2A71R)

3.3. Wireless Remote Controller

**A. BRC4C82 / BRC7E83 / C812 / E818: Wireless Remote Controller**

The Wireless Remote Controller can provide control for all VRV indoor units. The remote controller wiring consists of a non-polar two-wire connection to the indoor unit at terminals P1/P2. The Wireless Remote Controller is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s). The Wireless Remote Controller does not require addressing.

The Wireless Remote Controller can be used in conjunction with the BRC2A71 (Simplified Remote Controller) or another Wireless Remote Controller to control the same indoor unit group. No more than 2 remote controllers can be placed in the same group.

1. Mounting:

- a. The Wireless Remote Controller receiver shall be mounted on the wall or on the indoor unit (dependent on indoor unit model type).

2. Display Features:

- a. The Wireless Remote Controller shall be approximately 6.25" x 2.75" in size with a 3.75" x 0.75" LCD display.
- b. The controller shall be able to display Operation Mode, Setpoint and Fan Speed.
- c. The controller shall be able to display temperature setpoint in one degree increments with a range of 60-90°F (16-32°C).
- d. Error codes will be displayed in the event of system abnormality/error with a two digit code.
  - 1) A blinking LED will also signal system abnormality/error

3. Basic Operation:

- a. Capable of controlling a group of up to 16 indoor units.
- b. Controller shall control the following group operations:
  - 1) On/Off, Operation Mode (Cool, Heat, Fan, Dry and Auto\* (\*with VRV Heat Recovery System))
  - 2) Independent Cooling and Heating Setpoints in the occupied mode

VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM  
REMOTE CONTROLLERS

- 3) Fan Speed
- 4) Air flow direction (dependent on indoor unit type)
- 5) Indoor unit group assignment

4. Programmability:

- a. Supports timer controlled start/stop operation (up to 72 hours).

3.4. Remote Temperature Sensor

**A. KRCS01-1B: Remote Temperature Sensor**

The Remote Temperature Sensor can provide temperature sensing for all VRV indoor units. The remote controller wiring consists of a non-polar two-wire connection to the indoor unit at terminals X13A. The Remote Temperature Sensor is wall mounted and is used to maintain the optimal operation of the connected indoor unit.

The Remote Temperature Sensor can be used in conjunction with the Navigation Remote Controller, Simplified Remote Controller, and the Wireless Remote Controller to sense space temperature outside of the indoor unit. No more than 2 remote controllers can be placed in the same group.

1. Mounting:

- a. Sensor Box shall be 2.38" x 1.97" x 0.75" (H x W x D) in size.
- b. Can be mounted on the wall in the provided sensor box.
- c. Can be mounted in the Simplified Remote Controller (BRC2A71).
- d. Can be mounted a button temperature sensor holder (field supplied).

2. Application:

- a. The location of the temperature sensor should provide a realistic sample of the space temperature in order to provide the optimum comfort level to the occupants.
  - 1) Things that need to be considered are:
    - i. Indoor unit location
    - ii. Will outside area be brought into the space and/or indoor unit
    - iii. Ceiling heights
    - iv. Control Scheme
    - v. Design and limitations due to architecture
    - vi. Plenum air return

3. Basic Operation:

- a. Replaces indoor unit return air temperature sensor.
  - 1) Senses room temperature for only one indoor unit



### 3.5. DKN Cloud Wi-Fi Adaptor

#### A. AZAI6WSCDKA: DKN Cloud Wi-Fi Adaptor

The Wi-Fi adaptor enables the control of all VRV indoor units through an iOS/Android smartphone app. The Wi-Fi adaptor wiring consists of a non-polar two-wire connection to the indoor unit at terminals P1/P2 and a connection to the indoor unit power supply connector (16VDC). A remote controller is required to connect to the indoor unit together with the Wi-Fi adaptor. Only one DKN Cloud Wi-Fi adaptor can be placed in one remote controller group controlling up to 16 indoor units.

1. Mounting:

The Wi-Fi adaptor shall be mounted onto a flat surface either through screws or through double-sided adhesive tape.

2. The DKN Cloud Wi-Fi adaptor shall be approximately 3.6 x 3.15 x 1.15 inches in size.

3. A VRV remote controller is required to be connected to the indoor unit terminal together with the Wi-Fi adaptor.

4. Power supply:

- a. The DKN Cloud Wi-Fi adaptor shall be supplied with 12-16VDC power, with maximum current of 85mA and max power consumption of 1360mW
- b. The DKN Cloud Wi-Fi adaptor shall be able to obtain 16VDC power from the indoor unit with a supplied wire of up to 6.5 ft.

5. Operating temperatures:

- a. The DKN Cloud Wi-Fi adaptor shall be stored at a temperature range from -4 °F to 158 °F
- b. The DKN Cloud Wi-Fi adaptor shall be operated at a temperature range from 32 °F to 122 °F
- c. The DKN Cloud Wi-Fi adaptor shall be operated at a humidity range from 5% to 90% (non-condensing)

6. Communication:

- a. Capable of communicating through WiFi-Certificated network 802.11b/g/n
- b. Communication frequency of 2.4GHz
- c. Maximum antenna power of 20dBm
- d. Sensitivity of -97dBm
- e. Static DHCP IP addressing

7. iOS/Android App Operation:

- a. Shall be capable of control a group of up to 16 indoor units
- b. Shall display the following:
  - i. On/Off
  - ii. Mode – Cool, Heat, Fan, Auto and Dry

VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM  
REMOTE CONTROLLERS

- iii. Room temperature
    - 1) Sensed by the remote controller or indoor unit return air sensor
  - iv. Setpoint
  - v. Fan speed
  - vi. Error code
  - vii. Next scheduled event
  - c. Shall be capable of commanding the following:
    - i. On/Off
    - ii. Mode – Cool, Heat, Fan, Auto and Dry
    - iii. Setpoint
    - iv. Fan speed
  - d. Capable of setting a 7 day schedule for each indoor unit group
  - e. Shall be capable of editing unit name and icon, and grouping units
  - f. Shall be capable of managing users with Basic and Advanced authority
  - g. Shall be capable of displaying different languages: English, French, and Spanish
  - h. Shall be able to switch temperature units between °F/°C
8. Support Voice Control
- a. Shall work with Amazon Alexa and Google Assistant
9. Public API integration
- a. Shall support third party Public API integration

**END OF SECTION**

**SECTION 238132**  
**DUCTLESS SPLIT SYSTEMS**

**PART 1        GENERAL**

**1.01    WORK INCLUDED**

- A.     The work of this section consists of providing all labor, materials, equipment and services necessary for the fabrication and installation of all equipment and appurtenances in connection with the heating, ventilating and air conditioning work. This includes as shown on the drawings and as specified herein.

**1.02    SUBMITTALS**

- A.     Submit catalog data, shop drawings and installation instructions prior to commencement of work for all materials and equipment incorporated into the drawings and specified herein.
- B.     Provide one-year parts and labor and five-year compressor manufacturers' warranty from date of substantial completion.

**PART 2 - PRODUCTS**

**2.01    DUCTLESS SPLIT SYSTEMS**

- A.     Provide a ductless split system consisting of an evaporator and matched outdoor unit. Both units shall be provided by the same manufacturer and shall be designed to work together as a system. The system shall be either straight cool or heat pump as indicated on the drawings.

**2.02    EVAPORATOR**

- A.     The evaporator shall have the configuration as indicated on the drawings: floor mounted, high wall mounted, ceiling mounted, or ceiling recessed.
- B.     The evaporator cabinet shall be fabricated from heavy gauge galvanized steel. All exposed surfaces shall be either powder coated steel or polystyrene. All air stream surfaces shall be insulated with 1/2" foil faced insulation.
- C.     The intake grille shall be perforated steel. The discharge grille assembly shall be adjustable, aluminum bi-directional louvers.
- D.     The condensate drain pan shall be galvanized steel with an anti-corrosion coating.
- E.     The fan motor shall be forward curve direct drive centrifugal type. The motor, shafts and fan wheel shall be statically and dynamically balanced. The fan motor shall have internal thermal overload protection.
- F.     The evaporator shall be equipped with a permanent, electrostatic washable filter.
- G.     The coil shall be fabricated from seamless copper tubing arranged in a staggered configuration. The fins shall be mechanically bonded to the tubing. The coil shall be tested to 450 psig.

- H. Options:
  - 1. Electric strip heat.
  - 2. Condensate pump with a minimum of 4'-0" of head.
  - 3. Trim Kit
  - 4. 24-volt thermostat.
- I. Ductless split system evaporator shall be Mitsubishi, Samsung, Carrier, Trane, Daikin or approved equal per specification 230500.

## 2.03 OUTDOOR UNIT

- A. The outdoor unit cabinet shall be fabricated from G60 galvanized steel and shall be finished with a corrosion inhibiting powder coated paint which has passed a 2,000-hour salt spray test.
- B. The compressor shall be hermetically sealed, high efficiency rotary or reciprocating type, depending on the unit capacity. The motor shall be PSC type with internal overload protection. The compressor shall be installed on resilient mounts.
- C. Heat pump units shall be equipped with a four-way reversing valve, solenoid activated by 24 volts in the cooling mode. A thermal expansion valve with an internal check valve is used in the heat pump mode.
- D. The condenser coil shall be fabricated from seamless copper tubing, arranged in a staggered configuration. The fins shall be mechanically bonded to the tubing.
- E. The condenser fan shall be a large diameter, high efficiency, three blade propeller type, directly connected to a totally enclosed 8 pole PSC motor. The fan motor shall have internal thermal protection.
- F. Factory installed controls and components shall include the compressor and fan motor contactors, low pressure switch, high pressure switch, suction accumulator, solid core filter drier. Heat pump units shall be equipped with defrost control and defrost termination switch.
- G. Options:
  - 1. Low ambient controls with wind baffle when required.
- H. Ductless split systems outdoor units shall be Mitsubishi, Samsung, Carrier, Trane or Daikin.

**PART 3 EXECUTION**

**3.01 GENERAL**

- A. Ductless split systems shall be installed in accordance with the manufacturer's recommendations.
- B. Route the condensate piping as shown on the drawings.
- C. Refrigerant lines shall be sized in accordance with the manufacturer's recommendations.
- D. Both refrigerant lines shall be insulated independently. Both suction and liquid lines will not be installed together in one insulation barrier.

**END OF SECTION**

APPENDIX A  
GEOTECHNICAL REPORT



**GEOTECHNICAL  
ENGINEERING  
TESTING, INC.**

~ Geotechnical Evaluations ~ Construction Materials Testing ~ Geosciences ~ Infrastructure Management Services ~

**SOILS EXPLORATIONS AND GEOTECHNICAL STUDIES  
FOR THE PROPOSED  
ALOE BAY WATER QUALITY ENHANCEMENT PROJECT  
AT DAUPHIN ISLAND WASTE WATER TREATMENT  
FACILITY AT DAUPHIN ISLAND, ALABAMA**

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# Geotechnical Engineering-Testing, Inc.

PROFESSIONAL ENGINEERS

Geotechnical Evaluations - Geosciences - Construction Materials - Pavement Management

September 19, 2022

Ardurra  
200 Clinton Avenue West, Suite 601  
Huntsville, AL 35801

Attn.: Ben Lawrence, P.E.

Via email: [blawrence@ardurra.com](mailto:blawrence@ardurra.com)

Re: Soils Explorations and Geotechnical Engineering Studies for the Proposed Aloe Bay Water Quality Enhancement Project at the Dauphin Island Wastewater Treatment Facility at Dauphin Island, Alabama (GET Project Number 22-166)

Gentlemen:

Geotechnical Engineering-Testing, Inc. (GET) is pleased to submit this report of our soils explorations and geotechnical engineering evaluations for the proposed Aloe Bay Water Quality Enhancement Project at the Dauphin Island Wastewater Treatment Facility at Dauphin Island, Alabama. This report includes the results of the soil test borings and laboratory soils tests performed for these evaluations along with our recommendations for tank and building foundation design and construction. Our services were performed in general accordance with our proposal dated May 26, 2022 and they were authorized by signed Proposal Acceptance Document dated June 23, 2022.

This report has been prepared to aid in the evaluation of this site and to assist in the design of the project. The recommendations provided are based in part on the project information provided to GET and only apply to the specific project and site discussed in this report.

Please call Hank Oakes, P.E. if you have any questions regarding this report.

Sincerely,

GEOTECHNICAL ENGINEERING-TESTING, INC.



Hank M. Oakes, P.E.  
Sr. Project Engineer  
Alabama License No. 19576





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## **INTRODUCTION**

Geotechnical Engineering-Testing, Inc. has completed the authorized soils explorations and geotechnical engineering studies for the proposed Aloe Bay Water Quality Enhancement Project at the Dauphin Island Wastewater Treatment Facility (WWTF) at Dauphin Island, Alabama. The soils explorations have included twelve exploratory soil test borings, visual descriptions of the soils encountered, and laboratory tests on selected soil samples. The engineering study has included the planning, coordination, and supervision of the soils explorations program, evaluations of the results of the soils explorations, development of recommendations for tank and building foundation design and construction, and the preparation of this report.

Our understanding of the project was based on telephone and email correspondence with representatives of Ardurra. We understand that the subject project will generally consist of construction of two 90 ft diameter X 21.5 ft tall prestressed concrete tanks located about 25 ft apart, an operations building, a chlorine contact chamber, and a dewatering pavilion. The general arrangement of the proposed new facilities is shown by the Site / Boring Location Plan that is included in the appendix of this report.

We understand that the design water depth within the tanks will be 19 ft. Thus, widespread loading at the tank floors will be about 1200 psf. We anticipate that structures other than the tanks will be relatively lightweight and that, in some cases, uplift loads may control foundation size/embedment. We anticipate that all the new construction will take place very near the existing site grades, i.e., the project will require negligible cut or fill. A design grading plan has not been provided.

Details of our findings and recommendations are presented in the following sections of this report.

## **SITE DESCRIPTION**

The existing Dauphin Island WWTF is located on the west side of highway AL193 (Lemoyne Drive) very near the north edge of Dauphin Island. The site is bounded on the west by Aloe Bay which is at the southeast extremity of Mississippi Sound. The project location is indicated by the Highway Location Map included in Appendix A of this report.

The WWTF is separated from AL193 by an approximate 60-ft wide green space. The WWTF site is approximately rectangular with plan dimensions of about 350 ft by 375 ft (long dimension is parallel to the highway). The site is occupied with various structures and equipment associated with an operational WWTF. Outside the structure and equipment areas, roadways are generally gravel-surfaced and the ground surface is bare or covered with sparse grass.

Observations indicate that the project site is relatively flat and level. Elevation measurements made at boring locations indicate that the ground surface elevation ranges from about +5 to +7 ft.

### **SOILS EXPLORATIONS PROGRAM**

The procedures for the field explorations and laboratory testing programs utilized on this project are summarized in the following sections of this report.

#### Boring Locations

Fifteen soil test borings were planned for this project. Ardurra provided a preliminary site plan that included their recommended soil test boring locations. We overlaid the preliminary site plan on a Google Earth® image and from there we picked GPS coordinates of the recommended boring locations. Using these coordinates and a network rover, submeter GPS surveying instrument, soil test boring locations were established in the field.

Locations of some borings were adjusted in the field due to above ground obstructions or underground utilities/obstructions. Following the boring operations, the boring locations were re-surveyed using the network rover, submeter GPS instrument. The approximate as-drilled boring locations are shown on the Site / Boring Location Plan included in Appendix B of this report. State Plane coordinates of each soil boring is shown on the respective Log of Boring.

Of the fifteen soil test borings that were planned, only twelve were performed. Three of the borings, identified as B-10, B-11, and B-12, could not be performed due to widespread underground obstructions (apparent abandoned concrete foundations). Attempts to move the borings off the obstructions resulted in them being relatively close to other boring locations. Thus, these three borings were eliminated from our study. The last attempted boring locations are shown on the Site / Boring Location Plan.



### Soils Explorations

Soil test borings were performed using our MOBILE B37 drill rig. Boring depths ranged from 40 ft (one boring) to 90 ft (six borings). The boreholes were advanced using the rotary wash method in which a bentonite slurry drilling fluid is circulated through the borehole to stabilize the sides and bottom and to transport soil cuttings to the surface. Standard penetration tests (SPT's) were performed and split spoon soil samples were collected continuously to a depth of 7.5 ft, at 2.5 ft center-to-center intervals from 7.5 ft to 20 ft, and then at the standard 5-ft interval to the boring termination depths. Within cohesive soil strata, undisturbed tube samples were collected between split spoon samples.

Boring and sampling operations were conducted in general accordance with standard procedures. Depths where samples were collected and the results of the standard penetration tests are shown on the Logs of Boring included in Appendix C of this report.

Soil samples were field logged, sealed in moisture-tight plastic bags, and, along with the sealed tube samples, transported to our laboratory. At the laboratory the soil samples were visually examined by the project engineer to verify or adjust field classifications.

### Laboratory Testing

Selected samples were subjected to laboratory tests to aid the engineering evaluations. Tests included moisture content, Atterberg limits, percent finer than a #200 sieve, and one-dimensional consolidation. The tests were performed in general accordance with standard laboratory soil testing procedures. Test results are shown on the Logs of Boring opposite the samples tested and on test report forms included in Appendix D of this report.

## **SUBSURFACE CONDITIONS**

The Geological Map of Alabama indicates that the geological setting of the project site is the Holocene Series of the Quaternary System that consists of alluvial, coastal, and low terrace deposits. The soils are described as very pale-orange to grayish orange varicolored fine to coarse quartz sand containing clay lenses and gravel in places. Gravel composed of quartz and chert pebbles. Coastal deposits include fine to medium quartz sand and shell fragments and accessory heavy minerals along Gulf beaches; fine to medium quartz sand, silt, clay, peat, mud and ooze in

Mississippi Sound, Little Lagoon, bays, lakes, streams, and estuaries.

According to the USGS Mapping of Sinkholes/Possible Sinkholes, the project site is not located in an area of sinkhole susceptibility or where sinkholes are known to have occurred.

As could be expected on a barrier island such as Dauphin Island, the subsurface conditions at the project site are variable. However, broadly speaking, the general subsurface conditions are:

<u>Depth Below Surface</u>	<u>Soil Description</u>
0' – 25'	Loose and Very Loose Sands
25' – 35'	Firm Sands
35' – 52'	Soft to Very Soft Clays
52' – 62' (highly variable)	Stiff Clays
62' – Boring Termination	Firm to Dense to Very Dense Sands

The soil borings are representative of subsurface conditions at their respective locations and vertical reaches. However, local variations characteristic of the subsurface materials of the region are likely to exist. The boring logs and related information are based on the driller's logs and visual examination of recovered samples in the laboratory. The delineation between soil types shown on the logs is approximate and the descriptions represent the interpretation of subsurface conditions at the designated boring location on the date drilled.

At the time measured, the ground water table was 4 to 5 ft below the ground surface (water depth was not measured in every borehole). This water depth equated to elevations of about +1 to +3 ft. It should be expected that the ground water table will vary with the tide level in the adjacent Aloe Bay and the site will be inundated during severe storm events.

## **GEOTECHNICAL RECOMMENDATIONS**

The recommendations provided below are based on our understanding of the project as described in the **INTRODUCTION**, the subsurface data collected, our engineering evaluations regarding the geotechnical matters, our experience on projects at and in proximity to this site, and the typical climate conditions of the area. If our understanding of the project is incorrect, we should be provided accurate information and should be provided the opportunity to review our



recommendations taking into consideration the new project information.

#### General Site Preparation

Each planned construction area, and extending at least 5 ft outside structure limits, should be cleared and organics or any deleterious surface materials should be removed. For all the structures except the tanks, which are addressed below, construction sites should be compacted by at least one pass of a heavy vibratory compactor. This operation should be performed under the observation of a representative of the geotechnical engineer. Any areas of apparent soft or unstable soils should be removed down to firm soils or to a depth of 2 ft, whichever is greater. Building pads should be prepared by placing imported select backfill/fill soils in compacted lifts. Imported select soils should consist of sands that are free of deleterious materials and have no more than about 25 percent passing a number 200 sieve. These soils should also have a plasticity index of no more than six.

Select soils should be placed in loose lifts of no more than 8 inches and each lift should be compacted to at least 98 percent of standard proctor density (ASTM D 698).

#### Tank Foundations

We understand that the prestressed concrete tank manufacturer/constructor (Crom) has indicated that an allowable soil bearing capacity of at least 1500 psf is required for the use of conventional shallow foundations for the tank walls. Our explorations and evaluations indicate that this allowable soil bearing capacity is achievable with some modification of the near-surface soils. Therefore, we recommend the tank walls be supported on shallow foundations. Wall foundations should be at least 2 ft wide. Wall foundations less than 3 ft wide should be embedded at least 2 ft below the finished surface grade surrounding the tanks. Wall foundations equal to or greater than 3 ft wide should be embedded at least 1.5 ft below the finished surface grade surrounding the tanks.

Recommended modification of the near-surface soils consists of removal of existing soils and replacement with compacted crushed aggregate. More specifically, we recommend that soils be undercut below the design foundation bearing elevation a distance equal to the design foundation width plus 0.5 ft. Undercut excavations should also extend at least 1 ft outside the design

foundation location for each foot of undercut excavation (0.5 ft on each side of the foundation). That is, if 2-ft wide foundations will be used, insitu soils should be undercut at least 2.5 ft below the design foundation bearing elevation (foundation width plus 0.5 ft) and the bottom of the excavation should be at least 4.5 ft wide (foundation width plus 2.5 ft). A 3-ft wide foundation should be undercut at least 3.5 ft below design bearing elevation and the bottom of the excavation should be at least 6.5 ft wide. Undercut excavations should be centered on the centerline of the foundation locations.

Foundation undercut excavations should be backfilled with ALDOT #57 crushed aggregate. The aggregate should be placed in about 6-inch loose lifts and each lift should be compacted by at least two passes of a vibratory plate compactor and until firm in the judgment of a representative of the geotechnical engineer. If tank foundation undercut excavations are wide enough for a heavy vibratory compactor, ALDOT #57 crushed aggregate may be placed in 12-inch loose lifts. It is impractical to perform in-place density tests on #57 crushed aggregate and so no specific comparative compaction is recommended.

If the above recommendations are followed, tank wall foundations may be designed based on an allowable soil bearing capacity of 1500 psf.

Within the tank floor areas, we recommend that insitu soils be excavated to a depth of at least 6 inches below the design elevation of the bottom of the tank floor slab. Soils at the bottom of the excavation should be compacted by at least one pass of a heavy vibratory compactor. This operation should be performed under the observation of a representative of the geotechnical engineer. Any areas of soft or unstable soils revealed by the compaction efforts should be removed to a depth of at least 12 inches. The tank floor area should be backfilled with imported soil aggregate meeting the requirements of ALDOT 823.03 A or B. The soil aggregate should be placed in loose lifts not exceeding 8 inches and each lift should be compacted to at least 95 percent of standard proctor density.

#### Potential Tank Settlement

As stated above, the subsurface soils at the site include strata of soft to very soft clays between



depths of about 35 to 52 ft. Laboratory consolidation tests indicate that the soft to very soft clays will consolidate under stresses imposed by the filled tanks. Using classical geotechnical engineering methods, i.e., soil consolidation characteristics based on the laboratory test results, Boussinesq stress distribution equations, and Terzaghi settlement equations, potential long-term settlement of the tanks was estimated. The stress distribution equations are for flexible loads in which no rigidity of foundations is considered. Since the tanks will be constructed only about 25 ft apart, soil stresses from the tanks will overlap.

A summary of our settlement estimates is shown by the graph in Figure 1 on page 11 of this report. As shown, we estimate long-term settlement around the perimeters of the tanks, some distance away from the adjacent tank, will be on the order of 1 inch. Where the two tanks are in close proximity, long-term settlement at the perimeters is estimated to be closer to 1.5 inches. Long-term settlement at the centers of the two tanks is estimated to be about 2.5 to 3 inches.

In addition to the long-term settlement discussed above, which will likely occur over a period of several months (no formal time rate of settlement analyses have been performed), short-term settlement will likely occur due to deformation of the upper loose to very loose sands. Virtually all the deformation of the sands, estimated to be on the order of 3 inches, will occur upon initial loading of the tanks (hydro testing).

We understand that Crom has stated that the tanks should be able to tolerate the estimated amounts of settlement and differential settlement. Our recommendation that the tanks be supported on shallow foundations is based on this understanding. However, if it is determined that the estimated settlements are outside tolerable limits, we recommend that the tank sites be preloaded (to cause anticipated settlements to occur prior to tank construction) or that the tanks be supported on deep (pile) foundations. Detailed recommendations for a preload program or for deep foundations will be provided upon request.

#### Operations Building and Dewatering Pavilion Foundations

Subsurface soil conditions at the locations of the proposed Operations Building and Dewatering Pavilion were slightly better and more consistent, from a foundations perspective, than throughout



the remainder of the site. That is, the near-surface sands were firmer, the firmer sands extended slightly deeper (about 6 ft), and the underlying sands were slightly firmer than in most other areas. Based on these conditions, and our understanding that the Operations Building and Dewatering Pavilion will be relatively lightweight structures, we recommend they be supported on shallow foundations constructed directly on insitu soils.

Even though the soils are slightly better, because of the high ground water table (and the potential for inundation during severe storm events), recommended allowable soil bearing pressures are still relatively low. We recommend the following design allowable soil bearing pressures for foundations of various size and embedment depth constructed on insitu soils.

Bearing Depth*	Foundation Width					
	2 Ft		3 Ft		4 Ft	
	Spread	Continuous	Spread	Continuous	Spread	Continuous
1 Ft	750 PSF	850 PSF	900 PSF	1050 PSF	1100 PSF	1250 PSF
1.5 Ft	1000 PSF	1050 PSF	1150 PSF	1250 PSF	1300 PSF	1450 PSF
2 Ft	1200 PSF	1300 PSF	1350 PSF	1500 PSF	1550 PSF	1700 PSF

\*Below lowest adjacent final grade

If wider or deeper foundations are required, then foundation soil preparation should be performed as recommended above for the tank wall foundations.

For foundations constructed on insitu soils, soils at the bottoms of foundation excavations should remain undisturbed. If disturbed, soils should be re-compacted to at least 100 percent standard proctor density prior to placement of concrete.

#### Chlorine Contact Chamber Foundations

At the location of the proposed Chlorine Contact Chamber, the near surface soils consisted of loose to very loose sands. For this reason, we recommend that Chlorine Contact Chamber foundations be designed and constructed generally as recommended for the tank wall foundations. That is, we recommend that foundations be sized based on a design allowable soil bearing pressure of 1500 psf. Insitu soils should be undercut below the design foundation bearing elevation a distance equal to the design foundation width plus 0.5 ft. Undercut excavations should also extend at least 1 ft outside the design foundation location for each foot of undercut excavation (0.5 ft on each side of

the foundation). Undercut excavations should be centered on the foundation locations. Foundations should bear at least 1 ft below the lowest adjacent final grade.

Foundation undercut excavations should be backfilled with ALDOT #57 crushed aggregate. The aggregate should be placed in about 6-inch loose lifts and each lift should be compacted by at least two passes of a vibratory plate compactor and until firm in the judgment of a representative of the geotechnical engineer.

#### Other Considerations

- Recommended undercut excavations may encounter the ground water table. The contractor should control the inflow of ground water into excavations to prevent sides from sloughing. We anticipate the control method will vary with excavation depth and ground water level and might range from a sump pump(s) to well points with or without sheet pile cut-off walls.
- There are no expansive subgrade soils at the site.
- For design purposes, we recommend active, at-rest, and passive lateral soil pressure coefficients of 0.3, 0.5, and 3.0, respectively. For active and at-rest pressure conditions, we recommend assuming a soil unit weight of 120 pcf from the ground surface to a depth of 5 ft and a soil unit weight of 60 pcf below 5 ft. For passive pressure conditions, we recommend assuming a soil unit weight of 60 pcf.
- For foundations constructed on insitu soils, we recommend a sliding friction coefficient of 0.45. For foundations constructed on crushed aggregate, we recommend a sliding friction coefficient of 0.6.
- Based on reference literature, we estimate that the unimproved soils at the site will have a modulus of subgrade reaction (12-inch square plate) on the order of 60 pci. For improved soils, such as recommended for the tank floors, we estimate that the modulus of subgrade reaction (12-inch square plate) will be on the order of 150 pci.
- Using methods specified in document ASCE 7-10, Chapter 20, the seismic site classification was determined to be E.
- The water level at the site could rise several feet above ground during severe storms. Thus, the potential for buoyancy of an empty tank should be considered.



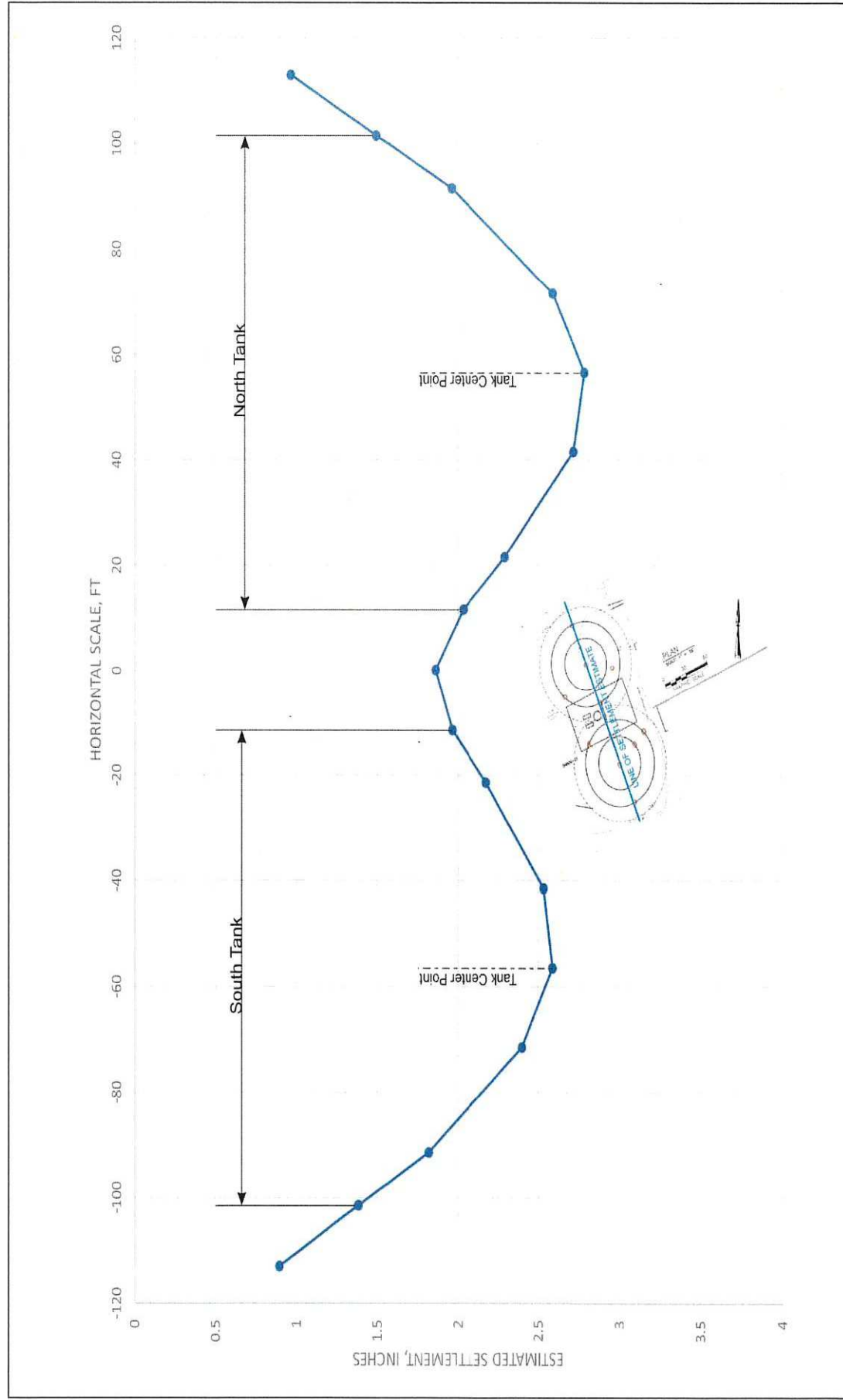
## **ENGINEERING SERVICES DURING CONSTRUCTION**

The engineering recommendations provided in this report are based on the information obtained from the soils explorations and laboratory testing program. Regardless of the thoroughness of geotechnical explorations, there is a possibility that conditions at locations remote from borings will be different from those at specific boring locations and that conditions will not be as anticipated by the designers or constructors. In addition, the construction process may itself alter soil conditions. Therefore, we recommend that a representative of the geotechnical engineer of record observe and document soil conditions encountered and the construction procedures used during the site preparation and foundation construction phases of the project. Unanticipated conditions and/or inadequate procedures should be reported to the design team along with timely recommendations to remediate such conditions or procedures. This representative could also perform the construction materials testing services that are typically required.

## **LIMITATIONS**

We prepared this report to aid in the evaluation of this site and to assist in the design of the project. The recommendations provided are based in part on the project information provided to GET and only apply to the specific project and site discussed in this report. If the project description or stated assumptions are incorrect or if additional information is available, correct or additional information should be conveyed to GET for review. Recommendations can then be modified if warranted.

Our professional services for this project have been performed, findings obtained, and recommendations prepared in accordance with generally accepted engineering principles and practices. The services identified herein were completed in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, expressed or implied, is included or intended, and no warranty or guarantee is included or intended in this report or any other instrument of service.



**FIGURE 1**  
ESTIMATED LONG-TERM  
SETTLEMENT OF TANKS  
September 19, 2022

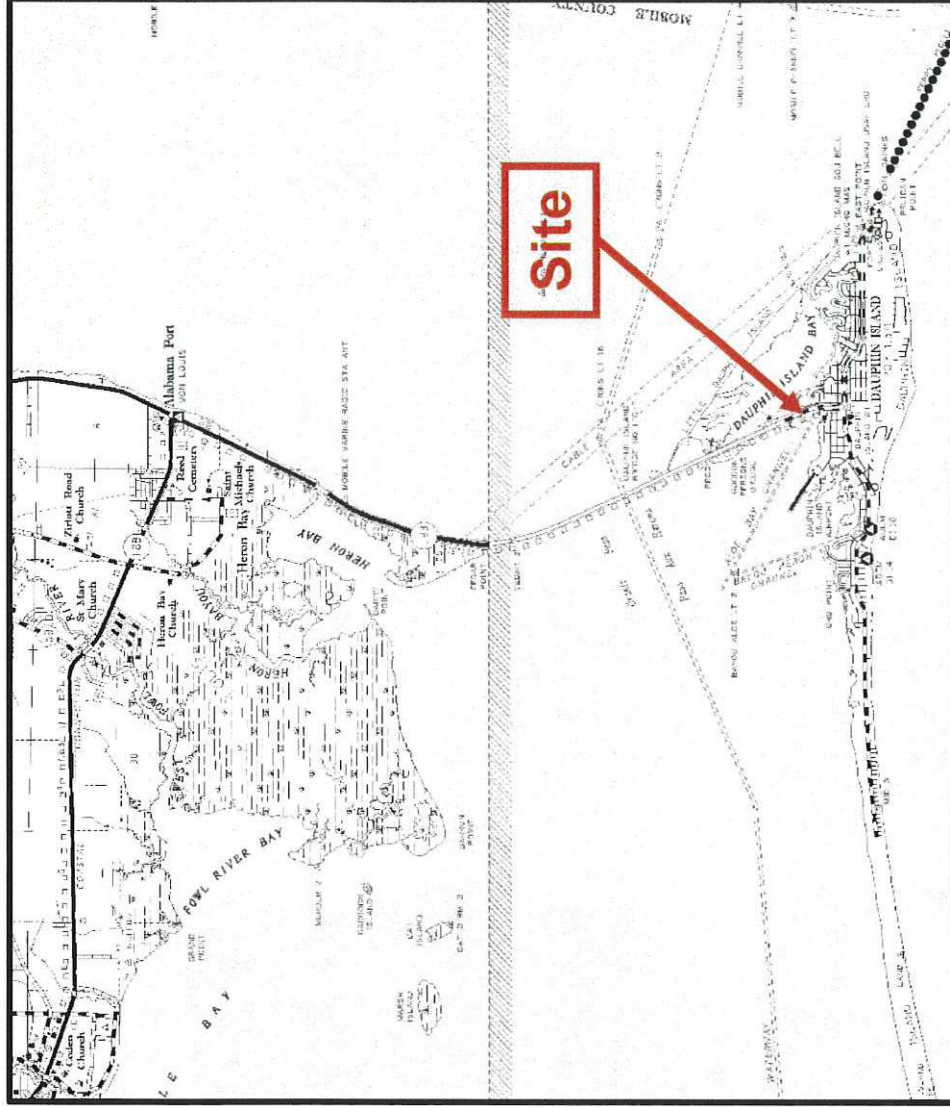
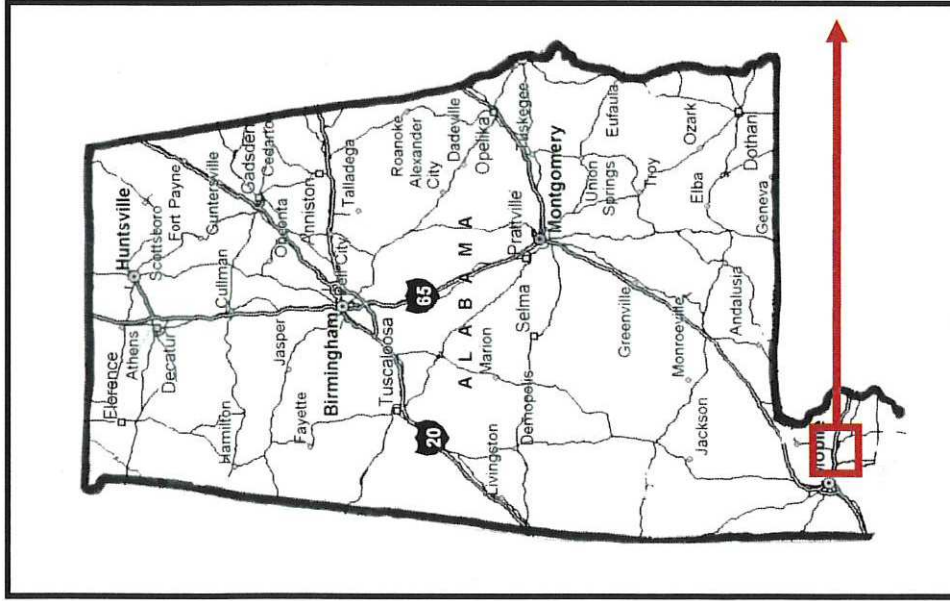
Aloe Bay Water Quality Enhancement  
Project at the Dauphin Island  
Wastewater Treatment Facility  
Dauphin Island, Alabama

**GEI** GEOTECHNICAL  
ENGINEERING  
TESTING, INC.



**APPENDIX A**  
**HIGHWAY LOCATION MAP**





Source – General Highway Map Mobile County, Alabama, Alabama Dept. of Transportation, 2011



**Aloe Bay Water Quality Enhancement  
Project at the Dauphin Island  
Wastewater Treatment Facility  
Dauphin Island, Alabama**

**Highway Location Map**

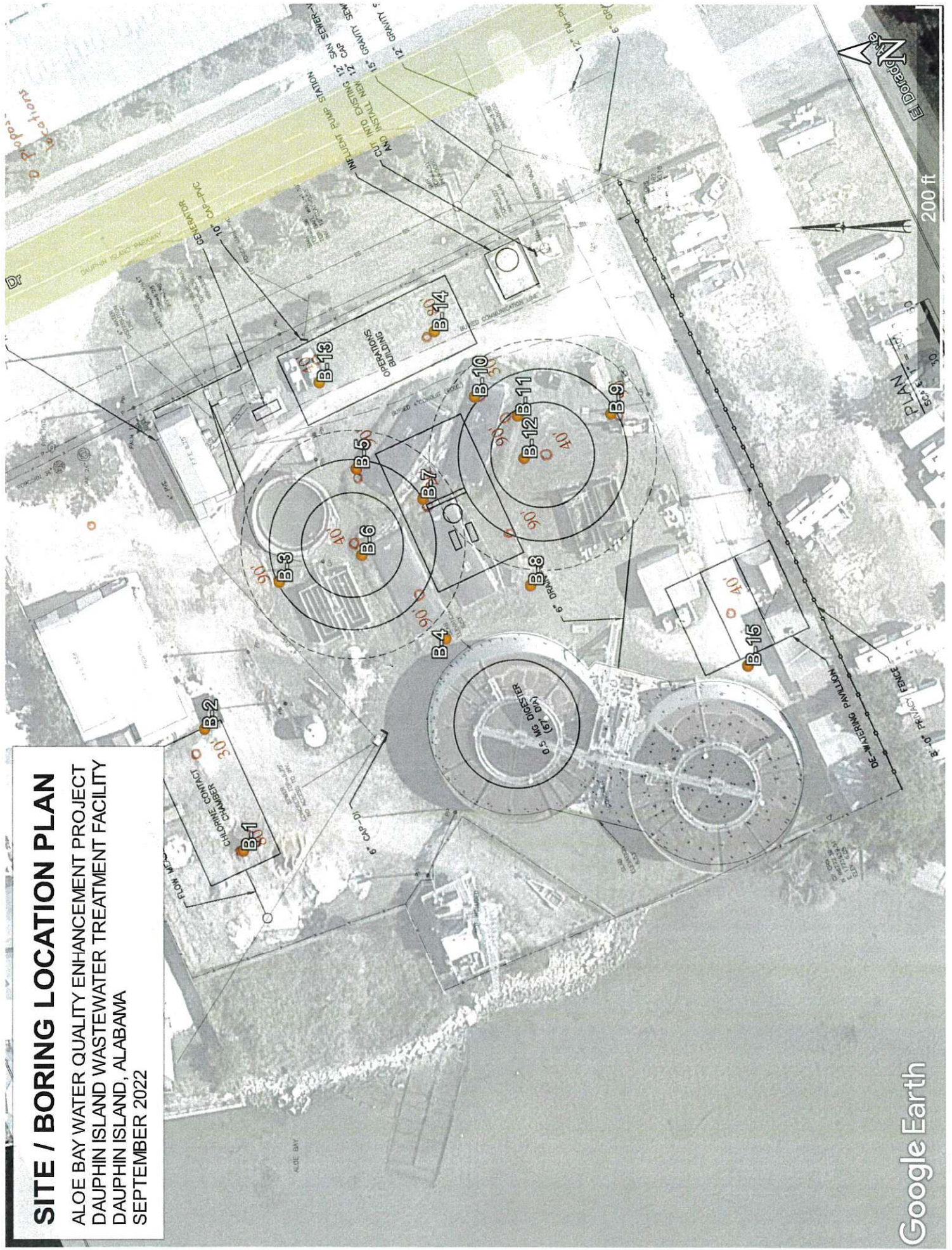


**APPENDIX B**  
**SITE / BORING LOCATION PLAN**



# SITE / BORING LOCATION PLAN

ALOE BAY WATER QUALITY ENHANCEMENT PROJECT  
DAUPHIN ISLAND WASTEWATER TREATMENT FACILITY  
DAUPHIN ISLAND, ALABAMA  
SEPTEMBER 2022





**APPENDIX C**  
**LOGS OF BORING**



PROJECT NAME:

DATE DRILLED:

G.E.T. PROJ. NUMBER:

BORING DEPTH: 0 FT.

PROJECT LOCATION:

BORING ELEV.:

DRILL RIG:

DATUM:

DRILL METHOD:

WATER DEPTH:

REMARKS:



BORING NUMBER: LEGEND

BORING LOCATION:

DRILL CREW:

DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T.		W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
				N <sub>t</sub>	N <sub>c</sub>		L.L.	P.I.				
0		TOPSOIL		N <sub>t</sub> - Standard penetration test value determined in the field - ASTM D1586 (WOH indicates penetration of sampler under weight of 104 lb hammer)	N <sub>c</sub> - Standard penetration test value of sand corrected for overburden by Peck-Hansen-Thornburn, 1974	w.c. % - Percent water content based on dry soil weight	L.L. - Liquid Limit	P.I. - Plasticity Index	Unit Wt., pcf - Dry unit weight of soil, pounds per cubic ft	% Minus #200 - Percent by weight of soils finer than #200 sieve	c - Cohesion, tons per square ft Φ - Angle of Internal friction, degrees s - Vane shear strength, tons per square ft c* - Values measure with a pocket penetrometer	Classification according to the Unified Classification System
5		SAND										
10		CLAY										
15		SILT										
20		GRAVEL										
25		ORGANICS										
30		PEAT										
35		SILTY SAND (EXAMPLE OF A SOIL MIXTURE)										
40		SPLIT-SPOON SAMPLE (STANDARD PENETRATION TEST)										
45		UNDISTURBED TUBE SAMPLE										
50		SAMPLE NOT RECOVERED										
55		VANE SHEAR										
60												
65												
70												

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/18/22

**BORING DEPTH:** 80 FT.

**BORING ELEV.:** 4.9 FT.

**DATUM:**

**WATER DEPTH:** 4.0 FT.

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-1

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96586.1 **E:** 1773917.08

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
	0		Firm gray to brown fine to medium sand w/ small amount shell	1	19							
				2	12							
				3	3							
0	5			4	2							
				5	2	25				14.1		
-5	10			6	WOH							
				7	2							
-10	15			8	3							
				9	2							
-15	20		Very loose brown & gray fine to medium sand w/ traces of shell, few small clayey pockets, small amount wood near 17'	10	2	18				9.3		
-20	25			11	4							
-25	30			12	3							
-30	35			13	2	26				9.9		
-35	40		Soft gray lean clay	14	2	37	43	32				
				T-1	-							
-40	45		Very loose gray silty sand w/ clay lense	15	WOH	25				27.4		
-45	50			16	2	65	99	76				
			Soft gray fat clay	T-2	-	64	93	71		98.3		CH
-50	55			17	2	61	98	71				
				T-3	-							
-55	60			18	26	26						
-60	65		Firm to dense gray & grayish brown silty sand	19	36							
-65	70			20	44	25						

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI ALGDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/18/22

**BORING DEPTH:** 80 FT.

**BORING ELEV.:** 4.9 FT.

**DATUM:**

**WATER DEPTH:** 4.0 FT.

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-1

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96586.1 **E:** 1773917.08

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T.	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
					N <sub>t</sub>		L.L.	P.I.				
-70	75	☒	Firm to dense gray & grayish brown silty sand	21	43							
-75	80	☒	B.T. @ 80 FT	22	49							
-80	85											
-85	90											
-90	95											
-95	100											
-100	105											
-105	110											
-110	115											
-115	120											
-120	125											
-125	130											
-130	135											
-135	140											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GET1 ALGDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

**Reviewed By:**

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/18/22

**BORING DEPTH:** 60 FT.

**BORING ELEV.:** 4.5 FT.

**DATUM:**

**WATER DEPTH:** 4.0 FT.

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-2

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96606.89 **E:** 1773982.29

MOD DEEP BORING LOG W/O NC & N-E & ELEV. 22-166 ALOE BAY WWTF, GPJ GETI, AL GDT 9/19/22

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
	0		Loose brown fine sand w/ shell	1	8							
			Very loose brown fine to medium sand w/ shell	2	5							
0	5		Firm light brown fine to medium sand	3	2							
				4	11	23				2.3		SP
				5	4							
-5	10			6	1							
			Loose to very loose dark brownish gray to light gray fine to medium sand w/ traces of clay, shell, fine gravel	7	WOH							
-10	15			8	2	19				5.7		
				9	1							
-15	20			10	WOH							
				11	11	21				3.0		SP
-20	25		Firm to loose brownish gray fine to medium sand w/ trace wood	12	4							
-25	30			13	WOH	31				22.4		
				14	2							
-30	35		Very loose gray silty clayey sand	15	2	30				41.0		
				16	2	26				33.6		
-35	40			T-1	-							
-40	45			17	1	40	48	30				
-45	50		Very soft gray lean clay	T-2	-							
				18	22	33	29	6				
-50	55		Very stiff gray clayey silt									
-55	60		B.T. @ 60 FT									
-60	65											
-65	70											

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/20/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.1 FT.

**DATUM:**

**WATER DEPTH:** 5.0 FT.

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-3

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96566 **E:** 1774060.87

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>r</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
5	0			1	6							
				2	12	6						
			Loose to firm to very loose brown fine	3	3							
			sand w/ trace shell	4	5							
0	5			5	2							
				6	3							
-5	10			7	4	23				7.3		
			Loose to very loose light gray to grayish	8	6							
			brown fine to medium sand w/ small	9	1							
-10	15		amount shell near 12'	10	2							
-15	20											
			Firm grayish brown fine to medium sand	11	16	21						
-20	25		w/ trace shell									
				12	6							
-25	30		Loose grayish brown fine to medium									
			sand w/ trace shell & trace clay lense	13	7	26				13.8		
-30	35											
			Very soft gray sandy clay w/ sand	14	WOH	29				55.6		
-35	40		pockets	T-1	-							
				15	1	32	54	36				
-40	45		Very soft gray lean & fat clay w/ small	T-2	-	35	35	19		94.7		CL
			amount organics & silt lenses	16	WOH	40	40	21				
-45	50			T-3	-							
			Very loose gray clayey sand w/ silt	17	1	26				27.4		
-50	55		lenses									
				18	20	34	62	45				
-55	60		Very stiff greenish gray to gray fat clay									
				19	20	25	33	17				
-60	65											
			Very stiff gray silty clay	20	27	31	26	9				
	70											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/20/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.1 FT.

**DATUM:**

**WATER DEPTH:** 5.0 FT.

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-3

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96566 **E:** 1774060.87

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>r</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT, pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
-65	70		Very stiff gray silty clay									
-70	75	⊗		21	34	24						
-75	80	⊗	Dense to very dense gray fine & fine to medium sand	22	65							
-80	85	⊗		23	70							
-85	90	⊗	Very desne gray silty sand	24	50+							
-85			B.T. @ 90 FT									
-90	95											
-95	100											
-100	105											
-105	110											
-110	115											
-115	120											
-120	125											
-125	130											
-130	135											
-135	140											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL GDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**DATE DRILLED:** 7/21/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.9 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,RS,  
BE(LOGGER)



**BORING NUMBER:** B-4

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**REMARKS:**

**N:** 96489.49 **E:** 1774053.59

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
0	0		Loose red & brown silty sand w/ few grass roots	1	8							
5	5		Loose to very loose brown fine sand w/ small clayey pockets & trace shell	2	8							
				3	3							
0	5		Soft gray sandy organic clay	4	7							
				5	4	61						
	10		Very loose gray fine to medium sand	6	2							
-5			Loose dark brown organic fine to medium sand	7	5	22				5.5		
				8	6							
-10			Loose brownish gray to gray fine to medium sand w/ small amount shell	9	5							
				10	5							
-15				11	15	23						
-20				12	15							
-25			Firm brown to gray fine sand	13	11	21				6.0		
-30				14	WOH	54				27.2		
-35			Very soft gray sandy clay w/ shell	T-1	-							
				15	WOH	34	28	16		73.2		CL
-40				T-2	-							
				16	1	41	42	25		94.4		CL
-45			Very soft to soft gray silty clay w/ trace organics	T-3	-							
				17	3	33	24	9		56.3		CL
-50				18	7	64	114	93				
-55			Medium consistency gray fat clay	19	19	32	34	15				
-60			Very stiff gray silty clay	20	37	30						
			Dense gray silty sand w/ clayey lenses									

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI ALGDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:



**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**DATE DRILLED:** 7/21/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.9 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,RS,  
BE(LOGGER)



**BORING NUMBER:** B-4

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**REMARKS:**

**N:** 96489.49 **E:** 1774053.59

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF GPJ GETI AL GDT 9/19/22

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
-65	70											
			Dense gray silty sand w/ clayey lenses	21	36							
-70	75											
			Very dense gray clayey sand w/ clay lenses	22	54	37						
-75	80											
			Very dense gray silty sand w/ small clayey pockets	23	66							
-80	85											
			B.T. @ 90 FT	24	70							
-85	90											
-90	95											
-95	100											
-100	105											
-105	110											
-110	115											
-115	120											
-120	125											
-125	130											
-130	135											
-140	140											

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/15/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.6 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,RS,  
B3(LOGGER)



**BORING NUMBER:** B-5

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96523.97 **E:** 1774121

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI ALGDT 9/19/22

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T.	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
					N <sub>r</sub>		L.L.	P.I.				
5	0		Loose pale orange fine sand w/ clayey pockets	1	9							
				2	11							
				3	9	13				5.7		
0	5		Firm to loose brown to gray fine to medium sand w/ trace fine gravel & w/ shell increasing with depth	4	4							
				5	6							
	10			6	8	22						
-5			Medium consistency dark gray sandy lean clay w/ shells	7	5	96						
	15			8	1	68	111	91				
-10			Very soft gray lean clay	T-1	-							
	20		Very loose gray fine to medium sand w/ shell & w/ clay pockets	10	2	29				27.0		
-15												
	25			11	22							
-20			Firm brownish gray to gray fine to medium sand									
	30			12	18	21						
-25												
	35		Very soft gray silty clay	13	WOH	32	21	5				
-30												
	40		Very soft gray lean clay w/ trace organics	14	WOH	40	43	25				
-35				T-2	-							
	45		Very soft gray silty clay	15	1	31						
-40				T-3	-							
	50		Very soft gray fat clay w/ silty pockets	16	WOH	41	40	25				
-45												
	55		Very soft gray silty clay	17	1	35	32	13				
-50												
	60		Soft gray fat clay w/ silty pockets	18	3	32						
-55												
	65		Firm gray fine sand w/ silt	19	15	26				7.9		
-60												
	70		Very stiff gray fat clay	20	19	34	31	18				

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/15/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.6 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,RS,  
B3(LOGGER)



**BORING NUMBER:** B-5

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96523.97 **E:** 1774121

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
-65	70		Very stiff gray fat clay									
-70	75	☒	Hard gray silty clay	21	36	29	31	17				
-75	80	☒	Firm gray silty sand w/ clayey lenses	22	21	25						
-80	85	☒	Very stiff gray silty sandy clay	23	29	37	40	26				
-85	90	☒	Hard gray silty clay w/ wood	24	37	64						
-85			B.T. @ 90 FT									
-90	95											
-95	100											
-100	105											
-105	110											
-110	115											
-115	120											
-120	125											
-125	130											
-130	135											
-135	140											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

**Reviewed By:**

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/5/22

**BORING DEPTH:** 65 FT.

**BORING ELEV.:** 5.7 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
RS(LOGGER)



**BORING NUMBER:** B-6

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96521.25 **E:** 1774074.9

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
5	0		Firm light brown fine sand w/ small amount shell fragments & w/ trace crushed stone near surface	1	12							
				2	20							
				3	12	7						
				4	13							
0	5		Very loose light brown fine sand w/ trace shell fragments	5	2							
			Very loose gray fine to medium sand w/ clay pockets & w/ shell fragments	6	3							
-5	10		Very loose dark brown (organic stained) fine to medium sand w/ trace clay in pockets & w/ trace organics and shell fragments	7	3	22				8.7		
				8	3							
-10	15			9	2							
			Very loose gray fine to medium sand w/ clay	10	3	23				8.9		
-15	20											
				11	9							
-20	25											
			Loose gray fine to medium sand w/ small amount shell near 25'	12	10	28				3.3		SP
-25	30											
				13	10							
-30	35											
				14	3	33	32	17				
-35	40											
			Soft to very soft gray silty lean clay	T-1	-	36	36	23		71.7		CL
-40	45			15	WOH	37	38	22				
-45	50		Very loose gray silty clayey sand	T-2	-	27				29.0		
				16	2							
-50	55		Soft greenish gray fat clay	T-3	-							
				17	3	45	61	44				
-55	60		Stiff greenish gray fat clay									
				18	10	43	58	39				
-60	65		Dense light grayish brown fine sand									
				19	32	26						
			B.T. @ 65 FT									
	70											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI ALGDT 9/19/22

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/1/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.4 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-7

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96488.5 **E:** 1774104.65

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>60</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
5	0		Firm dark brown fine sand w/ grass roots & wood	1	13							
			Loose reddish brown fine sand w/ trace organics	2	5							
			Crushed aggregate & dark brown fine sand	3	11							
0	5		Firm light brown fine to medium sand w/ trace shell fragments	4	12							
			Very loose gray fine sand w/ clay layers & shell fragments	5	3							
			Loose brown fine to medium sand & shell fragments	6	2	1629				12.5		
-5	10		Firm gray fine to medium sand w/ some organics below 15'	7	7							
			Loose gray fine to medium sand w/ trace clay in lenses	8	18	24						
-10	15			9	11							
				10	5							
-15	20			11	13	22						
				12	24							
-20	25			13	WOH	33				27.4		
				T-1	-							
-25	30			14	1	33	34	15				
				T-2	-							
-30	35			15	2	34	35	21				
				T-3	-	38	51	34		91.0		CH
-35	40			16	3	32						
				17	3	39	68	47				
-40	45			18	5	38						
				19	11	34	27	14				
-45	50			20	15	46						
-50	55											
-55	60											
-60	65											
-65	70											

MOD DEEP BORING LOG W/O MC & N-E & ELEV 22-166 ALOE BAY WWTF GFI AL GDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/1/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.4 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-7

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96488.5 **E:** 1774104.65

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>1</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
-65	70		Stiff to very stiff gray lean clay w/ small sand pockets (increasing w/ depth) & w/ wood near 69'	21	30	28	34	21				
-70	75											
-75	80		Firm light gray fine sand	22	20	27						
-80	85			23	28							
-85	90			24	30							
-85			B.T. @ 90 FT									
-90	95											
-95	100											
-100	105											
-105	110											
-110	115											
-115	120											
-120	125											
-125	130											
-130	135											
-135	140											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

PROJECT NAME: ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

G.E.T. PROJ. NUMBER: 22-166

PROJECT LOCATION: DAUPHIN ISLAND,  
ALABAMA

DRILL RIG: MOBILE B37

DRILL METHOD: MUD ROTARY

DATE DRILLED: 7/19/22

BORING DEPTH: 90 FT.

BORING ELEV.: 7.8 FT.

DATUM:

WATER DEPTH: 5.0 FT.

DRILL CREW: ES,BT,  
RS(LOGGER)



























BORING NUMBER: B-8

BORING LOCATION:  
SEE SITE / BORING LOCATION PLAN

REMARKS:

N: 96431.56 E: 1774058.37

MOD DEEP BORING LOG W/O NC & N-E & ELEV. 22-166 ALOE BAY WWTF, GPJ, AL, GDT, 9/19/22

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T.	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
					N <sub>i</sub>		L.L.	P.I.				
	0		⊗ Firm orange to pale orange silty clayey sand	1	14							
5			⊗ Firm brown silty fine to medium sand w/ fine gravel	2	10							
	5		⊗ Loose pale orange & gray silty sand	3	16							
			⊗ Very loose gray clayey sand	4	4							
0				5	2	29						
	10			6	3							
-5				7	9							
	15			8	9							
-10			⊗ Very loose to loose brown to gray fine to medium sand w/ trace organics	9	5	21				6.8		
	20			10	8							
-15				11	9							
-20				12	17	20				3.5		SP
-25				13	19							
-30			⊗ Firm brown fine to medium sand	14	25	20						
-35				15	2	37						
-40			⊗ Soft gray lean clay w/ silty lenses	T-1	-	35	41	27		93.5		CL
	50			16	3	32	48	28				
-45				T-2	-							
	55			17	12	29						
-50			⊗ Firm gray silty sand	18	13							
	60			19	16	41	49	33				
-55				20	19	36						
-60			⊗ Very stiff gray silty clay									
	70											

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/19/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 7.8 FT.

**DATUM:**

**WATER DEPTH:** 5.0 FT.

**DRILL CREW:** ES,BT,  
RS(LOGGER)



**BORING NUMBER:** B-8

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96431.56 **E:** 1774058.37

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
-65	70	[Hatched pattern]	Very stiff gray silty clay	21	26	35	38	21				
-75	75											
-80	80	[Dotted pattern]	Firm gray silty sand	22	26	29						
-85	85			23	23							
-90	90			24	28							
-95	95											
-100	100		B.T. @ 90 FT									
-105	105											
-110	110											
-115	115											
-120	120											
-125	125											
-130	130											
-135	135											
-140	140											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:



**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 6/27/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.6 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-9

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96388.3 **E:** 1774148.88

MOD DEEP BORING LOG W/O INC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>1</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
	0		Light brown crushed aggregate & brown fine sand	1	46							
5			firm light brown & brown fine sand w/ small amount organics & w/ clay pockets & shell fragments	2	21							
	5			3	17	15				24.0		
				4	15							
0				5	6							
			Loose to very loose gray fine to medium sand & shell fragments w/ clay lenses	6	2	23				6.5		
-5				7	3							
			Very loose grayish brown & light gray fine sand	8	4							
-10				9	2	25				9.3		
				10	2							
-15												
			Very loose gray to dark gray fine to medium sand w/ trace clay, organics, shell fragments	11	18	21						
-20												
			Firm grayish brown fine to medium sand w/ shell fragments	12	6	38						
-25												
			Loose gray fine to medium sand w/ clay & organics	13	WOH	31						
-30				T-1	-							
				14	4	33	31	17				
-35				T-2	-							
			Soft gray lean clay w/ small amount wood & w/ silt seams	15	3	33	30	8				
-40				T-3	-	46	62	45				
				16	11	39	22	9				
-45												
			Stiff gray lean clay w/ silt seams & trace shell fragments	17	15	37						
-50												
			Firm brown silty sand w/ clay clay layers	18	52	24						
-55												
				19	61							
-60												
			Very dense grayish brown & gray fine sand w/ thin clay layer near 60' and trace shell fragments near 70'	20	47							
-65												
-70												

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 6/27/22

**BORING DEPTH:** 90 FT.

**BORING ELEV.:** 6.6 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-9

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96388.3 **E:** 1774148.88

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>r</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
-65	70											
-70	75	☒		21	62	25						
-75	80	☒	Very dense grayish brown & gray fine sand w/ thin clay layer near 60' and trace shell fragments near 70'	22	57							
-80	85	☒		23	64							
-85	90	☒	B.T. @ 90 FT	24	84	20						
-90	95											
-95	100											
-100	105											
-105	110											
-110	115											
-115	120											
-120	125											
-125	130											
-130	135											
-135	140											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 6/25/22

**BORING DEPTH:** 60 FT.

**BORING ELEV.:** 5.7 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-13

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96543.79 **E:** 1774167.11

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
5	0		Crushed aggregate & brown fine sand	1	14							
			Firm light brown fine sand w/ shell fragments above 3'	2	19	5						
				3	16							
0	5			4	16							
			Loose gray fine to medium sand & shell fragments w/ trace organics	5	9							
-5	10			6	6	21				3.8		SP
				7	3							
-10	15		Very loose brown & gray fine to medium sand w/ small amount shell fragments near 12' & w/ wood near 20'	8	3	23				4.2		SP
				9	2							
-15	20			10	2							
				11	11	23				4.3		SP
-20	25		Firm to loose light brown to grayish brown fine to medium sand w/ clay layers & wood below 25'	12	9	35						
-25	30			13	2	29	28	10				
-30	35		Soft to very soft gray lean clay w/ silt lenses	T-1	-							
				14	1	30	33	18				
-35	40			T-2	-							
				15	6	33	32	10				
-40	45		Medium consistency gray lean clay w/ silt lenses	T-3	-	34	27	11		60.9		CL
				16	7	41	38	21				
-45	50			17	28	28						
-50	55		Firm to dense light brown to light gray fine sand	18	33							
-55	60		B.T. @ 60 FT									
-60	65											
	70											

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 6/23/22

**BORING DEPTH:** 80 FT.

**BORING ELEV.:** 6.0 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-14

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96481.91 **E:** 1774193.46

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
5	0		Firm brown fine sand w/ shell fragments & grass roots	1	27							
			Firm light brown fine sand w/ trace shell & w/ clay lenses	2	19							
0	5		Firm brown fine to medium sand & shell fragments	3	15					5.8		
				4	12	17						
				5	7							
	10		Loose grayish brown fine sand w/ clay lenses & shell fragments (decreasing with depth)	6	8	21						
-5			Medium consistency gray sandy clay	7	4	30				27.7		
	15		Very loose dark brown (organic stained) fine sand w/ trace organics	8	3	21						
-10				9	2							
	20		Very loose gray fine to medium sand w/ clayey lenses & small amount of wood	10	3	29				8.5		
-15				11	18	23						
-20	25		Firm light brown fine to medium sand w/ small amount shell fragments	12	4	27						
-25	30		Loose gray fine to medium sand w/ clay lenses w/ wood	13	WOH	30	24	4				
-30	35		Very soft gray silty sandy clay w/ silty sand pockets	T-1	-	49	51	34		94.4		CH
				14	WOH	28	29	14				
-35	40		Very soft gray silty clay	T-2	-							
	45		Soft gray clay w/ silt lenses	15	4	36	40	24				
-40				T-3	-							
-45	50		Loose gray silty sand w/ layer of fat clay near 54'	16	6	30						
				17	7	33						
-50	55			18	17							
-55	60			19	22							
-60	65		Firm to dense light gray & light brown to gray fine sand w/ small amount organics near 69'	20	15	37						
	70											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WASTE GPJ GETJ AL GDT 9/19/22

NOTE: The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 6/23/22

**BORING DEPTH:** 80 FT.

**BORING ELEV.:** 6.0 FT.

**DATUM:**

**WATER DEPTH:**

**DRILL CREW:** ES,BT,  
BE(LOGGER)



**BORING NUMBER:** B-14

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96481.91 **E:** 1774193.46

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>f</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							LL.	P.I.				
-65	70	[Soil Profile Diagram]	Firm to dense light gray & light brown to gray fine sand w/ small amount organics near 69'	21	22							
-70	75											
-75	80			22	49	28						
			B.T. @ 80 FT									
-80	85											
-85	90											
-90	95											
-95	100											
-100	105											
-105	110											
-110	115											
-115	120											
-120	125											
-125	130											
-130	135											
-140	140											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTFF.GPJ GETI ALGDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:

**PROJECT NAME:** ALOE BAY WATER  
QUALITY ENHANCEMENT WASTEWATER  
TREATMENT FACILITY

**G.E.T. PROJ. NUMBER:** 22-166

**PROJECT LOCATION:** DAUPHIN ISLAND,  
ALABAMA

**DRILL RIG:** MOBILE B37

**DRILL METHOD:** MUD ROTARY

**REMARKS:**

**DATE DRILLED:** 7/19/22

**BORING DEPTH:** 40 FT.

**BORING ELEV.:** 5.9 FT.

**DATUM:**

**WATER DEPTH:** 4.0 FT.

**DRILL CREW:** ES,BT,  
RS(LOGGER)



**BORING NUMBER:** B-15

**BORING LOCATION:**  
SEE SITE / BORING LOCATION PLAN

**N:** 96324.16 **E:** 1774043.78

ELEV IN FEET	DEPTH IN FEET	LOG	DESCRIPTION	SAMPLE NO.	S.P.T. N <sub>t</sub>	W.C. %	ATTERBERG LIMITS		DRY UNIT WT. pcf	% MINUS #200	SHEAR STRENGTH tsf	UNIFIED CLASS
							L.L.	P.I.				
5	0			1	15							
				2	17							
			Firm light brown fine sand	3	12	17				6.6		
	5			4	10							
0				5	2							
				6	3							
-5	10			7	3	22				5.4		
			Very loose dark brown & grayish brown fine to medium sand w/ trace shell	8	7							
-10	15			9	2							
				10	3	23				6.0		
-15	20											
				11	16							
-20	25											
				12	13	59						
-25	30		Firm grayish brown to gray fine to medium sand w/ small pockets of organics & organic clay									
				13	14							
-30	35											
				14	12	23						
-35	40		B.T. @ 40 FT									
-40	45											
-45	50											
-50	55											
-55	60											
-60	65											
-65	70											

MOD DEEP BORING LOG W/O NC & N-E & ELEV 22-166 ALOE BAY WWTF.GPJ GETI AL.GDT 9/19/22

**NOTE:** The stratification lines shown represent the approximate boundary between soil types and the transition may be gradual. The groundwater level stated is for conditions at the time of boring and the level may fluctuate large amounts for other conditions or seasons.

Reviewed By:



**APPENDIX D**

**LABORATORY TEST REPORTS**



Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (If hydrometer data available)		D <sub>50</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96586.1 E: 1773917.08	B-1	5	6.5	25				0.0	85.9	14.1		0.425		
N: 96586.1 E: 1773917.08	B-1	10	19.0	18				0.0	90.7	9.3		0.482		
N: 96586.1 E: 1773917.08	B-1	13	34.0	26				0.0	90.1	9.9		0.475		
N: 96586.1 E: 1773917.08	B-1	14	39.0	37	43	11	32							
N: 96586.1 E: 1773917.08	B-1	15	44.0	25				0.0	72.6	27.4		0.273		
N: 96586.1 E: 1773917.08	B-1	16	49.0	65	99	23	76							
N: 96586.1 E: 1773917.08	B-1	T-2	51.5	64	93	22	71	0.0	1.7	98.3			CH	A-7-6 (80)
N: 96586.1 E: 1773917.08	B-1	17	54.0	61	98	27	71							
N: 96586.1 E: 1773917.08	B-1	18	59.0	26										
N: 96586.1 E: 1773917.08	B-1	20	69.0	25										
N: 96606.89 E: 1773982.29	B-2	4	5.0	23				0.0	97.7	2.3		0.568	SP	
N: 96606.89 E: 1773982.29	B-2	8	14.0	19				0.0	94.3	5.7		0.526		
N: 96606.89 E: 1773982.29	B-2	11	24.0	21				4.5	92.5	3.0		0.618	SP	
N: 96606.89 E: 1773982.29	B-2	13	34.0	31				0.0	77.6	22.4		0.328		
N: 96606.89 E: 1773982.29	B-2	15	44.0	30				0.0	59.0	41.0		0.141		
N: 96606.89 E: 1773982.29	B-2	16	49.0	26				0.0	66.4	33.6		0.208		



# SOIL CLASSIFICATION SUMMARY

GET PROJECT NUMBER: 22-166  
PROJECT NAME: ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE



Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (if hydrometer data available)		D <sub>30</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96606.89 E: 1773982.29	B-2	17	54.0	40	48	18	30							
N: 96606.89 E: 1773982.29	B-2	18	59.0	33	29	23	6							
N: 96566 E: 1774060.87	B-3	2	2.0	6										
N: 96566 E: 1774060.87	B-3	7	11.5	23				4.2	88.4	7.3		0.384		
N: 96566 E: 1774060.87	B-3	11	24.0	21										
N: 96566 E: 1774060.87	B-3	13	34.0	26				0.0	86.2	13.8		0.428		
N: 96566 E: 1774060.87	B-3	14	39.0	29				2.3	42.1	55.6				
N: 96566 E: 1774060.87	B-3	15	44.0	32	54	18	36							
N: 96566 E: 1774060.87	B-3	T-2	46.5	35	35	16	19	0.0	5.3	94.7			CL	A-6 (18)
N: 96566 E: 1774060.87	B-3	16	49.0	40	40	19	21							
N: 96566 E: 1774060.87	B-3	17	54.0	26				0.0	72.6	27.4		0.272		
N: 96566 E: 1774060.87	B-3	18	59.0	34	62	17	45							
N: 96566 E: 1774060.87	B-3	19	64.0	25	33	16	17							
N: 96566 E: 1774060.87	B-3	20	69.0	31	26	17	9							
N: 96566 E: 1774060.87	B-3	21	74.0	24										
N: 96489.49 E: 1774053.59	B-4	5	6.5	61										



#### SOIL CLASSIFICATION SUMMARY

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PROJECT NAME: ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE



Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (if hydrometer data available)		D <sub>50</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96523.97 E: 1774121	B-5	12	29.0	21										
N: 96523.97 E: 1774121	B-5	13	34.0	32	21	16	5							
N: 96523.97 E: 1774121	B-5	14	39.0	40	43	18	25							
N: 96523.97 E: 1774121	B-5	15	44.0	31										
N: 96523.97 E: 1774121	B-5	16	49.0	41	40	15	25							
N: 96523.97 E: 1774121	B-5	17	54.0	35	32	19	13							
N: 96523.97 E: 1774121	B-5	18	59.0	32										
N: 96523.97 E: 1774121	B-5	19	64.0	26				0.0	92.1	7.9		0.499		
N: 96523.97 E: 1774121	B-5	20	69.0	34	31	13	18							
N: 96523.97 E: 1774121	B-5	21	74.0	29	31	14	17							
N: 96523.97 E: 1774121	B-5	22	79.0	25										
N: 96523.97 E: 1774121	B-5	23	84.0	37	40	14	26							
N: 96523.97 E: 1774121	B-5	24	89.0	64										
N: 96521.25 E: 1774074.9	B-6	3	3.5	7										
N: 96521.25 E: 1774074.9	B-6	7	11.5	22				0.0	91.3	8.7		0.49		
N: 96521.25 E: 1774074.9	B-6	10	19.0	23				0.0	91.1	8.9		0.487		



# SOIL CLASSIFICATION SUMMARY

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WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE

Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (Hydrometer data available)		D <sub>50</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96521.25 E: 1774074.9	B-6	12	29.0	28				0.0	96.7	3.3		0.556	SP	
N: 96521.25 E: 1774074.9	B-6	14	39.0	33	32	15	17							
N: 96521.25 E: 1774074.9	B-6	T-1	41.5	36	36	13	23	0.0	28.3	71.7			CL	A-6 (14)
N: 96521.25 E: 1774074.9	B-6	15	44.0	37	38	16	22							
N: 96521.25 E: 1774074.9	B-6	16	49.0	27				0.0	71.0	29.0		0.256		
N: 96521.25 E: 1774074.9	B-6	17	54.0	45	61	17	44							
N: 96521.25 E: 1774074.9	B-6	18	59.0	43	58	19	39							
N: 96521.25 E: 1774074.9	B-6	19	64.0	26										
N: 96488.5 E: 1774104.65	B-7	6	9.0	1629				18.6	69.0	12.5		0.717		
N: 96488.5 E: 1774104.65	B-7	8	14.0	24										
N: 96488.5 E: 1774104.65	B-7	11	24.0	22										
N: 96488.5 E: 1774104.65	B-7	13	34.0	33				0.0	72.6	27.4		0.273		
N: 96488.5 E: 1774104.65	B-7	14	39.0	33	34	19	15							
N: 96488.5 E: 1774104.65	B-7	15	44.0	34	35	14	21							
N: 96488.5 E: 1774104.65	B-7	T-3	46.5	38	51	17	34	0.0	9.0	91.0			CH	A-7-6 (33)
N: 96488.5 E: 1774104.65	B-7	16	49.0	32										



# SOIL CLASSIFICATION SUMMARY

GET PROJECT NUMBER: 22-166  
PROJECT NAME: ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE

Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (if hydrometer data available)		D <sub>50</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96488.5 E: 1774104.65	B-7	17	54.0	39	68	21	47							
N: 96488.5 E: 1774104.65	B-7	18	59.0	38										
N: 96488.5 E: 1774104.65	B-7	19	64.0	34	27	13	14							
N: 96488.5 E: 1774104.65	B-7	20	69.0	46										
N: 96488.5 E: 1774104.65	B-7	21	74.0	28	34	13	21							
N: 96488.5 E: 1774104.65	B-7	22	79.0	27										
N: 96431.56 E: 1774058.37	B-8	5	6.5	29										
N: 96431.56 E: 1774058.37	B-8	9	16.5	21				0.0	93.2	6.8		0.512		
N: 96431.56 E: 1774058.37	B-8	12	29.0	20				4.6	91.9	3.5		0.611	SP	
N: 96431.56 E: 1774058.37	B-8	14	39.0	20										
N: 96431.56 E: 1774058.37	B-8	15	44.0	37										
N: 96431.56 E: 1774058.37	B-8	T-1	46.5	35	41	14	27	0.0	6.5	93.5			CL	A-7-6 (25)
N: 96431.56 E: 1774058.37	B-8	16	49.0	32	48	20	28							
N: 96431.56 E: 1774058.37	B-8	17	54.0	29										
N: 96431.56 E: 1774058.37	B-8	19	64.0	41	49	16	33							
N: 96431.56 E: 1774058.37	B-8	20	69.0	36										



### SOIL CLASSIFICATION SUMMARY

GET PROJECT NUMBER: 22-166  
PROJECT NAME: ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE

Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (if hydrometer data available)		D <sub>50</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96431.56 E: 1774058.37	B-8	21	74.0	35	38	17	21							
N: 96431.56 E: 1774058.37	B-8	22	79.0	29										
N: 96388.3 E: 1774148.88	B-9	3	3.5	15				0.1	75.9	24.0		0.311		
N: 96388.3 E: 1774148.88	B-9	6	9.0	23				9.7	83.8	6.5		0.645		
N: 96388.3 E: 1774148.88	B-9	9	16.5	25				0.0	90.7	9.3		0.483		
N: 96388.3 E: 1774148.88	B-9	11	24.0	21										
N: 96388.3 E: 1774148.88	B-9	12	29.0	38										
N: 96388.3 E: 1774148.88	B-9	13	34.0	31										
N: 96388.3 E: 1774148.88	B-9	14	39.0	33	31	14	17							
N: 96388.3 E: 1774148.88	B-9	15	44.0	33	30	22	8							
N: 96388.3 E: 1774148.88	B-9	T-3	46.5	46	62	17	45							
N: 96388.3 E: 1774148.88	B-9	16	49.0	39	22	13	9							
N: 96388.3 E: 1774148.88	B-9	17	54.0	37										
N: 96388.3 E: 1774148.88	B-9	18	59.0	24										
N: 96388.3 E: 1774148.88	B-9	21	74.0	25										
N: 96388.3 E: 1774148.88	B-9	24	89.0	20										



# SOIL CLASSIFICATION SUMMARY

GET PROJECT NUMBER: 22-166  
PROJECT NAME: ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE

Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (if hydrometer data available)		D <sub>50</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96543.79 E: 1774167.11	B-13	2	2.0	5										
N: 96543.79 E: 1774167.11	B-13	6	9.0	21				8.6	87.6	3.8		0.67	SP	
N: 96543.79 E: 1774167.11	B-13	8	14.0	23				0.0	95.8	4.2		0.545	SP	
N: 96543.79 E: 1774167.11	B-13	11	24.0	23				0.0	95.7	4.3		0.544	SP	
N: 96543.79 E: 1774167.11	B-13	12	29.0	35										
N: 96543.79 E: 1774167.11	B-13	13	34.0	29	28	18	10							
N: 96543.79 E: 1774167.11	B-13	14	39.0	30	33	15	18							
N: 96543.79 E: 1774167.11	B-13	15	44.0	33	32	22	10							
N: 96543.79 E: 1774167.11	B-13	T-3	46.5	34	27	16	11	0.0	39.1	60.9			CL	A-6 (4)
N: 96543.79 E: 1774167.11	B-13	16	49.0	41	38	17	21							
N: 96543.79 E: 1774167.11	B-13	17	54.0	28										
N: 96481.91 E: 1774193.46	B-14	4	5.0	17				14.7	79.5	5.8		0.754		
N: 96481.91 E: 1774193.46	B-14	6	9.0	21										
N: 96481.91 E: 1774193.46	B-14	7	11.5	30				0.0	72.3	27.7		0.27		
N: 96481.91 E: 1774193.46	B-14	8	14.0	21										
N: 96481.91 E: 1774193.46	B-14	10	19.0	29				1.2	90.3	8.5		0.505		



# SOIL CLASSIFICATION SUMMARY

GET PROJECT NUMBER: 22-166  
PROJECT NAME: ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE

Boring Location	Boring No.	Sample ID	Depth (ft)	Water Content (%)	Atterberg Limits			% Gravel	% Sand	% Passing 200 (if hydrometer data available)		D <sub>50</sub> (mm)	USCS	AASHTO Class
					LL	PL	PI			% Silt	% Clay			
N: 96481.91 E: 1774193.46	B-14	11	24.0	23										
N: 96481.91 E: 1774193.46	B-14	12	29.0	27										
N: 96481.91 E: 1774193.46	B-14	13	34.0	30	24	20	4							
N: 96481.91 E: 1774193.46	B-14	T-1	36.5	49	51	17	34	0.0	5.6	94.4			CH	A-7-6 (34)
N: 96481.91 E: 1774193.46	B-14	14	39.0	28	29	15	14							
N: 96481.91 E: 1774193.46	B-14	15	44.0	36	40	16	24							
N: 96481.91 E: 1774193.46	B-14	16	49.0	30										
N: 96481.91 E: 1774193.46	B-14	17	54.0	33										
N: 96481.91 E: 1774193.46	B-14	20	69.0	37										
N: 96481.91 E: 1774193.46	B-14	22	79.0	28										
N: 96324.16 E: 1774043.78	B-15	3	3.5	17				3.3	90.1	6.6		0.553		
N: 96324.16 E: 1774043.78	B-15	7	11.5	22				5.0	89.6	5.4		0.592		
N: 96324.16 E: 1774043.78	B-15	10	19.0	23				0.5	93.6	6.0		0.528		
N: 96324.16 E: 1774043.78	B-15	12	29.0	59										
N: 96324.16 E: 1774043.78	B-15	14	39.0	23										

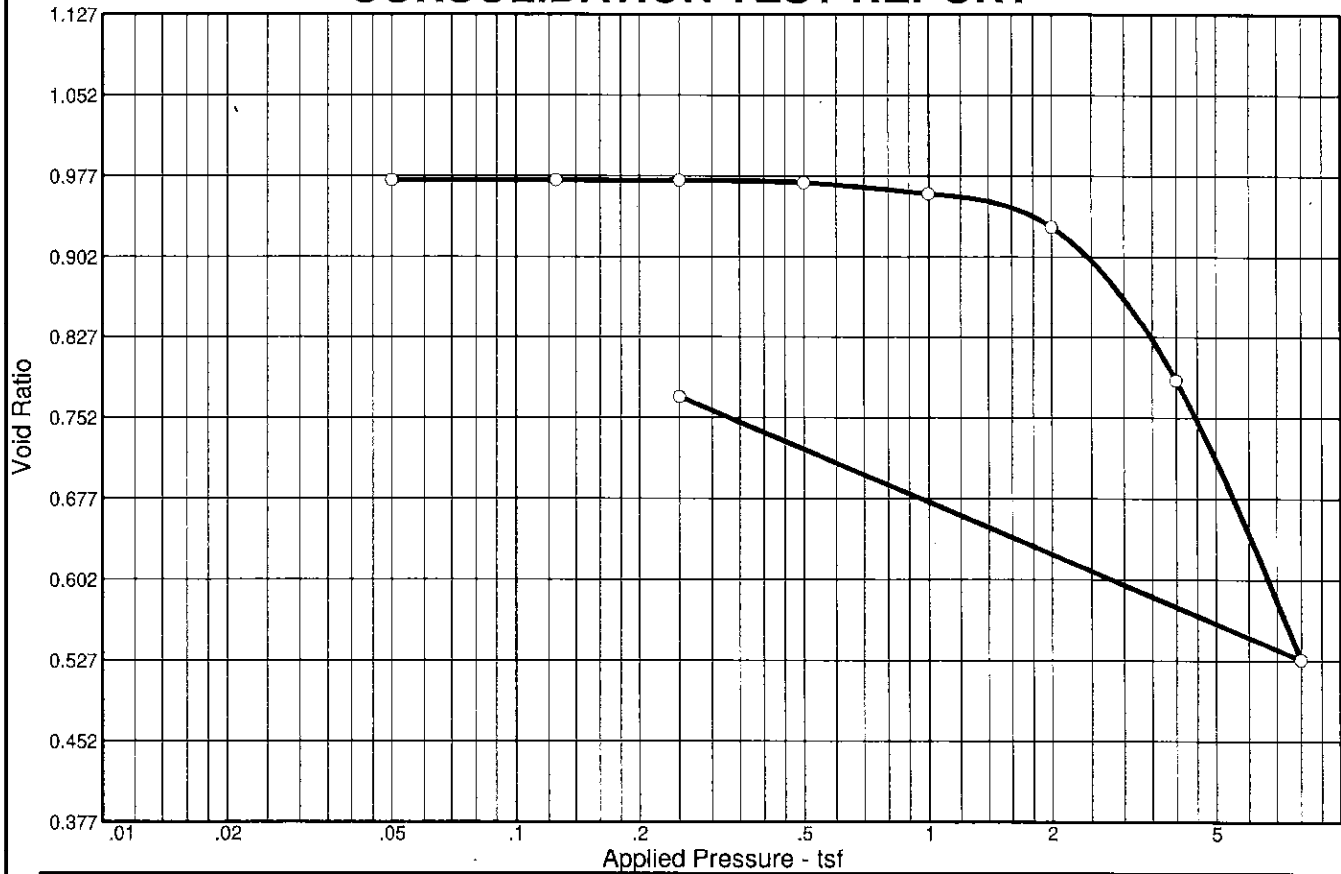


# SOIL CLASSIFICATION SUMMARY

GET PROJECT NUMBER: 22-166  
PROJECT NAME: ALOE BAY WATER QUALITY ENHANCEMENT  
WASTEWATER TREATMENT FACILITY  
COUNTY: MOBILE



# CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$
5	1.00	0.20									
6	2.00	0.18	0.001								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	$P_c$ (tsf)	Initial Void Ratio
Saturation	Moisture							
130.9 %	64.4 %	62.4	93	71	1.98		2.96	0.973

MATERIAL DESCRIPTION	USCS	AASHTO
Bluish Gray SILTY CLAY	CH	

<b>Project No.</b> 22-166 <b>Client:</b> ARDURRA <b>Project:</b> ALOE BAY WATER QAULTY ENHANCMENT WASTEWATER TREATMENT FACILITY <b>Source:</b> <b>Sample No.:</b> B-1, T-2 <b>Elev./Depth:</b> 51.5' - 53.5'	<b>Remarks:</b> 08-10-2022
<b>Geotechnical Engineering-Testing, Inc.</b> <b>Mobile, AL</b>	

Figure

# Dial Reading vs. Time

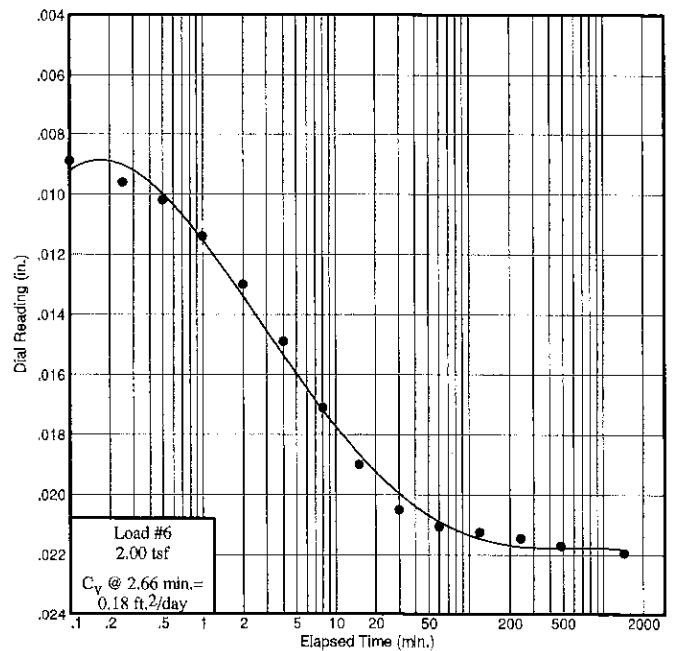
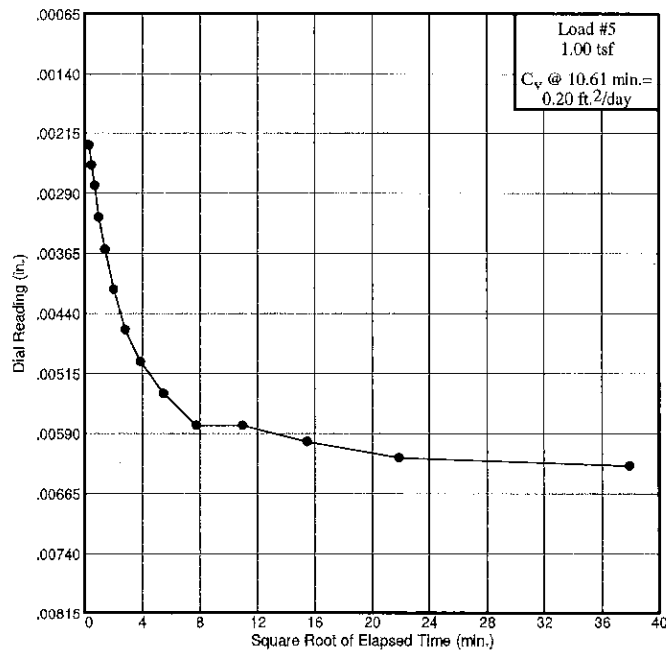
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-1, T-2

Elev./Depth: 51.5' - 53.5'

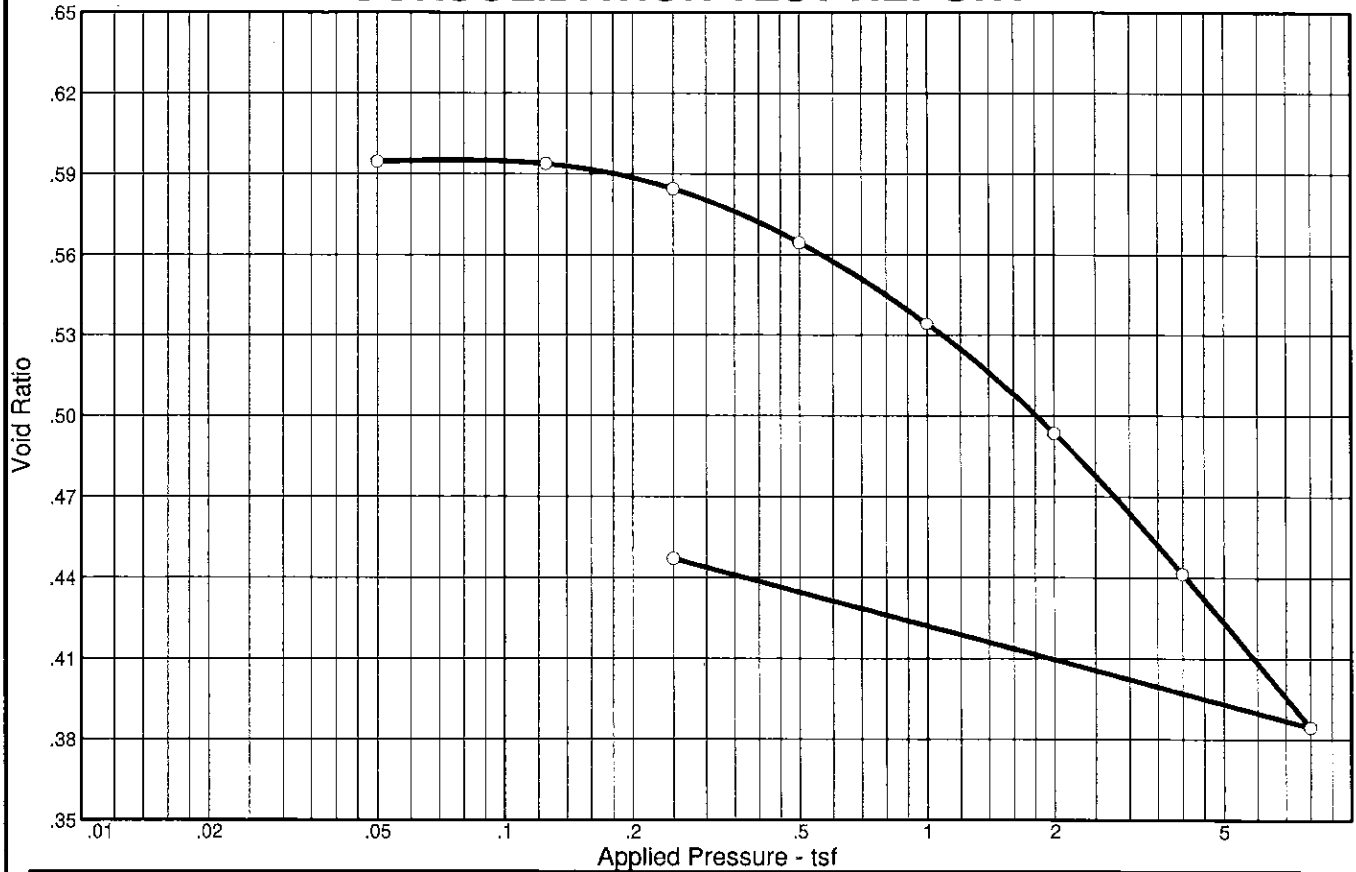


Geotechnical Engineering-Testing, Inc.

Mobile, AL

Figure

# CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$
5	1.00	1.11	0.002								
6	2.00	1.00	0.003								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	$P_c$ (tsf)	Initial Void Ratio
Saturation	Moisture							
122.4 %	35.4 %	82.1	35	19	2.06		0.82	0.595

MATERIAL DESCRIPTION	USCS	AASHTO
Gray SILTY CLAY with SAND pockets	CL	

<b>Project No.</b> 22-166 <b>Client:</b> ARDURRA <b>Project:</b> ALOE BAY WATER QAULTY ENHANCMENT WASTEWATER TREATMENT FACILITY <b>Source:</b> <b>Sample No.:</b> B-3, T-2 <b>Elev./Depth:</b> 46.5' - 48.5' <div style="text-align: center; border: 1px solid black; padding: 5px;"> <b>Geotechnical Engineering-Testing, Inc.</b>  <b>Mobile, AL</b> </div>	<b>Remarks:</b> 08-10-2022   <div style="text-align: right; border-top: 1px solid black; padding-top: 5px;"> <b>Figure</b> </div>
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## Dial Reading vs. Time

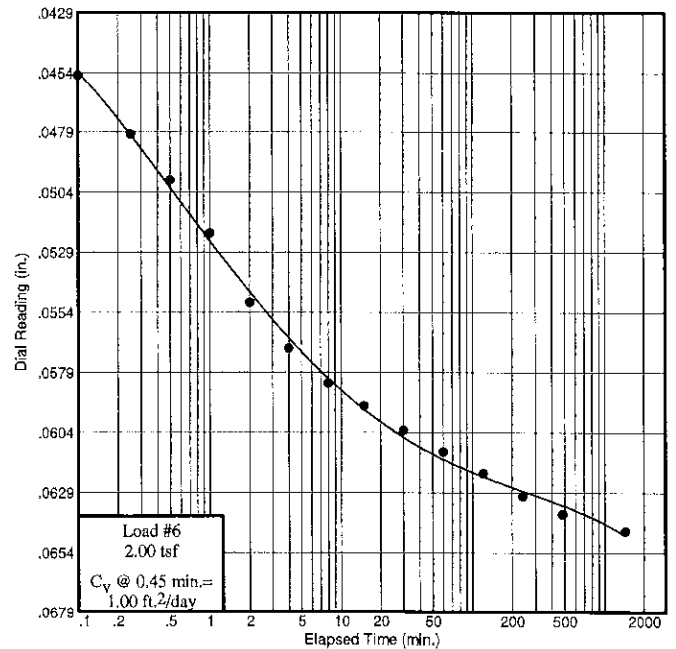
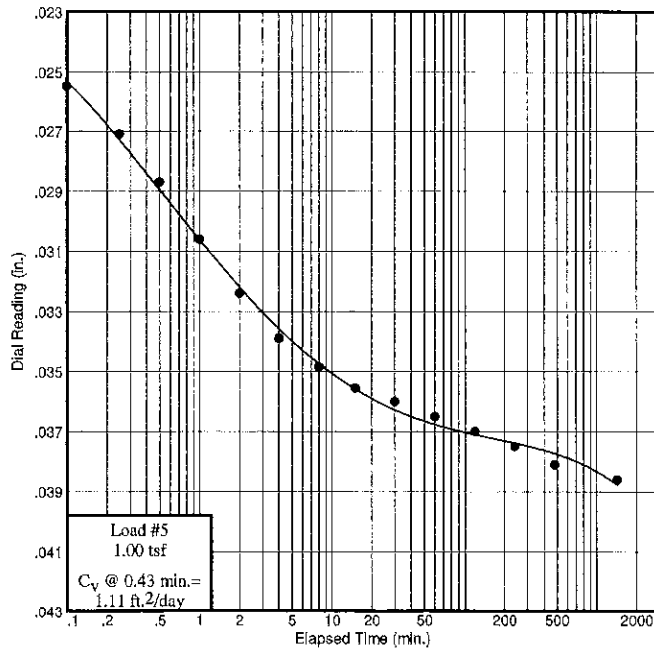
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-3, T-2

Elev./Depth: 46.5' - 48.5'

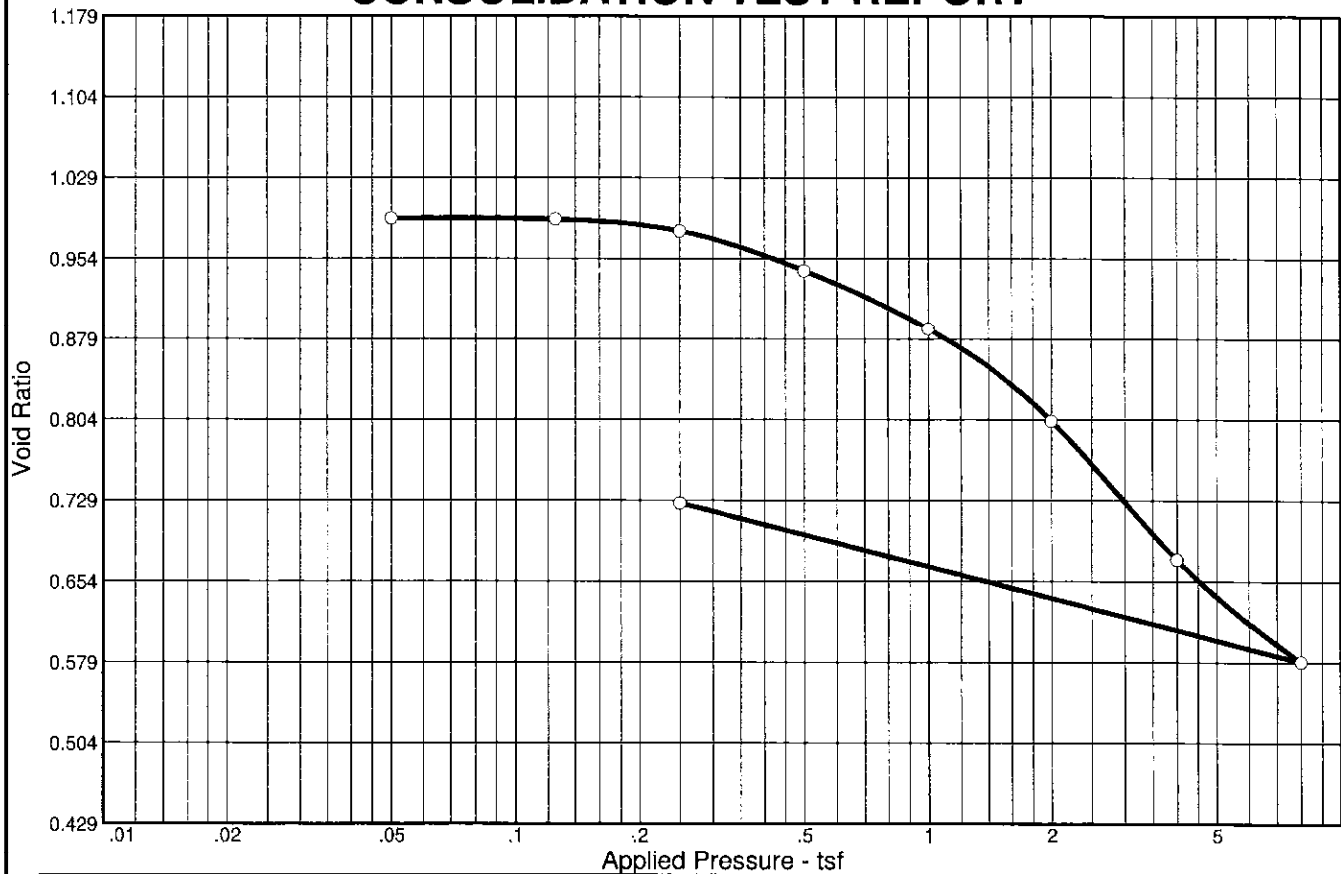


Geotechnical Engineering-Testing, Inc.

Mobile, AL

Figure

# CONSOLIDATION TEST REPORT



<b>Coefficients of Consolidation and Secondary Consolidation</b>											
<b>No.</b>	<b>Load (tsf)</b>	<b>C<sub>v</sub> (ft.<sup>2</sup>/day)</b>	<b>C<sub>α</sub></b>	<b>No.</b>	<b>Load (tsf)</b>	<b>C<sub>v</sub> (ft.<sup>2</sup>/day)</b>	<b>C<sub>α</sub></b>	<b>No.</b>	<b>Load (tsf)</b>	<b>C<sub>v</sub> (ft.<sup>2</sup>/day)</b>	<b>C<sub>α</sub></b>
5	1.00	0.09	0.003								
6	2.00	0.04	0.003								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P <sub>c</sub> (tsf)	Initial Void Ratio
Saturation	Moisture							
88.4 %	35.9 %	81.4	36	23	2.44		0.41	0.991

MATERIAL DESCRIPTION	USCS	AASHTO
Very Soft Gray CLAY with SAND pockets	CL	

Project No. 22-166

**Client:** ARDURRA

**Project:** ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

**Source:**

**Sample No.:** B-6, T-1

**Elev./Depth:** 41.5' - 43.5'

**Geotechnical Engineering-Testing, Inc.**

## Mobile, AL

Remarks:

08-10-2022

### Figure

## Dial Reading vs. Time

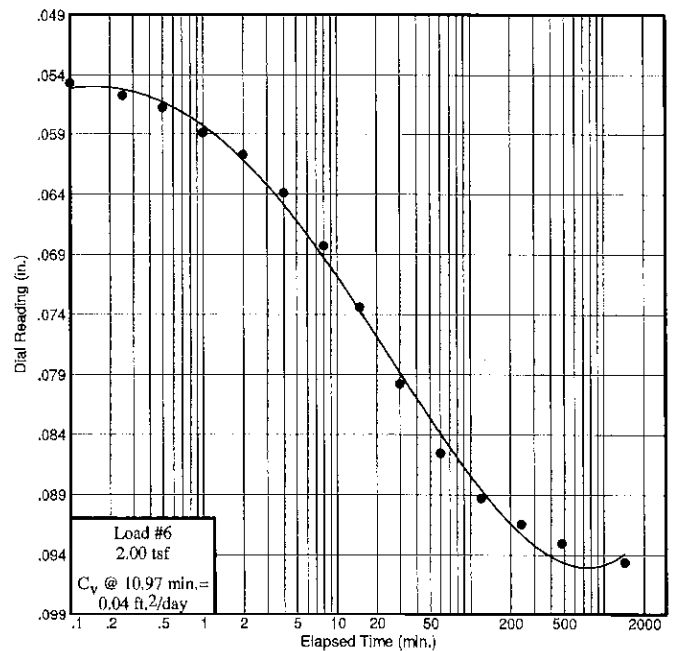
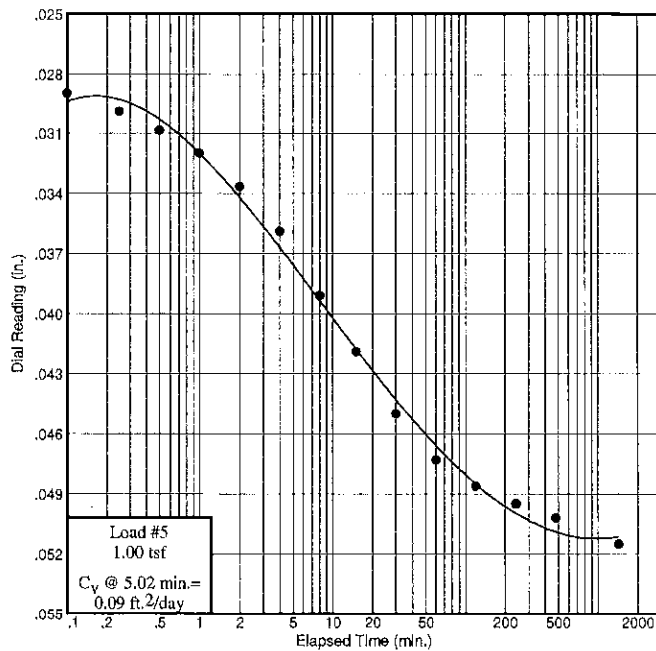
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-6, T-1

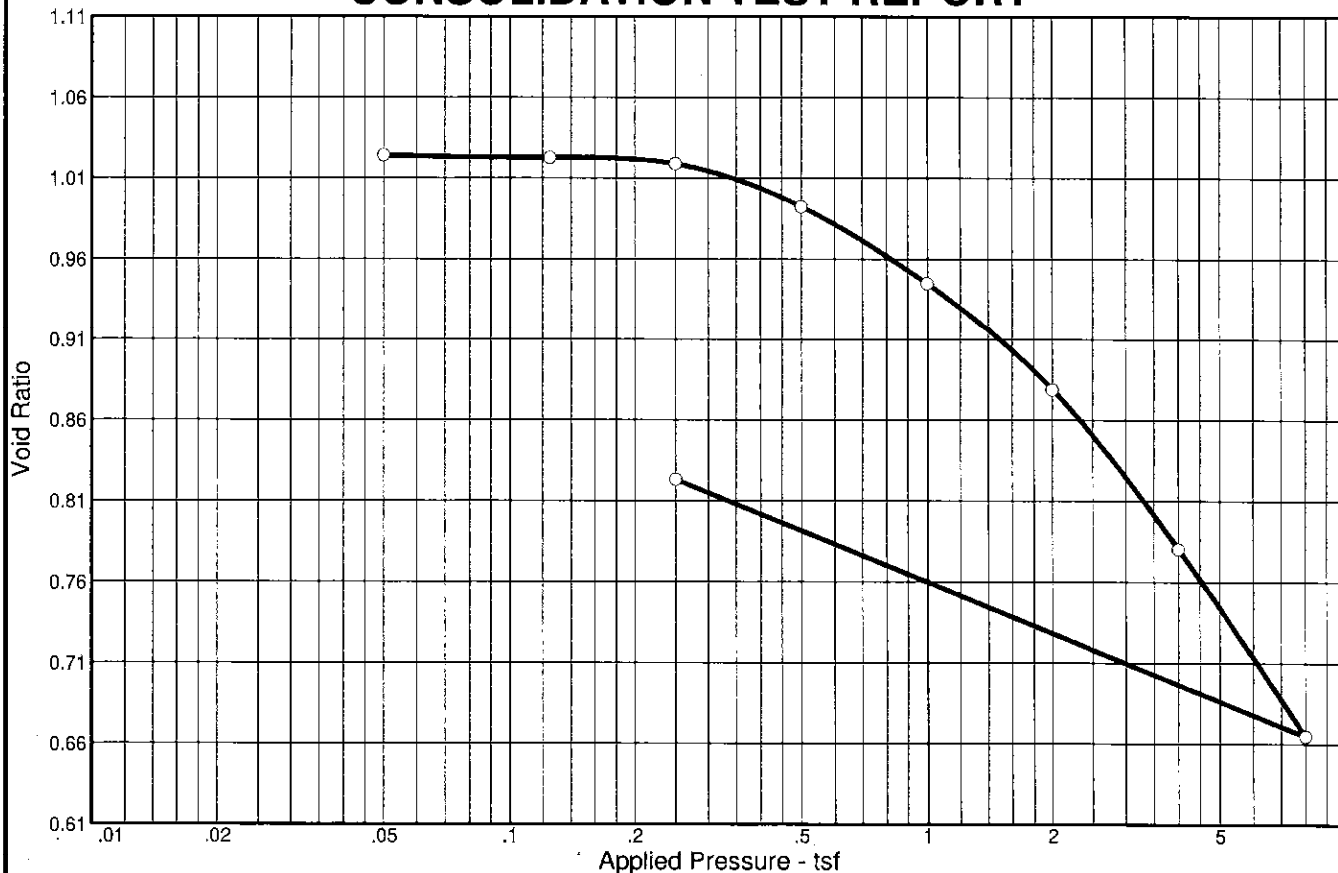
Elev./Depth: 41.5' - 43.5'



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Mobile, AL

Figure

# CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$
5	1.00	0.04	0.001								
6	2.00	0.04	0.001								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	$P_c$ (tsf)	Initial Void Ratio
Saturation	Moisture							
94.6 %	38.1 %	81.6	51	34	2.65		1.05	1.066

MATERIAL DESCRIPTION	USCS	AASHTO
Gray CLAY	CH	

<b>Project No.</b> 22-166 <b>Client:</b> ARDURRA <b>Project:</b> ALOE BAY WATER QAULTY ENHANCMENT WASTEWATER TREATMENT FACILITY <b>Source:</b> <b>Sample No.:</b> B-7, T-3 <b>Elev./Depth:</b> 46.5' - 48.5'	<b>Remarks:</b> 08-11-2022
<b>Geotechnical Engineering-Testing, Inc.</b> <b>Mobile, AL</b>	
<b>Figure</b>	

## Dial Reading vs. Time

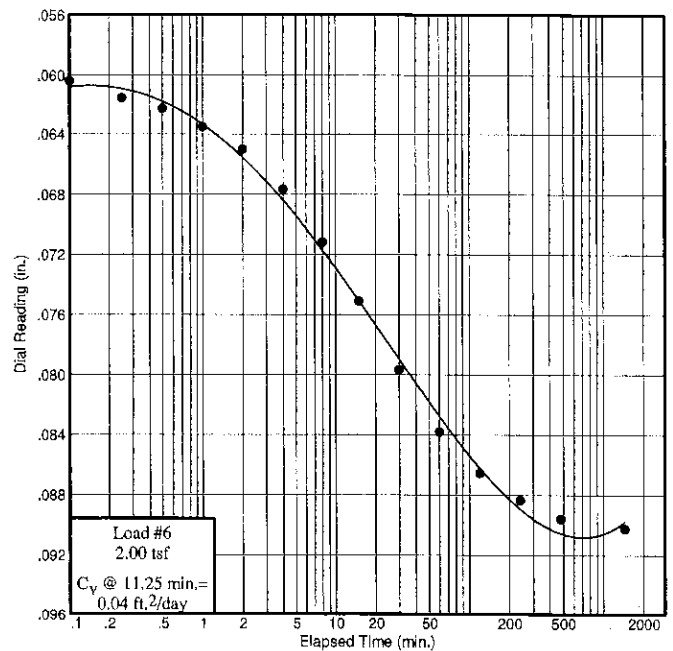
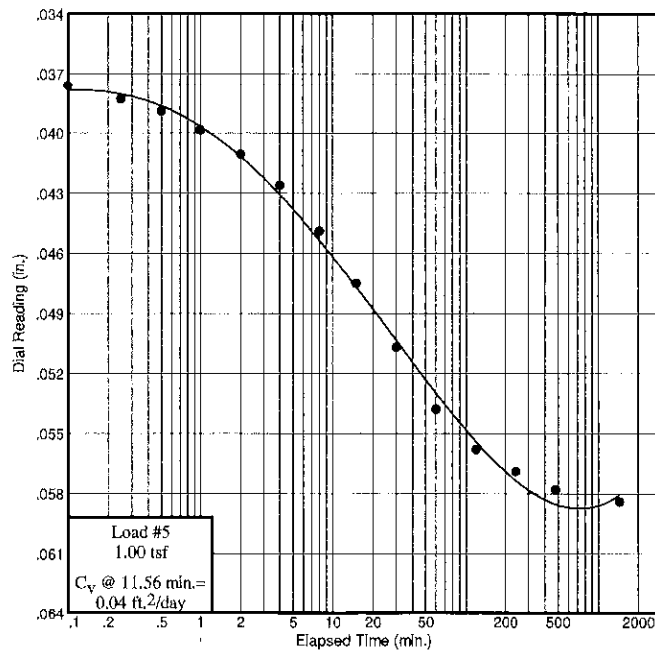
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-7, T-3

Elev./Depth: 46.5' - 48.5'



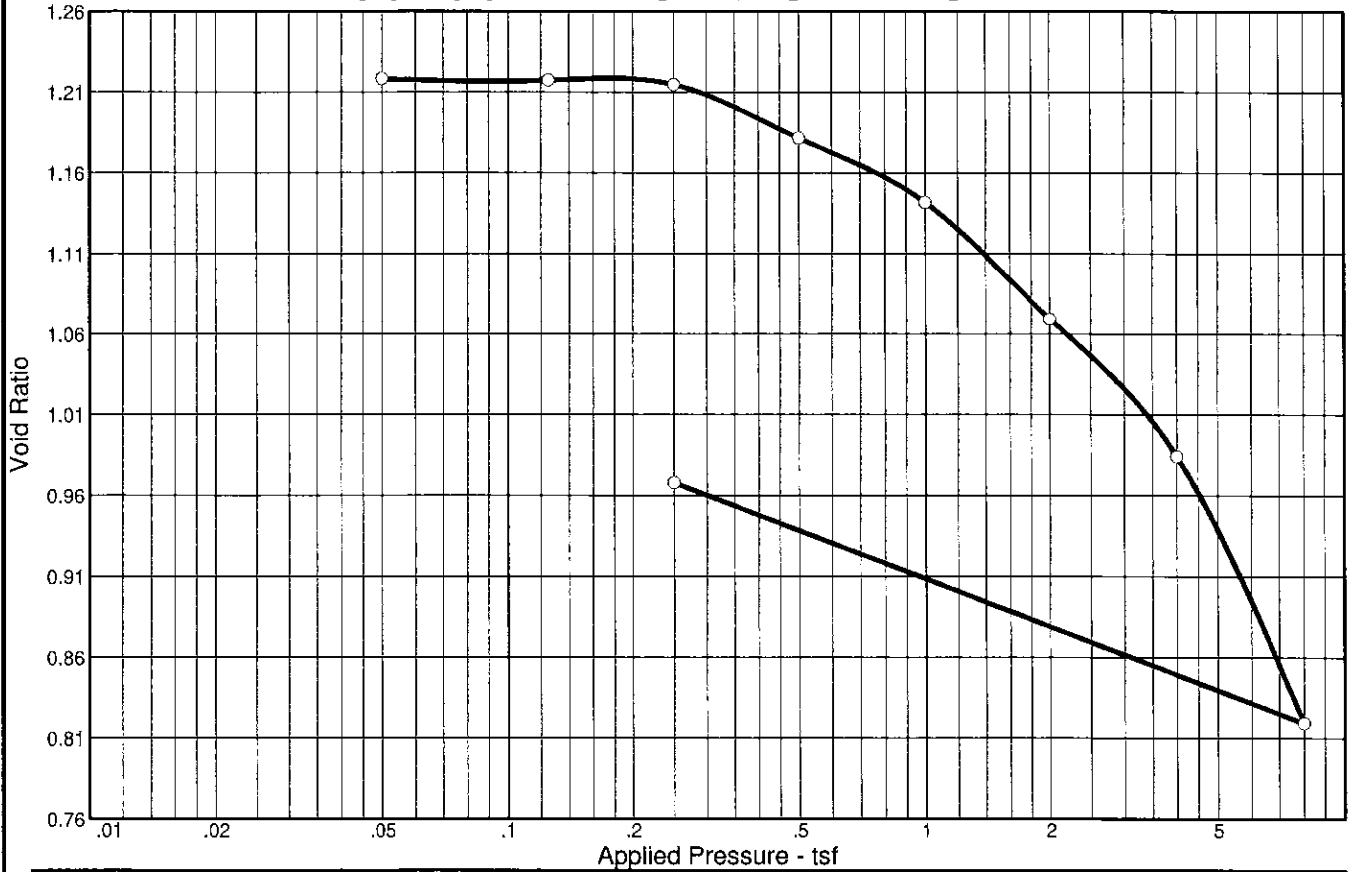
Geotechnical Engineering-Testing, Inc.

Mobile, AL

Figure



# CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$
5	1.00	0.25	0.001								
6	2.00	0.10	0.001								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P <sub>C</sub> (tsf)	Initial Void Ratio
Saturation	Molsture							
81.7 %	35.1 %	82.6	41	27	2.83		1.82	1.218

MATERIAL DESCRIPTION	USCS	AASHTO
Gray CLAY with SAND pockets		

### Figure

08-11-2022

**Source:**

**Sample No.:** B-8, T-1

**Elev./Depth: 46.5' - 48.5'**

**Geotechnical Engineering-Testing, Inc.**

**Mobile, AL**

### Figure

## Dial Reading vs. Time

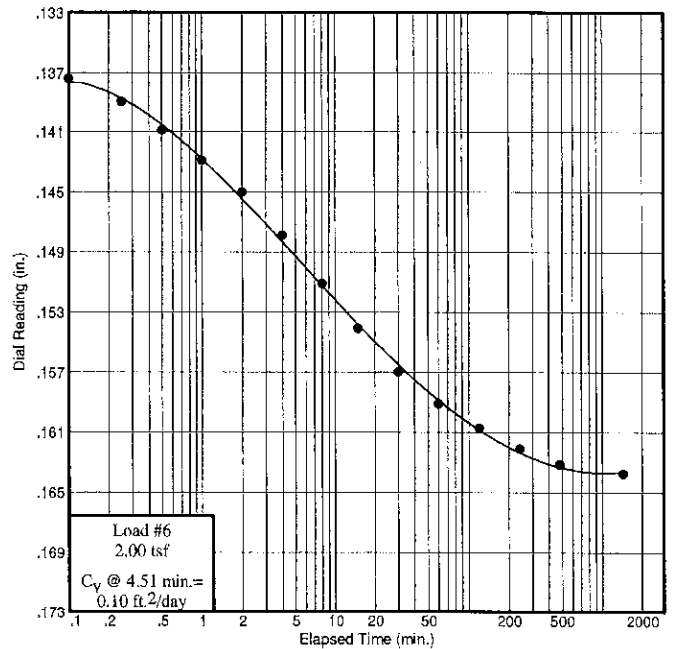
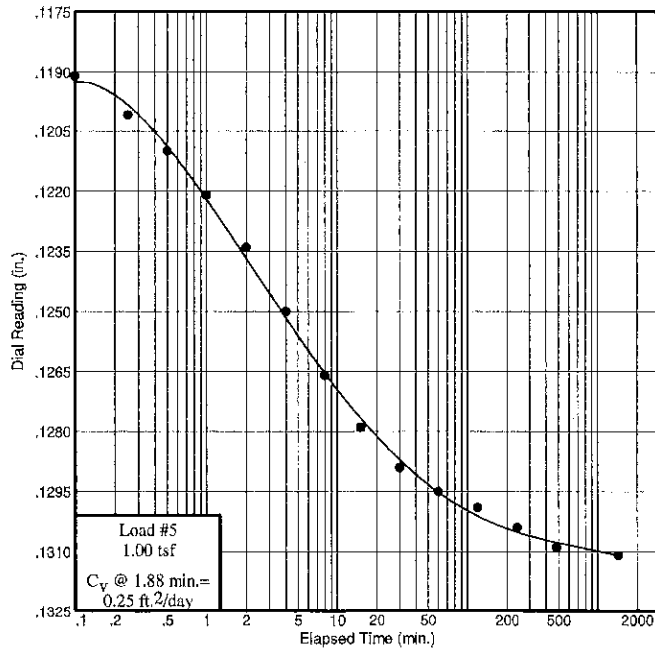
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-8, T-1

Elev./Depth: 46.5' - 48.5'

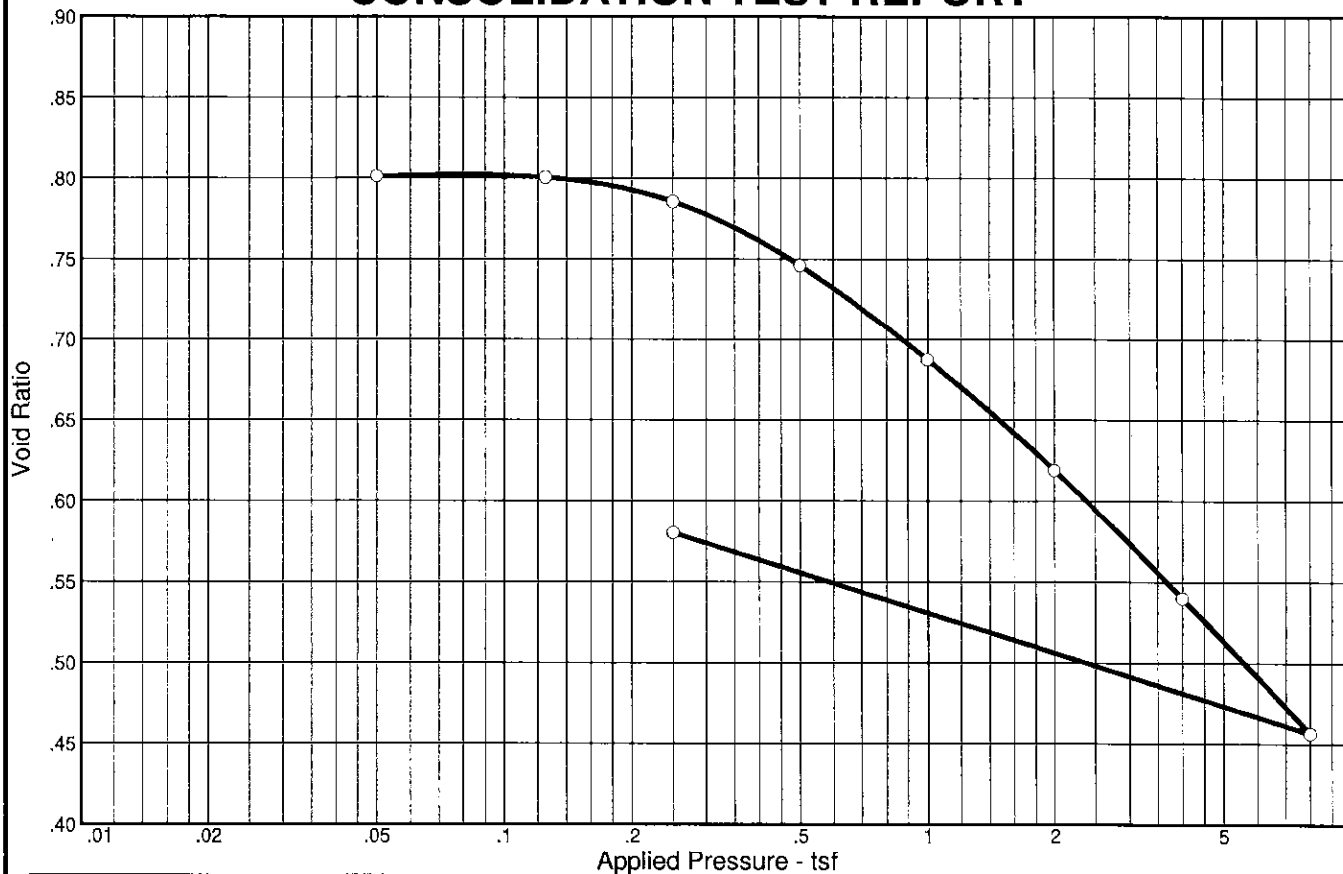


Geotechnical Engineering-Testing, Inc.

Mobile, AL

Figure

# CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$
5	1.00	0.02	0.002								
6	2.00	0.02	0.001								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	$P_c$ (tsf)	Initial Void Ratio
Saturation	Moisture							
130.1 %	46.1 %	75.8	62	45	2.26		0.60	0.801

MATERIAL DESCRIPTION	USCS	AASHTO
Gray CLAY with SAND pockets		

<b>Project No.</b> 22-166 <b>Project:</b> ALOE BAY WATER QAULITY ENHANCMENT WASTEWATER TREATMENT FACILITY <b>Source:</b>	<b>Client:</b> ARDURRA <b>Sample No.:</b> B-9, T-3 <b>Elev./Depth:</b> 46.5' - 48.5' <b>Geotechnical Engineering-Testing, Inc.</b> <b>Mobile, AL</b>	<b>Remarks:</b> 08-11-2022   <div style="text-align: right;"><b>Figure</b></div>
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## Dial Reading vs. Time

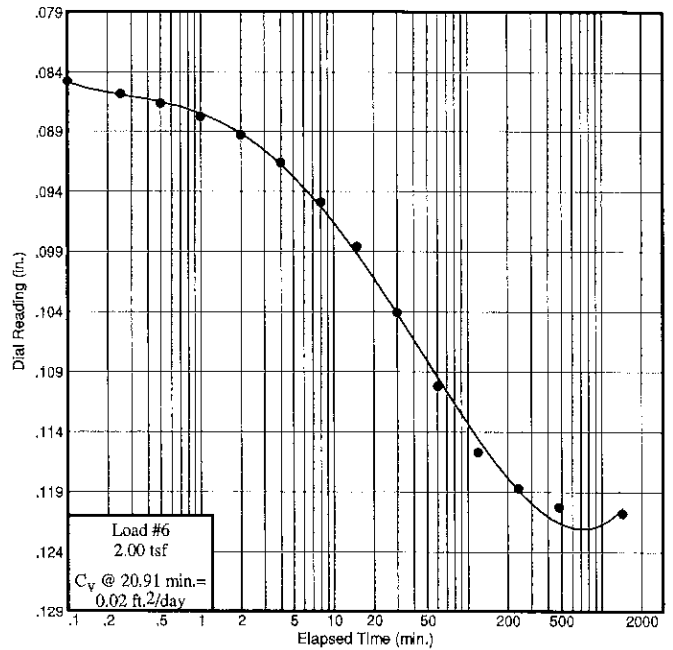
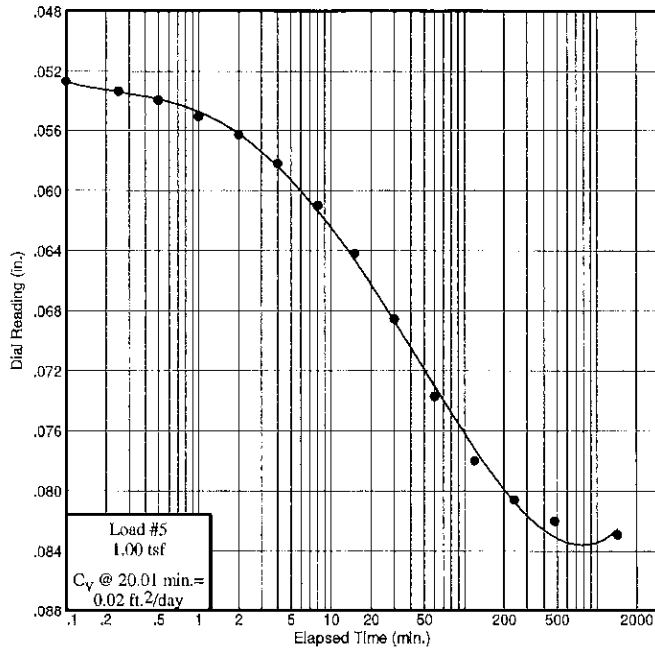
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-9, T-3

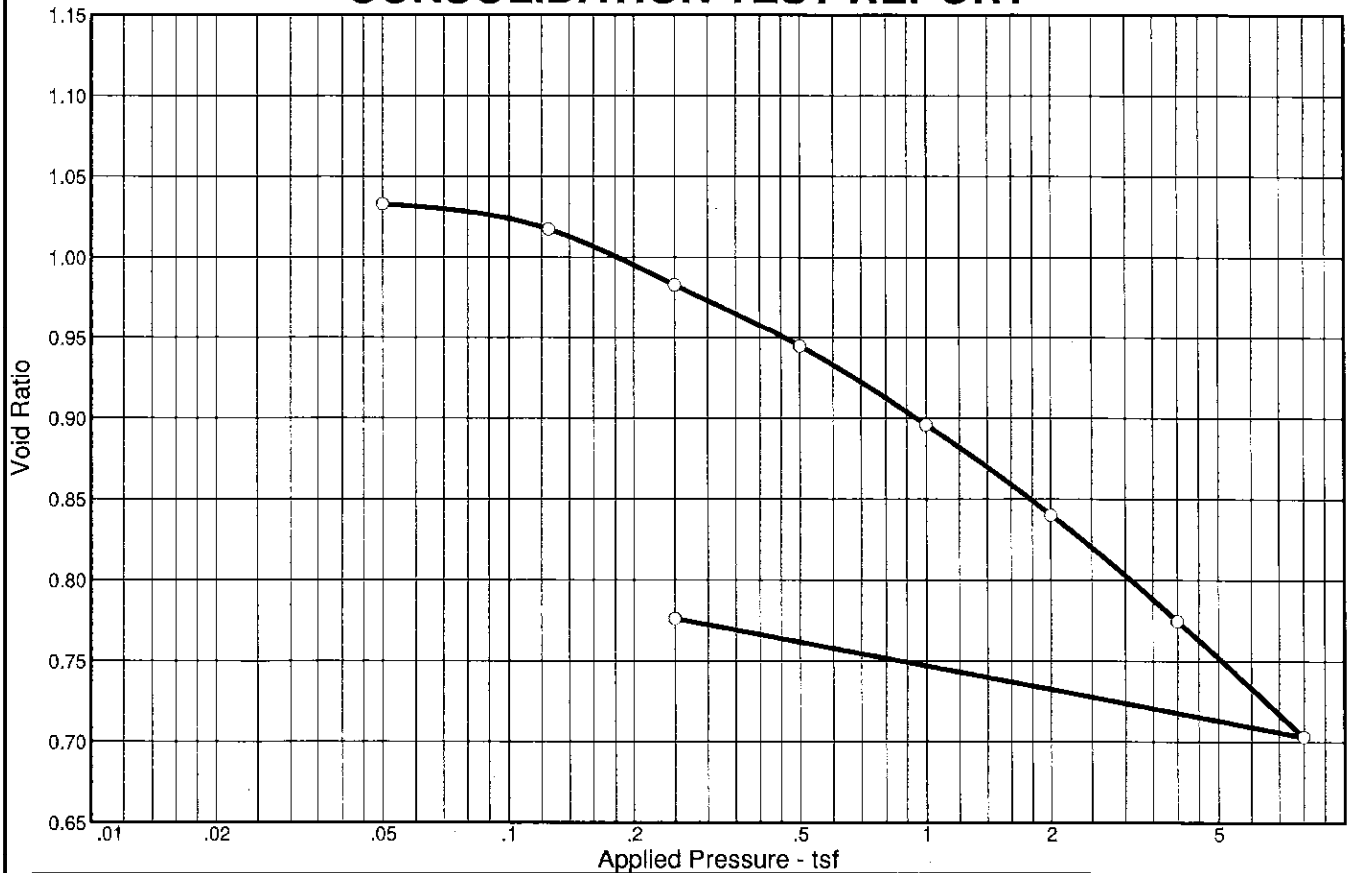
Elev./Depth: 46.5' - 48.5'



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Mobile, AL

Figure

# CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation											
No.	Load (tsf)	$C_v$ (ft. <sup>2</sup> /day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft. <sup>2</sup> /day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft. <sup>2</sup> /day)	$C_\alpha$
5	1.00	0.47	0.002								
6	2.00	0.42	0.002								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	$P_c$ (tsf)	Initial Void Ratio
Saturation	Moisture							
88.2 %	34.0 %	84.5	27	11	2.68		0.49	1.035

MATERIAL DESCRIPTION	USCS	AASHTO
Gray SANDY CLAY with SAND pockets		

<b>Project No.</b> 22-166	<b>Client:</b> ARDURRA	<b>Remarks:</b> 08-11-2022
<b>Project:</b> ALOE BAY WATER QAULTY ENHANCMENT WASTEWATER TREATMENT FACILITY		
<b>Source:</b>	<b>Sample No.:</b> B-13, T-3 <b>Elev./Depth:</b> 46.5' - 48.5'	
<b>Geotechnical Engineering-Testing, Inc.</b> <b>Mobile, AL</b>		

Figure

Figure

## Dial Reading vs. Time

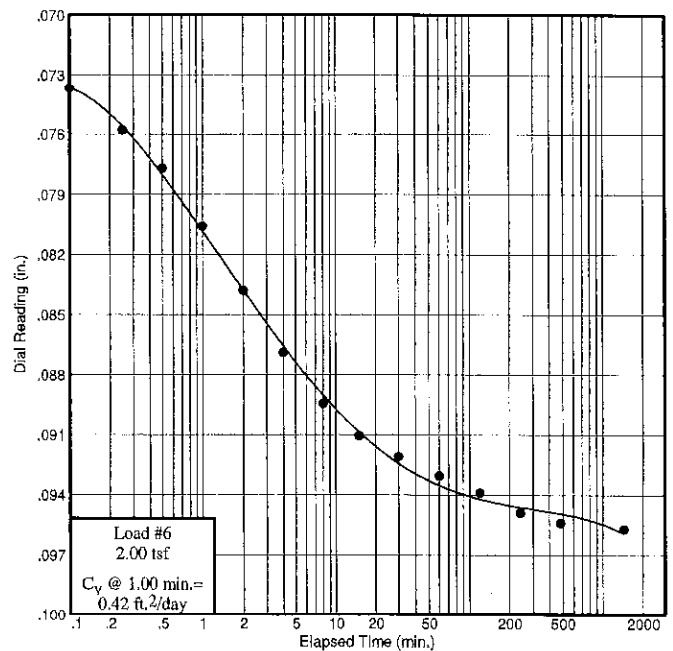
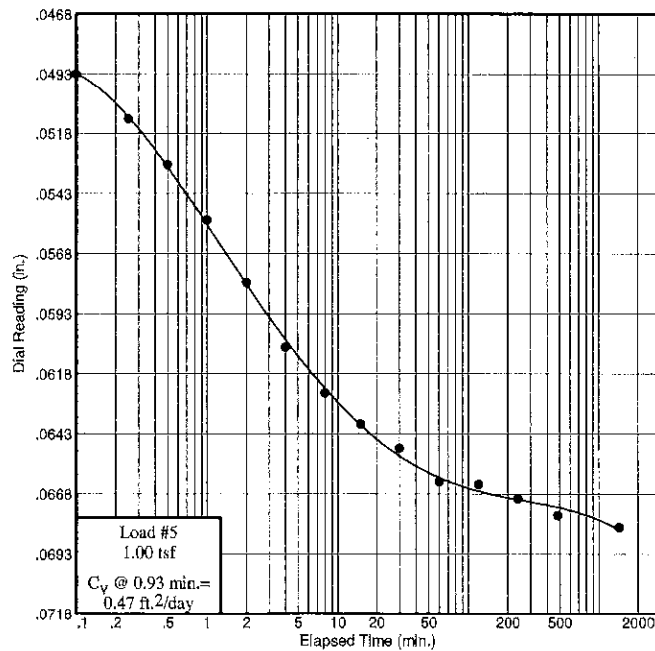
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-13, T-3

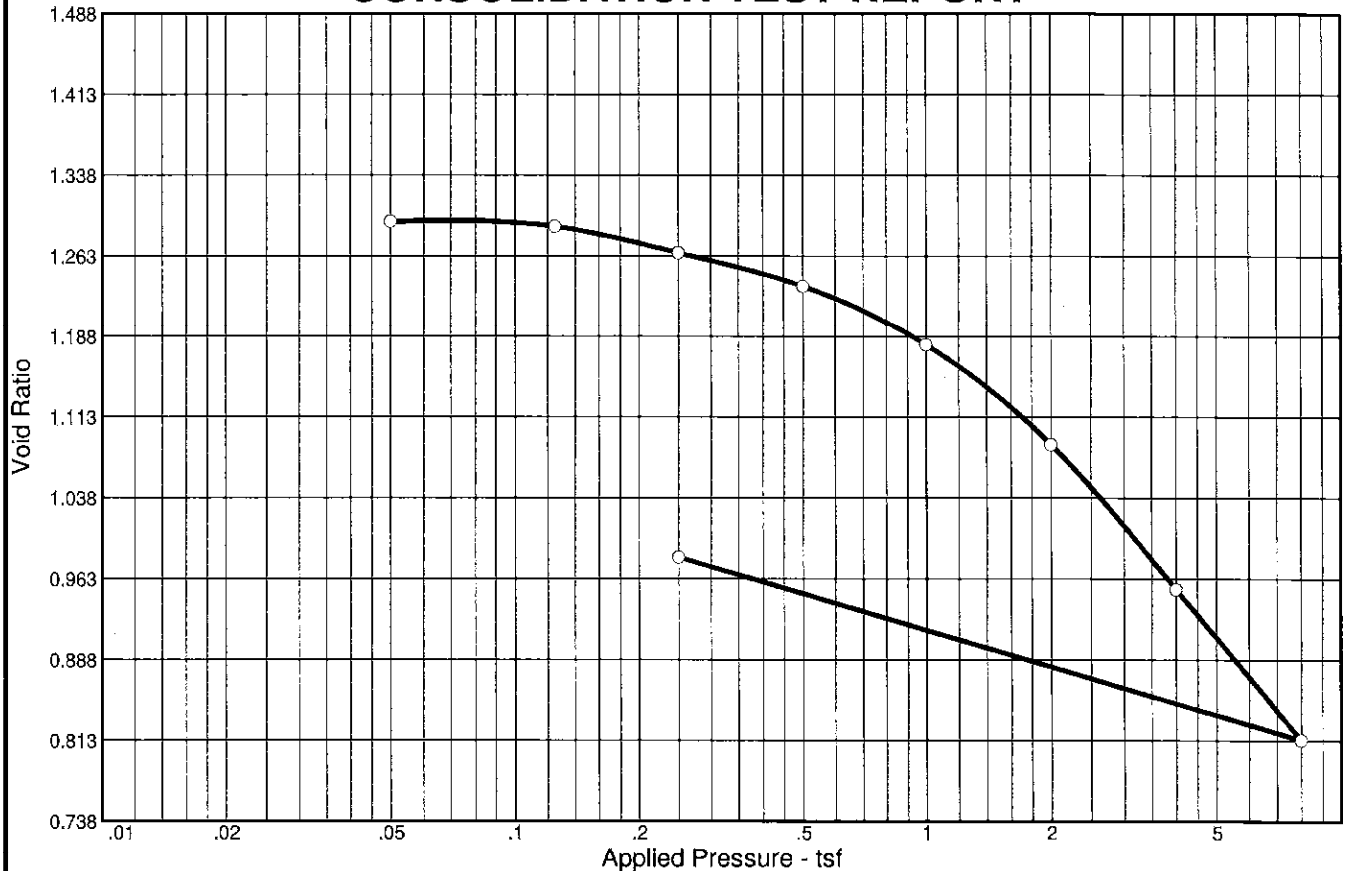
Elev./Depth: 46.5' - 48.5'



Geotechnical Engineering-Testing, Inc.  
Mobile, AL

Figure

# CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$	No.	Load (tsf)	$C_v$ (ft.2/day)	$C_\alpha$
5	1.00	0.12	0.001								
6	2.00	0.06	0.001								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	$P_c$ (tsf)	Initial Void Ratio
Saturation	Moisture							
101.7 %	49.0 %	72.8	51	34	2.69		0.83	1.296

MATERIAL DESCRIPTION	USCS	AASHTO
Gray CLAY with SAND pockets		

<b>Project No.</b> 22-166		<b>Client:</b> ARDURRA	<b>Remarks:</b> 08-11-2022
<b>Project:</b> ALOE BAY WATER QAULTY ENHANCMENT WASTEWATER TREATMENT FACILITY			
<b>Source:</b>	<b>Sample No.:</b> B-14, T-1	<b>Elev./Depth:</b> 36.5' - 38.5'	
<b>Geotechnical Engineering-Testing, Inc.</b> <b>Mobile, AL</b>			

Figure

Figure

# Dial Reading vs. Time

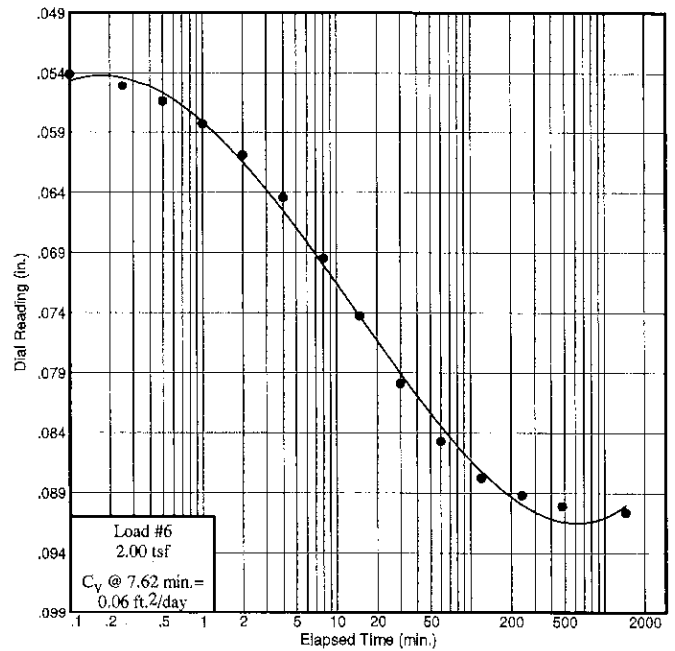
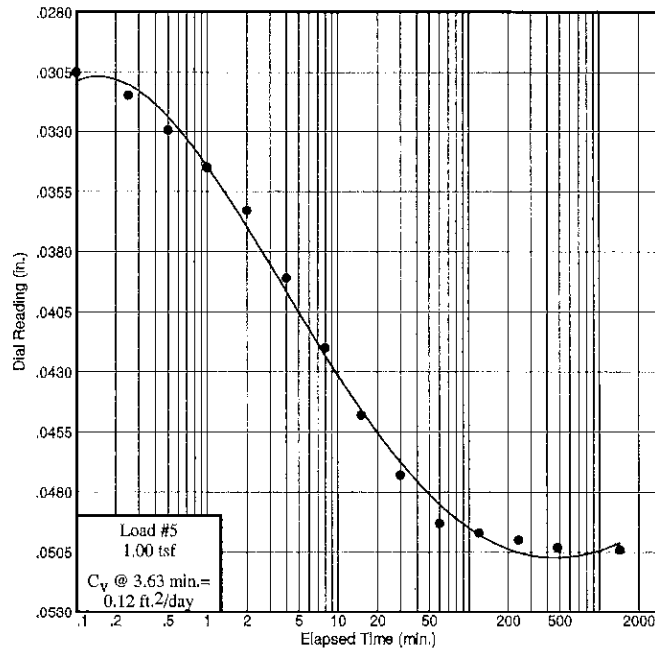
Project No.: 22-166

Project: ALOE BAY WATER QUALITY ENHANCEMENT WASTEWATER TREATMENT FACILITY

Source:

Sample No.: B-14, T-1

Elev./Depth: 36.5' - 38.5'



Geotechnical Engineering-Testing, Inc.

Mobile, AL

Figure



APPENDIX B  
STATEMENT OF SPECIAL INSPECTIONS

## STATEMENT OF SPECIAL INSPECTIONS

Project Name: ALOE BAY WATER QUALITY ENHANCEMENT PROJECT

Project Address: DAUPHIN ISLAND, AL 36561

Building Permit No.: \_\_\_\_\_

Name of Permit Applicant: DAUPHIN ISLAND WATER AND SEWER AUTHORITY

Permit Applicant's Address: \_\_\_\_\_

Architect-of-Record: \_\_\_\_\_

Structural Engineer-of-Record: Mark F. Weiss, PE

Mechanical Engineer-of-Record: \_\_\_\_\_

Electrical Engineer-of-Record: \_\_\_\_\_

Design Professional in Responsible Charge (DPIRC): \_\_\_\_\_

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the Alabama adopted 2021 International Building Code with amendments. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project and the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Requirements for Seismic Resistance*.

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*? ☒ Yes ☐ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Contractor and to the Design Professional in Responsible Charge ("DPIRC") at a frequency agreed upon by the Contractor and the DPIRC prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of Mobile County Department of Planning and Development ("Mobile County") and the Owner prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the DPIRC and Owner at the conclusion of the project.

Frequency of interim report submittals to the Contractor and Design Professional in Responsible Charge:

\_\_\_\_\_ Weekly \_\_\_\_\_ Bi-Weekly ☒ Monthly Other (specify): \_\_\_\_\_

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

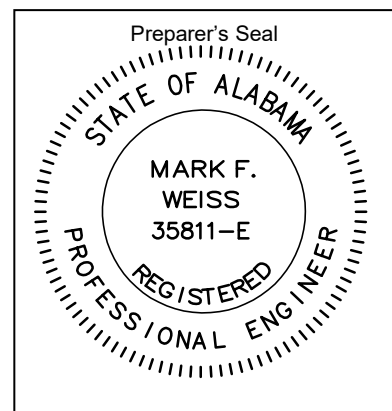
Statement of Special Inspections Prepared by:

Mark F. Weiss, PE  
Type or print

\_\_\_\_\_  
Signature Date

Acceptance by the Department of Planning & Development:

\_\_\_\_\_  
Signature Date



SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
<b>1705.1.1 Special Cases</b> (work unusual in nature, including but not limited to alternative materials and systems, unusual design applications, materials and systems with special manufacturer's requirements - add additional rows as needed.)	Submittal review, shop (3) and/or field inspection				
1. Inspection of anchors post-installed in solid grouted masonry: Per research reports including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, masonry unit, grout, masonry compressive strength, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
2. Aggregate Pier Inspection: The special inspector's responsibilities include, but are not limited to, review of the aggregate pier designer's use of soil parameters as presented in the project soils report, and during construction, verification of aggregate properties, type and number of lifts of aggregate, hole size and depths and top elevations of the pier elements, and applied energy. Additionally, results of qualitative tests on production aggregate pier elements such as modulus load testing, uplift pull-out testing, bottom stabilization tests and dynamic cone penetration tests, shall be reviewed to verify compliance with design specifications.	Field inspection	N	Periodic or as required by the research report issued by an approved source		
<b>1705.2.1 Structural Steel Construction</b>					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 360, Section N 3.2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Material verification of structural steel	Shop (3) and field inspection	Y	Periodic		
3. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection	Y	Observe (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints: <i>see Commentary</i>					
1) Complete penetration groove welds 5/16" or greater in <i>risk category</i> III or IV	Shop (3) or field ultrasonic testing - 100%	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2) Complete penetration groove welds 5/16" or greater in <i>risk category II</i>	Shop (3) or field ultrasonic testing - 10% of welds minimum	Y	Periodic		
3) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	Y	Periodic		
4) Fabricator's NDT reports when fabricator performs NDT	Verify reports	Y	Each submittal (5)		
4. Structural steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360, Table N5.6-1)		Y	Observe or Perform as noted (4)		
b. Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360, Table N5.6-2)		Y	Observe (4)		
1) Pre-tensioned and slip-critical joints					
a) Turn-of-nut with matching markings		Y	Periodic		
b) Direct tension indicator		Y	Periodic		
c) Twist-off type tension control bolt		Y	Periodic		
d) Turn-of-nut without matching markings		Y	Continuous		
e) Calibrated wrench		Y	Continuous		
2) Snug-tight joints			Periodic		
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		Y	Perform (4)		
5. Visual inspection of exposed cut surfaces of galvanized structural steel main members and exposed corners of the rectangular HSS for cracks subsequent to galvanizing	Shop (3) or field inspection	Y	Periodic		
6. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Periodic		
7. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic		
<b>1705.2.2 Cold-Formed Steel Deck</b>					
1. Manufacturer documents (Verify reports and certificates as listed in SDI QA/QC, Section 2, Paragraphs 2.1 and 2.2 for compliance with construction documents)	Submittal Review	Y	Each submittal		
2. Material verification of steel deck, mechanical fasteners and welding materials	Shop (3) and field inspection	Y	Periodic		
3. Cold-formed steel deck placement:	Shop (3) and field inspection				
a. Inspection tasks Prior to Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.1)		Y	Perform (4)		
b. Inspection tasks After Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.2)		Y	Perform (4)		
4. Cold-formed steel deck welding:	Shop (3) and field inspection	Y			
a. Inspection tasks Prior to Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.3)		Y	Observe (4)		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
b. Inspection tasks During Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.4)		Y	Observe (4)		
c. Inspection tasks After Welding (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.5)		Y	Perform (4)		
5. Cold-formed steel deck mechanical fastening:	Shop (3) and field inspection	Y			
a. Inspection tasks Prior to Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.6)		Y	Observe (4)		
b. Inspection tasks During Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.7)		Y	Observe (4)		
c. Inspection tasks After Mechanical Fastening (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.8)		Y	Perform (4)		
<b>1705.2.3. Open-Web Steel Joists and Joist Girders</b>					
1. Installation of open-web steel joists and joist girders.					
a. End connections - welding or bolted.	per SJI CJ or SJI 100	N	Periodic		
b.. Bridging - horizontal or diagonal.					
1) Standard bridging.	per SJI CJ or SJI 100	N	Periodic		
2) Bridging that differs from the specifications listed in SJI CJ or SJI 100.		N	Periodic		
<b>1705.2.4. Cold-Formed Steel Trusses Spanning 60 feet or Greater</b>					
Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
<b>1705.3 Concrete Construction</b>					
1. Inspection and placement verification of reinforcing steel and prestressing tendons.	Shop (3) and field inspection	Y	Periodic		
2. Reinforcing bar welding:					
a. Verification of weldability of bars other than ASTM A706.		Y	Periodic		
b. Inspection of single-pass fillet welds 5/16 or less in size.		Y	Periodic		
c. Inspection of all other welds.		Y	Continuous		
3. Inspection of anchors cast in concrete.	Shop (3) and field inspection	Y	Periodic		
4. Inspection of anchors post-installed in hardened concrete members per research reports, or, if no specific requirements are provided, requirements shall be provided by the registered design professional and approved by the building official, including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
a. Adhesive anchors installed in horizontal or upward-inclined orientation that resist sustained tension loads.		Y	Continuous		
b. Mechanical and adhesive anchors note defined in 4a.		Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic		
6. Prior to placement, fresh concrete sampling, perform slump and air content tests and determine temperature of concrete and perform any other tests as specified in construction documents.	Shop (3) and field inspection	Y	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	Y	Continuous		
8. Verify maintenance of specified curing temperature and techniques	Shop (3) and field inspection	Y	Periodic		
9. Inspection of prestressed concrete:	Shop (3) and field inspection	Y			
a. Application of prestressing force		Y	Continuous		
b. Grouting of bonded prestressing tendons		Y	Continuous		
10. Inspect erection of precast concrete members		Y	Periodic		
11. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	Y	Periodic		
12. Inspection of formwork for shape, lines, location and dimensions	Field inspection	Y	Periodic		
13. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
<b>1705.4 Masonry Construction</b>					
<b>MINIMUM VERIFICATION REQUIREMENTS</b>					
<b>(A) Level 1, 2 and 3 Quality Assurance:</b>					
1. Prior to construction, verification of compliance of submittals	Submittal Review	Y	Prior to Construction		
<b>(B) Level 2 &amp; 3 Quality Assurance:</b>					
1. Prior to construction verification of $f'_m$ and $f'_{AAC}$ except where specifically required by the code	Testing by unit strength method or prism test method	Y	Prior to Construction		
2. During construction, verification of Slump Flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to project site.	Testing by unit strength method or prism test method	Y	Periodic		
<b>(C) Level 3 Quality Assurance:</b>					
1. During construction, verification of $f'_m$ and $f'_{AAC}$ for every 5,000 SF	Testing by unit strength method or prism test method	N	Periodic		
2. During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.	Field inspection	N	Periodic		
<b>MINIMUM SPECIAL INSPECTION REQUIREMENTS</b>					
<b>(D) Levels 2 and 3 Quality Assurance:</b>					
<b>1. As masonry construction begins, verify that the following are</b>					
a. Proportions of the site-prepared mortar	Field inspection	Y	Periodic		
b. Grade and size of prestressing tendons and anchorages	Field Inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
c. Grade, type, and size of reinforcement, anchor bolts, and prestressing tendons and anchorages	Field Inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
d. Prestressing technique	Field Inspection	N	Periodic		
e. Properties of thin-bed mortar for AAC masonry	Field Inspection	N	Level 2 - Continuous <sup>(b)</sup> Level 2 - Periodic <sup>(c)</sup>		
(b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet			Level 3 - Continuous		
f. Sample panel construction	Field Inspection	N	Level 2 - Periodic Level 3 - Continuous		
2. Prior to grouting, verify that the following are in compliance:					
a. Grout space	Field Inspection	Y	Level 2 - Periodic Level 3 - Continuous		
b. Placement of prestressing tendons and anchorages	Field Inspection	N	Periodic		
c. Placement of reinforcement, connectors, and anchor bolts	Field inspection	Y	Level 2 - Periodic Level 3 - Continuous		
d. Proportions of site-prepared grout and prestressing grout for bonded tendons	Field Inspection	Y	Periodic		
3. Verify compliance of the following during construction:					
a. Materials and procedures with the approved submittals	Field inspection	Y	Periodic		
b. Placement of masonry units and mortar joint construction	Field Inspection	Y	Periodic		
c. Size and location of structural members	Field inspection	Y	Periodic		
d. Type, size, location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	Field inspection	Y	Level 2 - Periodic Level 3 - Continuous		
e. Welding of reinforcement		Field inspection	Y	Continuous	
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F)	Field inspection	Y	Periodic		
g. Application and measurement of prestressing force	Field testing	N	Continuous		
h. Placement of grout and prestressing grout for bonded tendons is in compliance	Field inspection	N	Continuous		
i. Placement of AAC masonry units and construction of thin-bed mortar joints	Field inspection	N	Level 2 - Continuous <sup>(b)</sup> Level 2 - Periodic <sup>(c)</sup>		
(b) Required for the first 5,000 square feet (c) Required after the first 5,000 square feet			Level 3 - Continuous		
4. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	Y	Level 2 - Periodic Level 3 - Continuous		
1705.5 Wood Construction					
1. For prefabricated wood structural elements, inspection of the fabrication process and assemblies in accordance with Section 1704.2.5.	In-plant review (3)	N	Periodic		
2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans.	Field inspection	N	Periodic		



SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans	Field inspection	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
4. Metal-plate-connected wood trusses:		N			
a. Verification that permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package when the truss height is greater than or equal to 60".	Field inspection	N	Periodic		
b. For trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
<b>1705.6 Soils</b>					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of compacted fill materials.	Field inspection	Y	Periodic		
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill	Field inspection	Y	Continuous		
5. Prior to placement of controlled fill, inspect subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic		
<b>1705.7 Driven Deep Foundations</b>					
1. Verify element materials, sizes and lengths comply with requirements	Field inspection	Y	Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	Y	Continuous		
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection	Y	Continuous		
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	Y	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	Y	See Section 1705.2		
6. For concrete elements and concrete-filled elements, perform tests and additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	Y	In accordance with construction documents		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.8 Cast-in-Place Deep Foundations					
1. Inspect drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous		
3. For concrete elements, perform tests and additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3		
1705.9 Helical Pile Foundations					
Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other installation data as required by construction documents.	Field inspection	N	Continuous		
1705.10 Fabricated items					
1. List of fabricated items requiring special inspection during fabrication:	Shop inspection	N	As noted in each applicable shop activity		
2. List of fabricated items to be fabricated on the premises of a fabricator approved to perform such work without special inspection (including name of approved agency providing periodic auditing):		N			
1705.11.1 Structural Wood Special Inspections For Wind Resistance					
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.	Shop (3) and field inspection	N	Periodic		
1705.11.2 Cold-formed Steel Special Inspections For Wind Resistance					
1. Inspection during welding operations of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
2. Inspection of screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.	Shop (3) and field inspection	N	Periodic		
1705.11.3 Wind-resisting Components					
1. Roof covering, roof deck and roof framing connections.	Shop (3) and field inspection	Y	Periodic		
2. Exterior wall covering and wall connections to roof and floor diaphragms.	Shop (3) and field inspection	Y	Periodic		
1705.12.1 Structural Steel Special Inspections for Seismic Resistance					
1. Seismic force-resisting systems in SDC B, C, D, E, or F.	Shop (3) and field inspection	Y	In accordance with AISC 341		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2. Structural steel elements in SDC B, C, D, E, or F other than those in Item 1. including struts, collectors, chords and foundation elements.	Shop (3) and field inspection	Y	In accordance with AISC 341		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.12.2 Structural Wood Special Inspections for Seismic Resistance					
1. Field gluing operations of elements of the seismic-force resisting system for SDC C, D, E or F.	Field inspection	N	Continuous		
2. Nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system including wood shear walls, wood diaphragms, drag struts, shear panels and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
1705.12.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance					
1. During welding operations of elements of the seismic-force-resisting system for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
2. Screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
1705.12.4 Designated Seismic Systems Verification Special Inspections for Seismic Resistance					
For SDC C, D, E or F, inspect and verify that that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with ASCE 7 Section 13.2.2.	Field inspection	Y	Periodic		
1705.12.5 Architectural Components Special Inspections for Seismic Resistance					
1. For SDC D, E or F, inspection during the erection and fastening of exterior cladding and interior or exterior veneer more than 30 feet above grade or walking surface and weighing more than 5 psf.	Field inspection	N	Periodic		
2. For SDC D, E or F, inspection during the erection and fastening of interior nonbearing walls more than 30 feet above grade or walking surface and weighing more than 15 psf.	Field inspection	N	Periodic		
3. For SDC D, E or F, inspection during the erection and fastening of exterior nonbearing walls more than 30 feet above grade or walking surface.		N			
4. For SDC D, E or F, inspection during anchorage of access floors	Field inspection	N	Periodic		
1705.12.6 Plumbing, Mechanical and Electrical Components Special Inspections for Seismic Resistance					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems in SDC C, D, E or F	Field inspection	Y	Periodic		
2. Inspection during the anchorage of other electrical equipment in SDC E or F	Field inspection	N	Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units in SDC C, D, E or F	Field inspection	Y	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
4. Inspection during the installation and anchorage of HVAC ductwork designed to contain hazardous materials in SDC C, D, E or F	Field inspection	Y	Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems in SDC C, D, E or F where nominal clearance of 1/4 inch or less is required by the approved construction documents	Field inspection	Y	Periodic		
6. Inspection during installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to SDC C, D, E, or F to verify one of the following unless flexible sprinkler hose fittings are used:		Y			
a. ASCE/SEI 7, Section 13.2.3 minimum required clearances have been provided.	Field inspection	Y	Periodic		
b. A three inch or greater nominal clearance has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.	Field inspection	Y	Periodic		
<b>1705.12.7 Storage Racks Special Inspections for Seismic Resistance</b>					
Inspection during the anchorage of storage racks 8 feet or greater in height in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
<b>1705.12.8 Seismic Isolation Systems</b>					
Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system in structures assigned to SDC B, C, D, E or F.	Shop and field inspection	N	Periodic		
<b>1705.12.9 Cold-formed Steel Special Bolted Moment Frames</b>					
Inspection of installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
<b>1705.13.1 Structural Steel Testing for Seismic Resistance</b>					
1. Nondestructive testing of structural steel in the seismic force-resisting systems in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		
2. Nondestructive testing of structural steel elements in the seismic force-resisting systems not covered in 1 above including struts, collectors, chords and foundation elements in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		

SCHEDULE OF SPECIAL INSPECTIONS SERVICES					
PROJECT					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
<b>1705.13.2 Seismic Certification of Nonstructural Components</b>					
Review certificate of compliance for designated seismic system components in structures assigned to SDC B, C, D, E or F.	Certificate of compliance review	Y	Each submittal		
<b>1705.13.3 Seismic Certification of Designated Seismic Systems</b>					
Review certificate of compliance for designated seismic system components in structures assigned to SDC C, D, E or F	Certificate of compliance review	Y	Each submittal		
<b>1705.13.4 Seismic Isolation Systems</b>					
Test seismic isolation system in accordance with ASCE 7 Section 17.8 in structures assigned to SDC B, C, D, E or F.	Prototype testing	N	Per ASCE 7		
<b>1705.14 Sprayed Fire-resistant Materials</b>					
1. Verify surface condition preparation of structural members	Field inspection	N	Periodic		
2. Verify minimum thickness of sprayed fire-resistant materials applied to structural members	Field inspection	N	Periodic		
3. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection and testing	N	Per IBC Section 1705.14.5		
4. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection and testing	N	Per IBC Section 1705.14.6		
5. Condition of finished application	Field inspection	N	Periodic		
<b>1705.15 Mastic and Intumescent Fire-Resistant Coatings</b>					
Inspect and test mastic and intumescent fire-resistant coatings applied to structural elements and decks per AWCI 12-B	Field inspection and testing	N	Periodic		
<b>1705.16 Exterior Insulation and Finish Systems (EIFS)</b>					
Inspection of water-resistive barrier over sheathing substrate	Field inspection	N	Periodic		
<b>1705.17 Fire-Resistant Penetrations and Joints</b>					
1. Inspect penetration firestop	Field testing	Y	Per ASTM E2174		
2. Inspect fire-resistant joint systems	Field testing	Y	Per ASTM E2393		
<b>1705.18 Smoke Control Systems</b>					
1. Leakage testing and recording of device locations prior to concealment	Field testing	N	Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing	N	Periodic		
<b>* INSPECTION AGENTS</b>					
<b>FIRM</b>		<b>ADDRESS</b>		<b>TELEPHONE NO.</b>	
1.					
2.					
3.					
4.					
<p>Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies may be subject to the approval of the Building Official and/or the Design Professional.</p> <p>2. The list of Special Inspectors may be submitted as a separate document, if noted so above.</p> <p>3. Shop Inspections of fabricated items are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1 and listed in activity 1709.2.</p> <p>4. Observe: Observe on a random basis, operations need not be delayed pending these inspections. Perform: These tasks shall be performed for each welded joint, bolted connection, or steel element.</p> <p>5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N6.</p>					
Are Special Inspections for Seismic Resistance included in the Statement of Special Inspections?				Yes	
Are Special Inspections for Wind Resistance included in the Statement of Special Inspections?				Yes	
DATE:					

APPENDIX C  
ASBUILTS

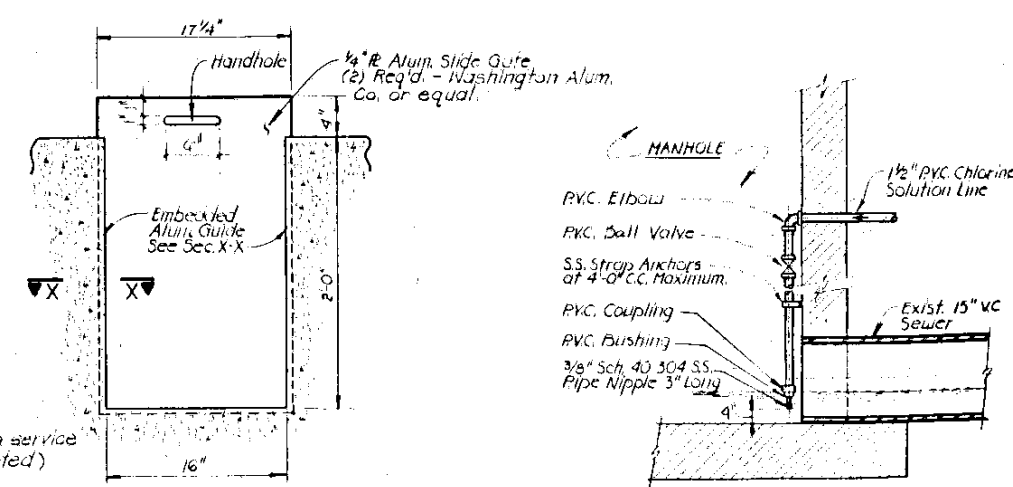
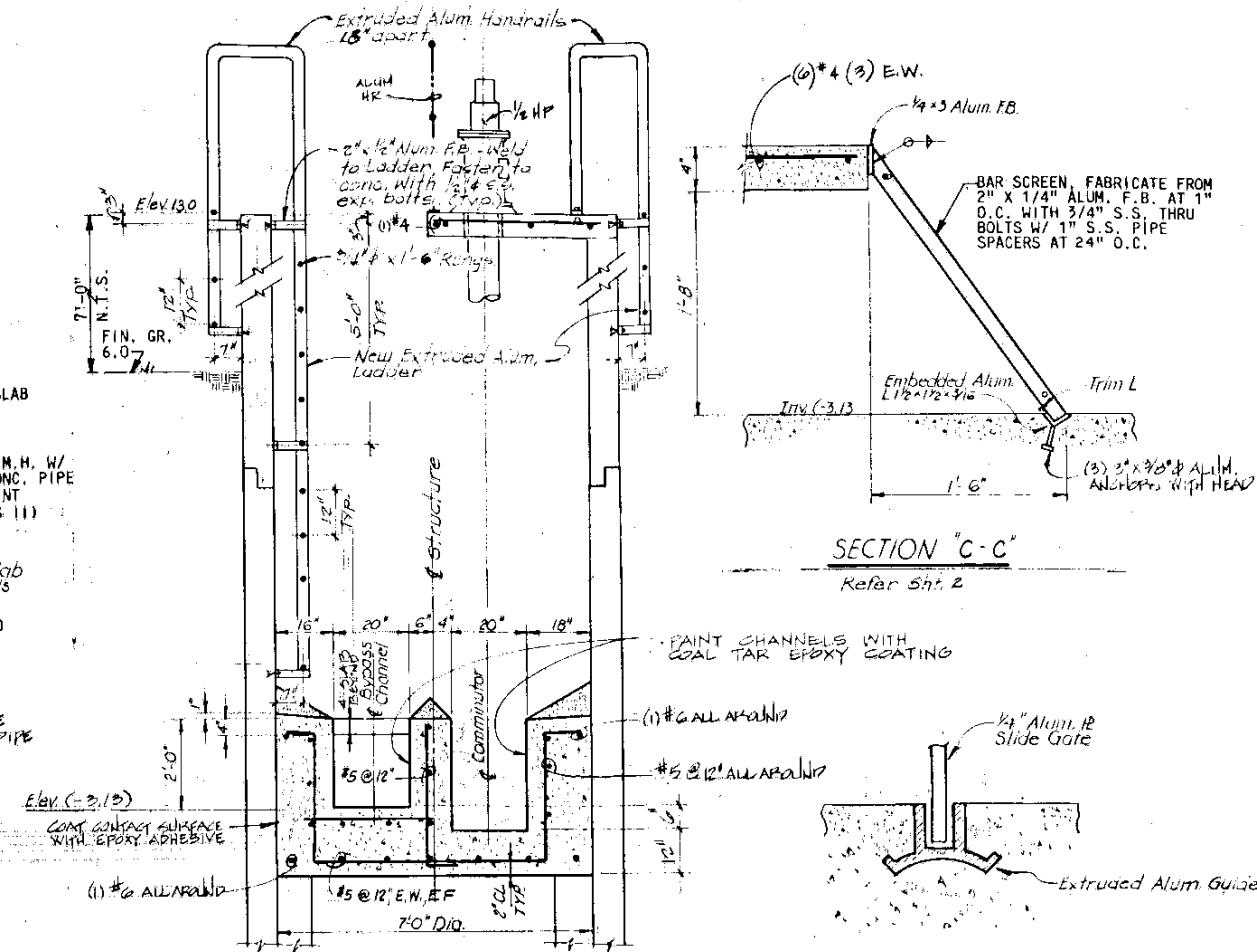
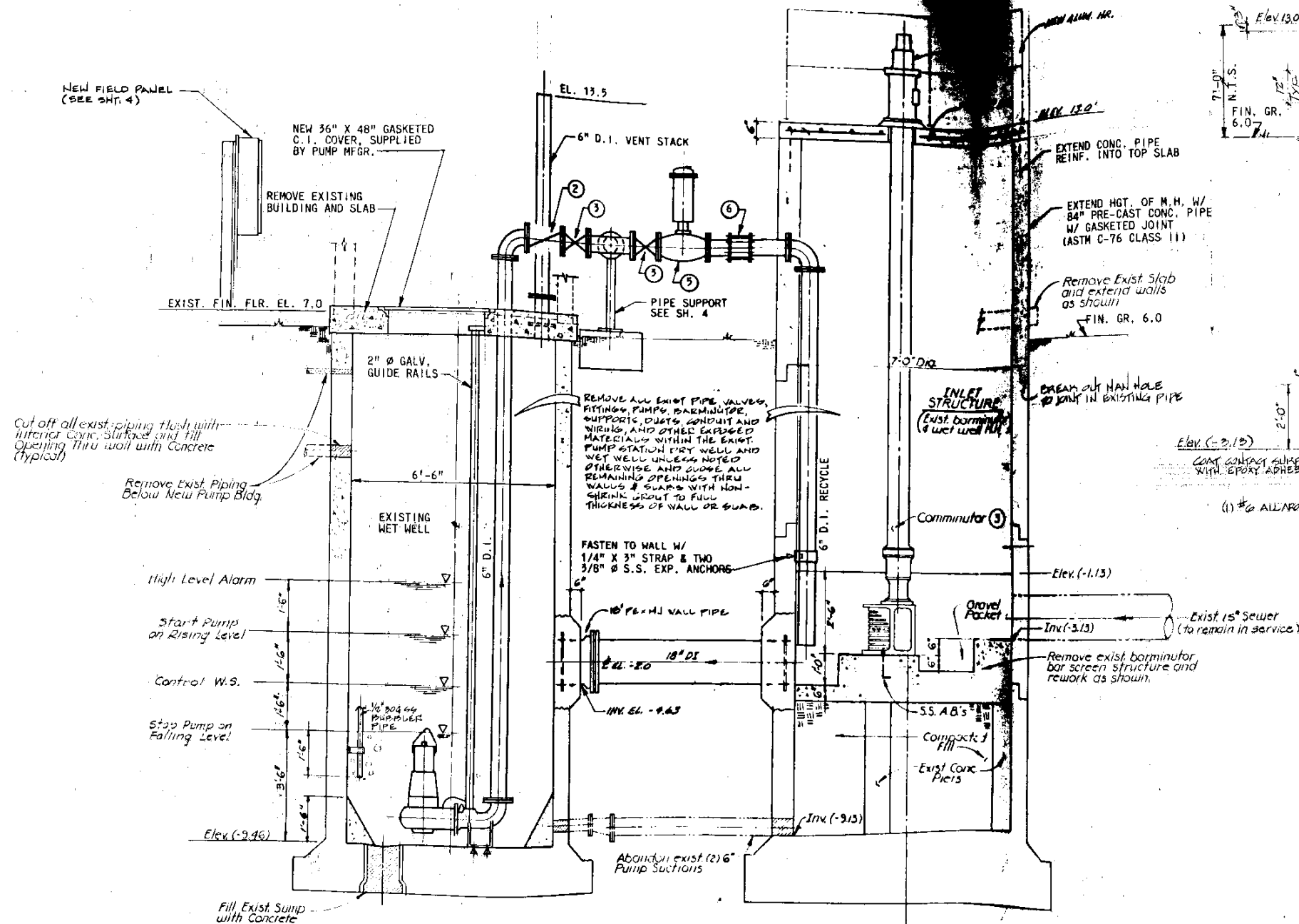


SHEET:



# GENERAL NOTES ALL STRUCTURES

1. EXPOSED EDGES BOTH HORIZONTAL & VERTICAL OF ALL CONCRETE STRUCTURES SHALL BE CHAMFERED 3/4".
2. ALL CONSTRUCTION JOINTS SUBJECT TO HYDRAULIC PRESSURE SHALL RECEIVE PVC WATERSTOPS.
3. ALL EQUIPMENT BASE PLATES AND FRAMES SHALL BE SET ON GROUT BED OF NOT LESS THAN 1" THICKNESS WITH EDGE DRESSED TO DRAIN ON 45° CHAMFER.



## NOTES:

1. COAT HARDEND CONCRETE WITH EPOXY GROUT IN ACCORDANCE WITH THE MFG.'S. WRITTEN INSTRUCTIONS PRIOR TO PLACING NEW CONCRETE AGAINST EXISTING CONCRETE.
2. COAT INSIDE OF PIPE TO BE PLUGGED WITH EPOXY GROUT PRIOR TO PLUGGING WITH GROUT OR CONCRETE.
3. ALL ALUMINUM SURFACES WHERE IN CONTACT WITH CONCRETE OR MASONRY SHALL BE COATED WITH BITUMASTIC (TOTAL DRY THICKNESS 16 MILLS).

SECTION "A-A"

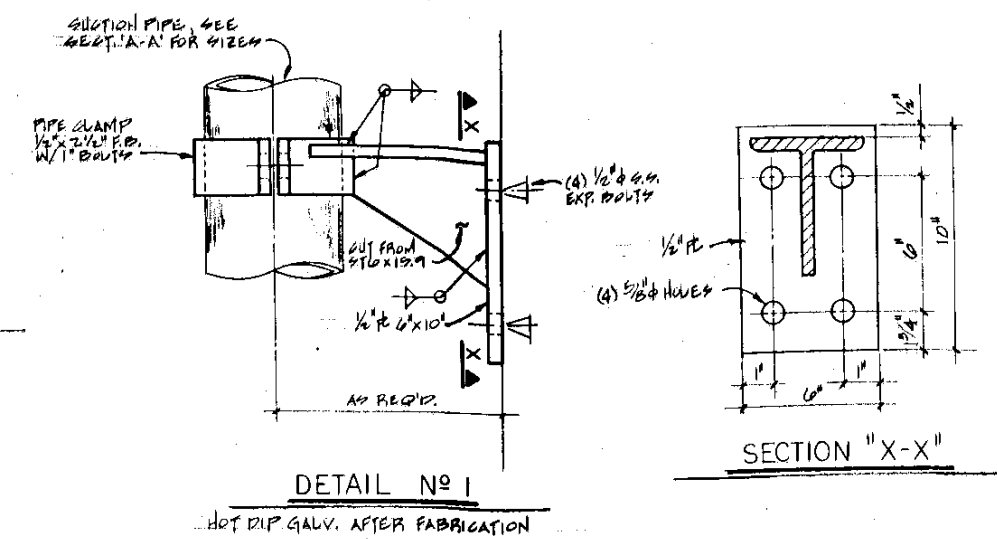
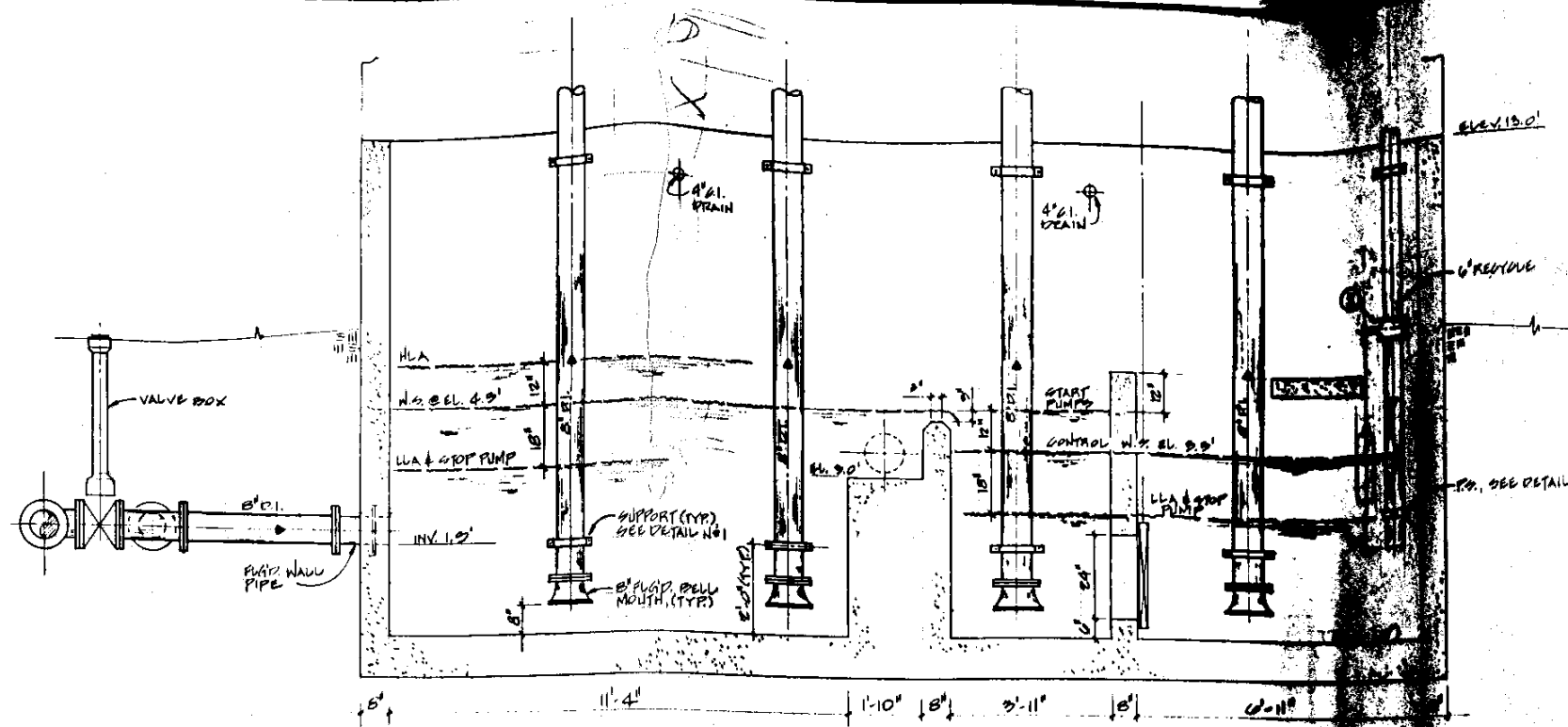
Refer Sh. 2

**Existing Influent Pump Station Asbuilt**

1. Provided as additional information. Field verify accuracy prior to bid
2. Mechanical systems have been upgraded and re-configured. Field verify prior to bid.

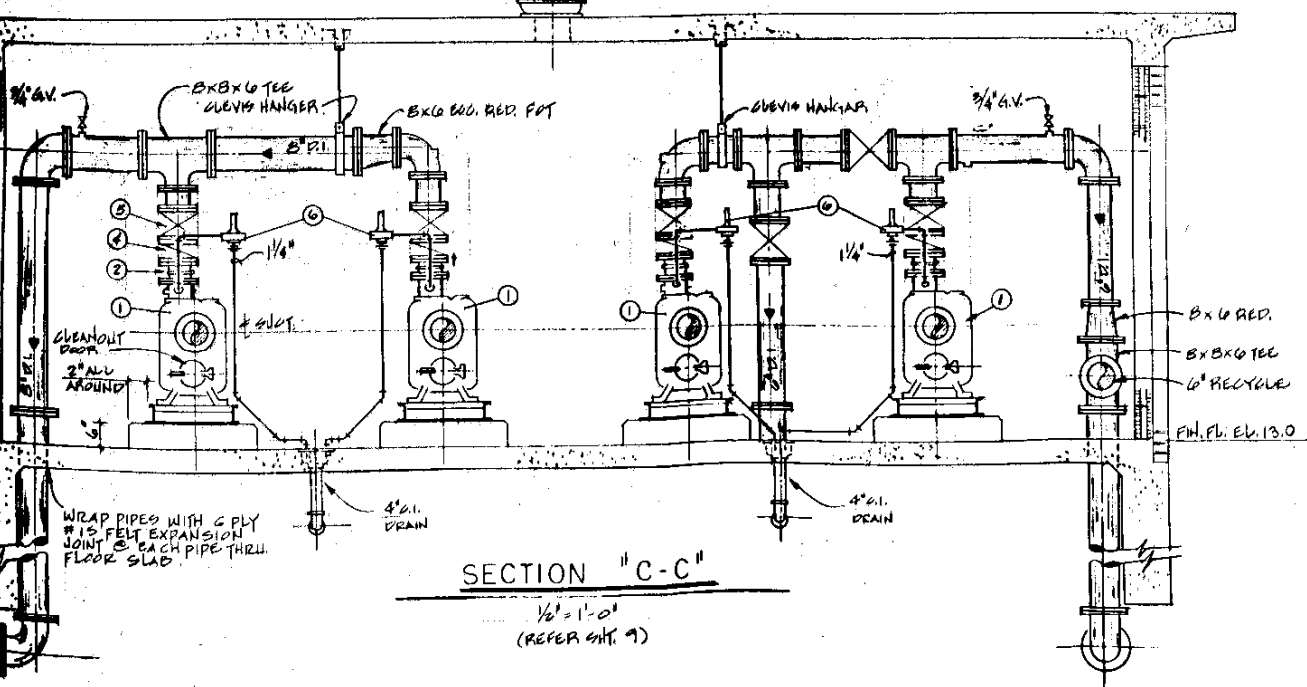
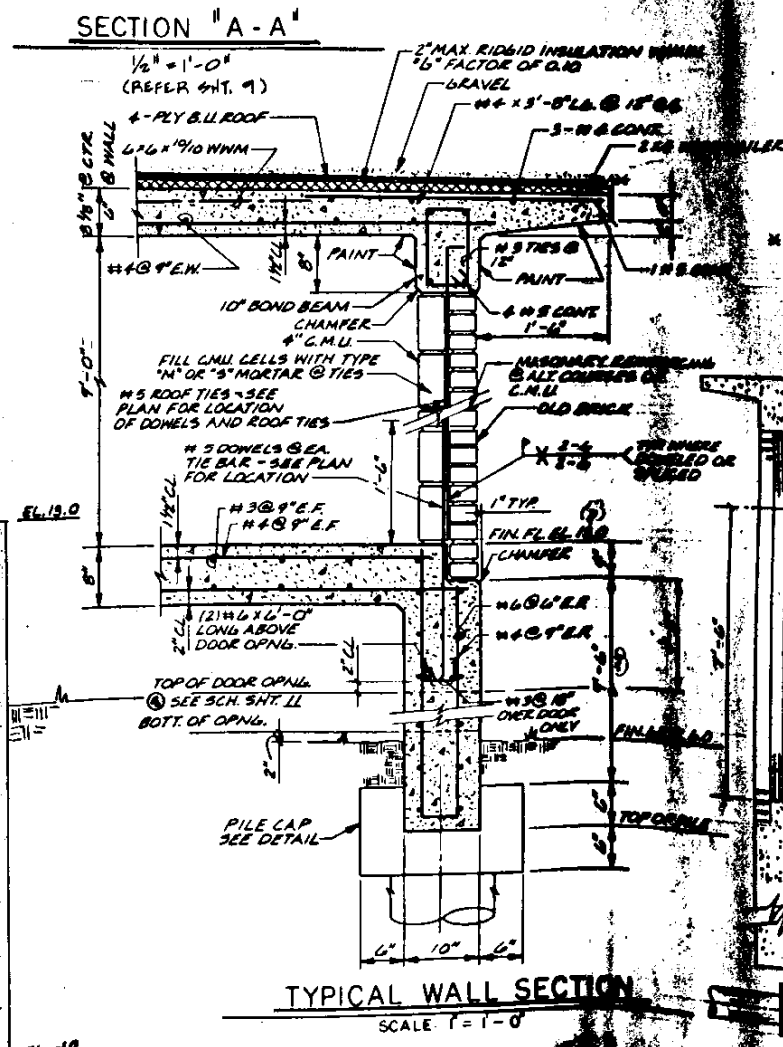
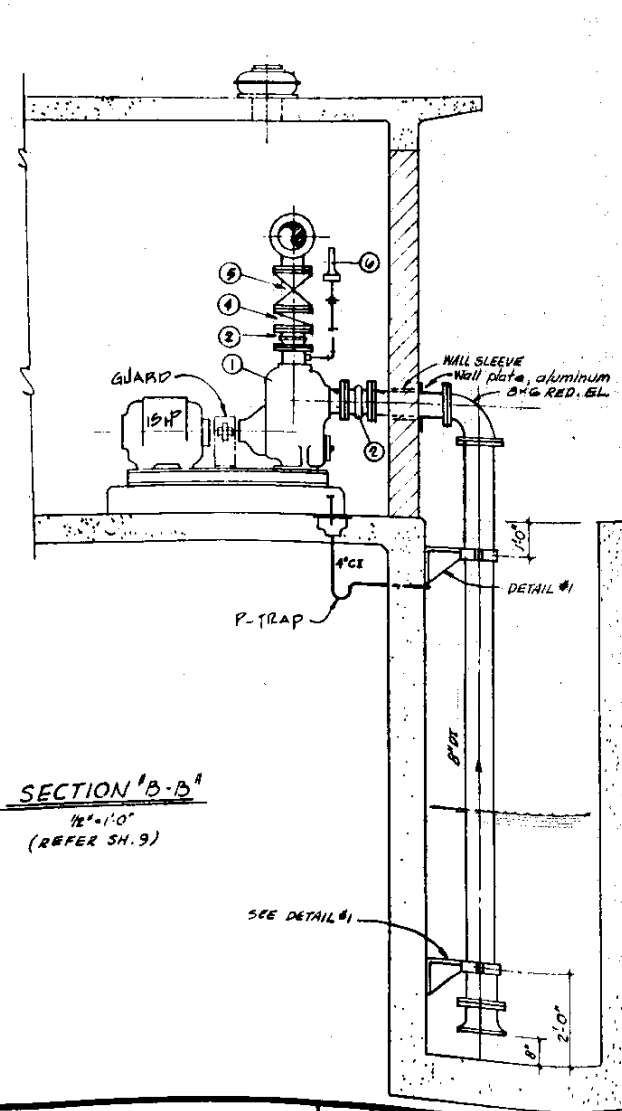






**EXISTING PREVIOUSLY DEMOLISHED ITF WETWELL ASBUILT**

1. Provided for additional information only
2. This wetwell was previously demo'd. All mechanical parts were removed and the walls were collapsed in. The structure was covered up with fill material.
3. Portions of this structure may require excavation and removal prior to installing new pipe, footers and structures.
4. If there is no interference with new construction no removal will be required.



REVISIONS		DESCRIPTION	DATE	BY
1	4-83	TYPICAL WALL SECTION ADDED - ADDENDUM NO. 1	CHS	
2	2-83	GENERAL REV., FIN. FL. EL.	CHS	
3	2-78	GENERAL REV., FIN. FL. EL.	CHS	

**J. B. Conyers & Co. Inc.**  
 Consulting Engineers  
 Panama City, Alabama

CLIENT: DAUPHIN ISLAND WATER AND SEWER AUTHORITY  
 DAUPHIN ISLAND, ALABAMA  
 WASTEWATER TREATMENT PLANT RENOVATIONS

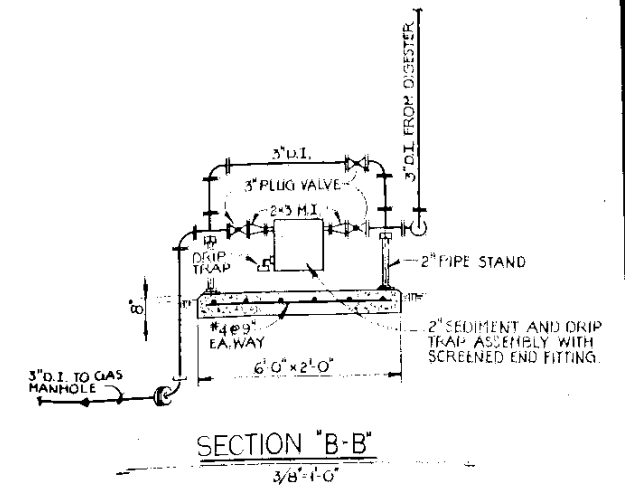
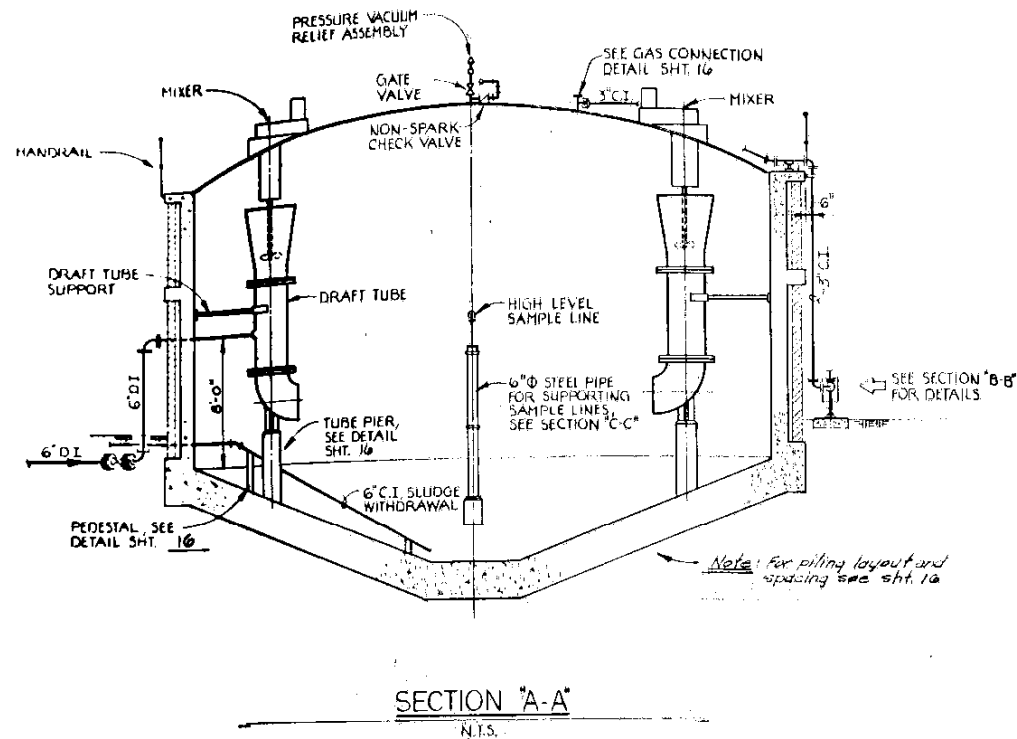
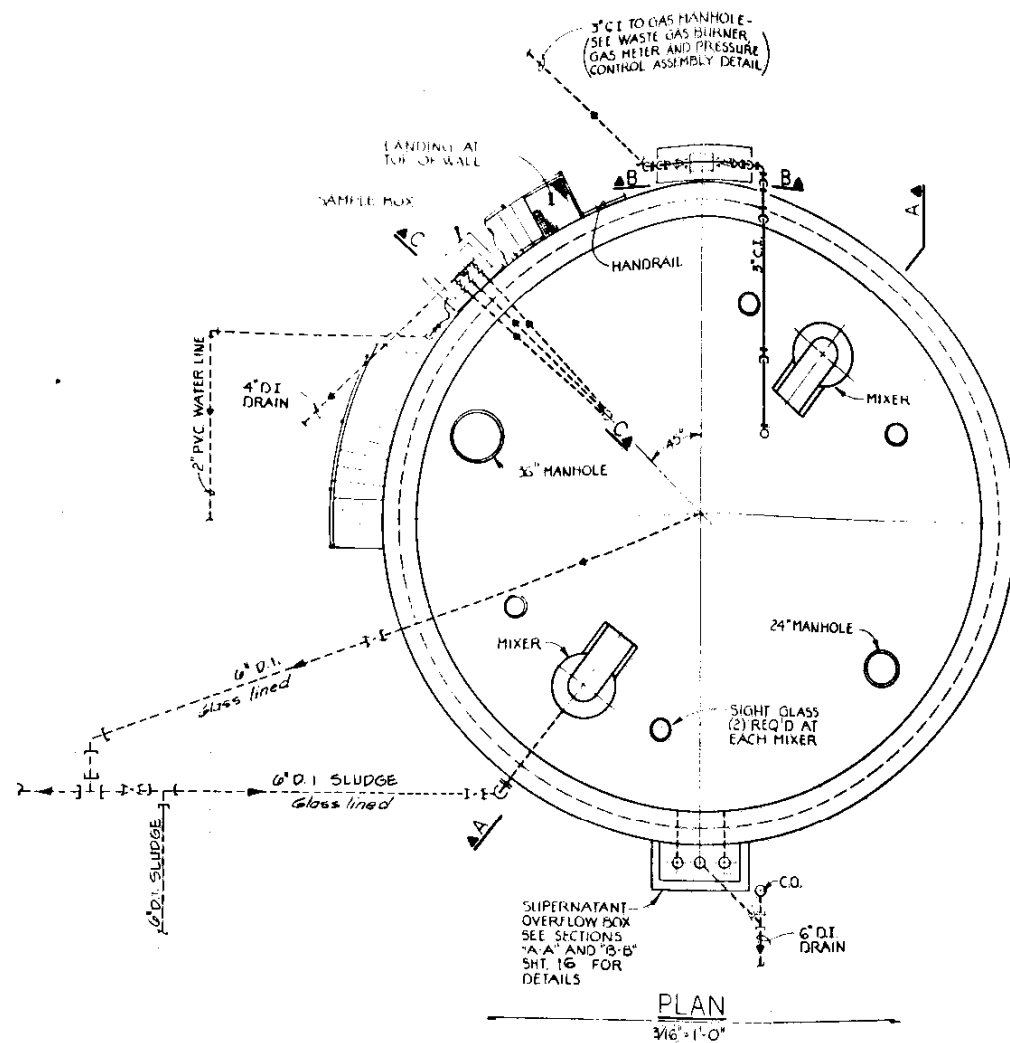
TITLE: FILTER RECIRCULATION AND FINAL CLARIFIER PUMP STATION SECTIONS AND DETAILS

DRAWING NUMBER: 05-0209-11  
 SHEET: 10 OF 27

Professional Engineer Seal: No. 2445, State of Alabama

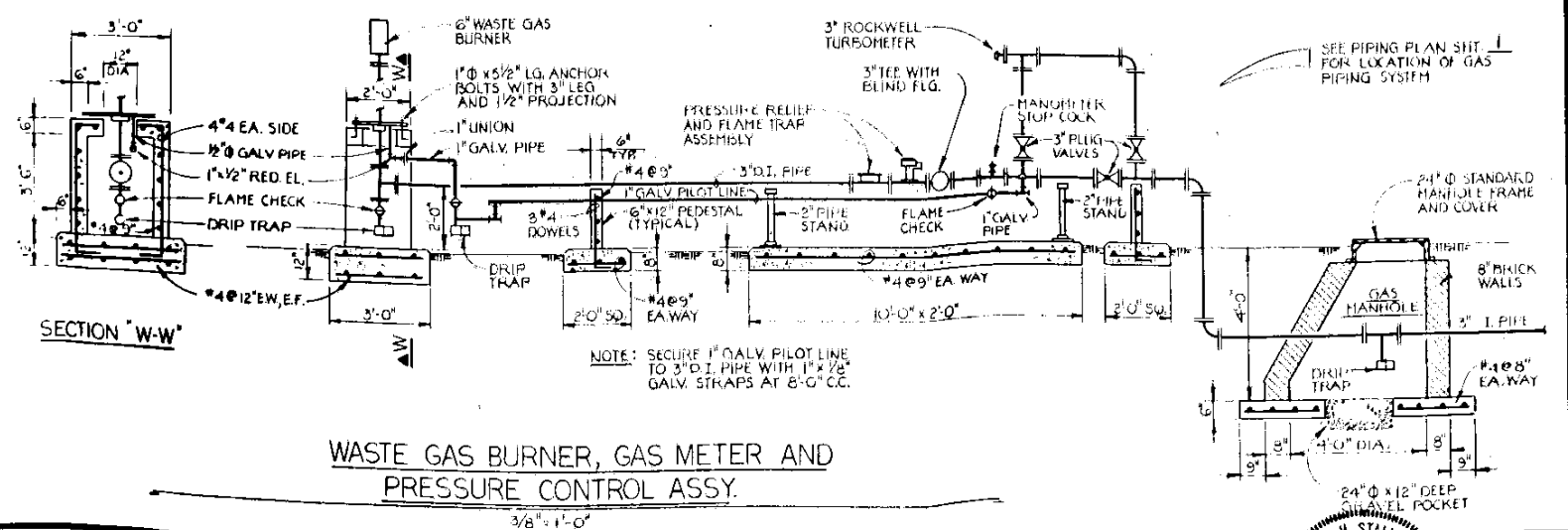
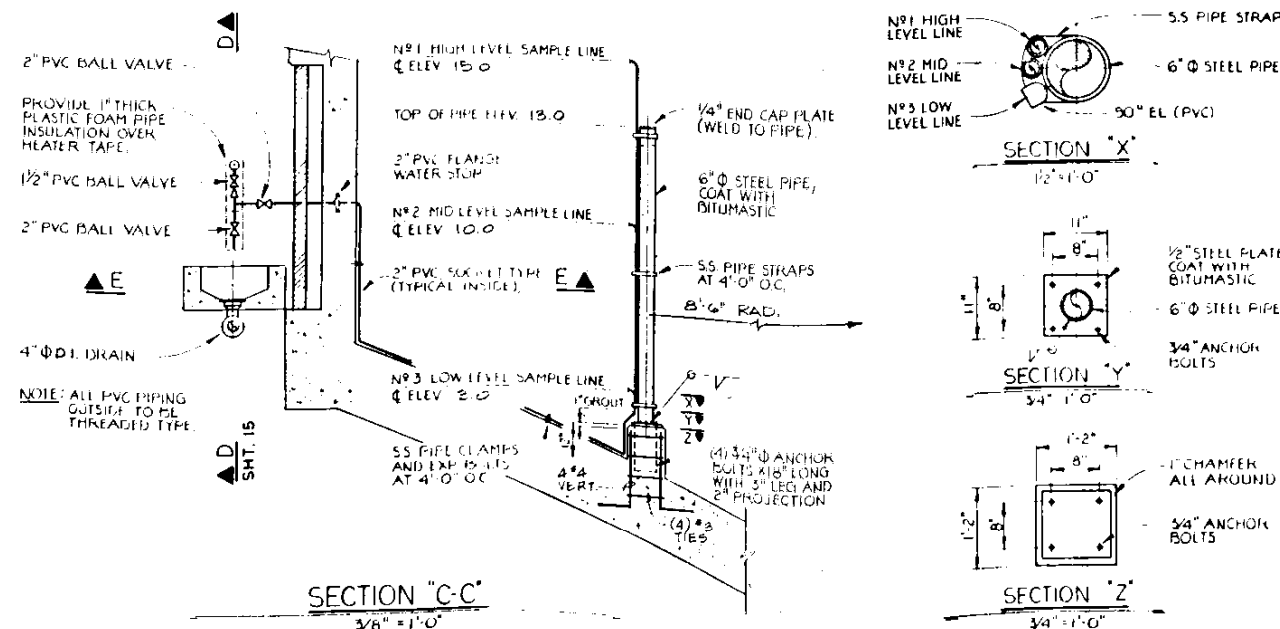






# **EXISTING PREVIOUSLY DEMOLISHED DIGESTER BASIN ASBUILT**

1. Provided for additional information only
2. This digester was previously demo'd. All mechanical parts were removed and the walls were collapsed in. The structure was covered up with fill material.
3. Portions of this structure may require excavation and removal prior to installing new pipe, footers and structures.
4. If there is no interference with new construction no removal will be required.



**J. B. Converse & Co. Inc.**  
Consulting Engineers  
Mobile, Alabama

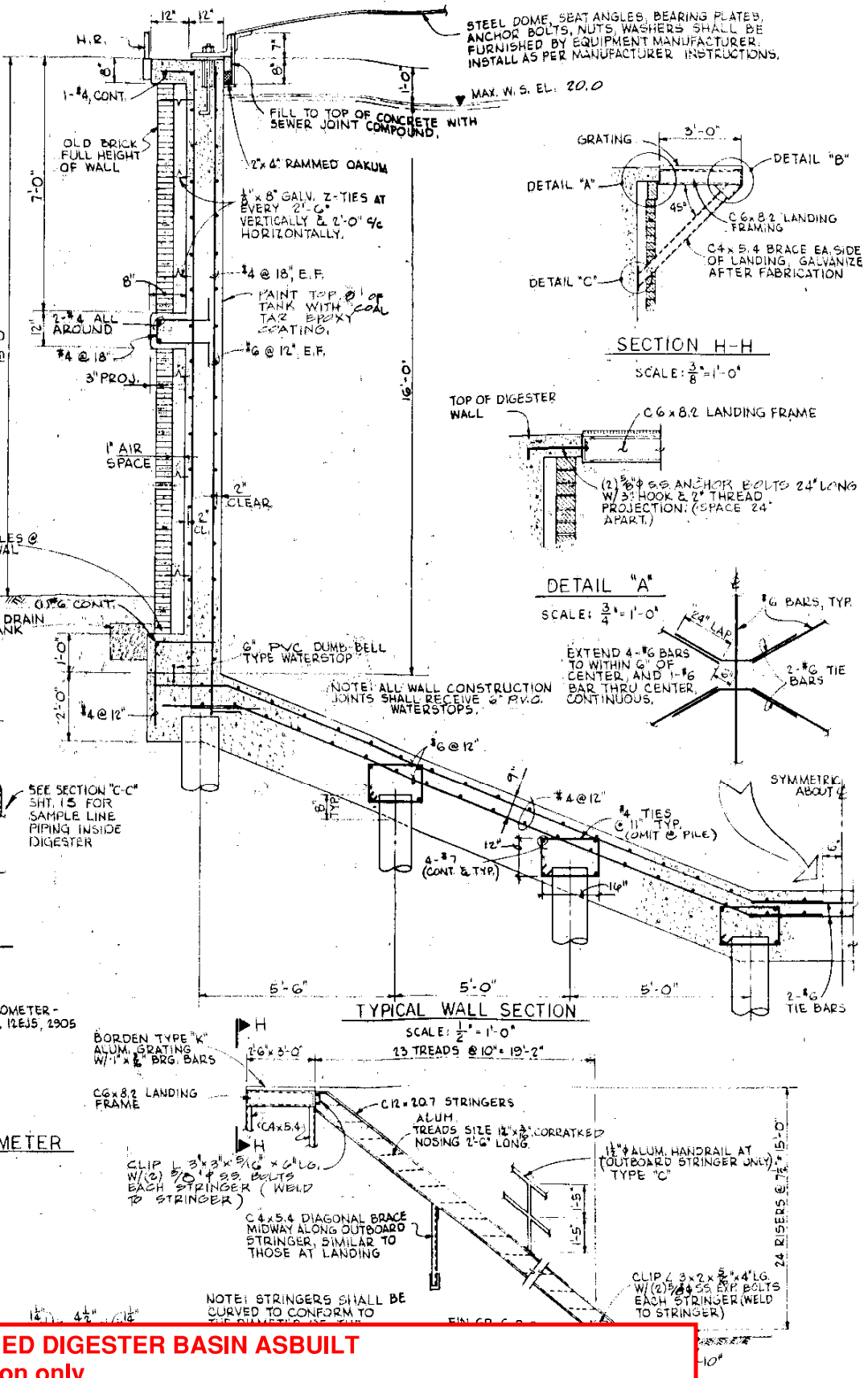
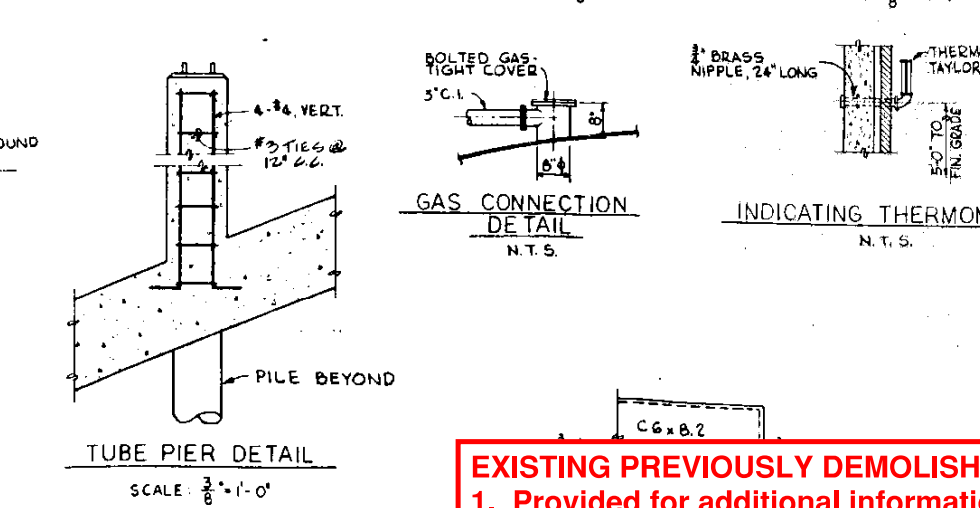
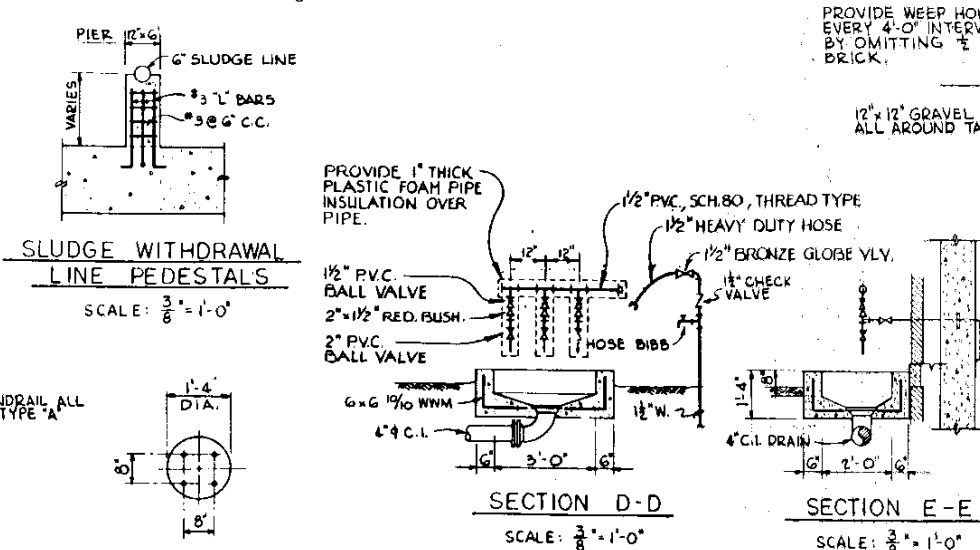
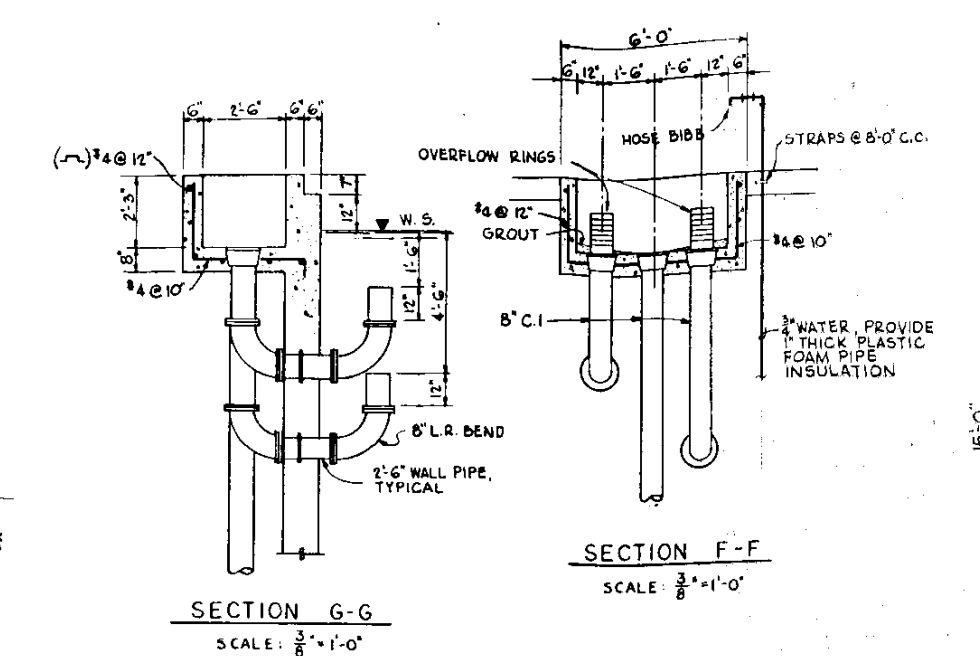
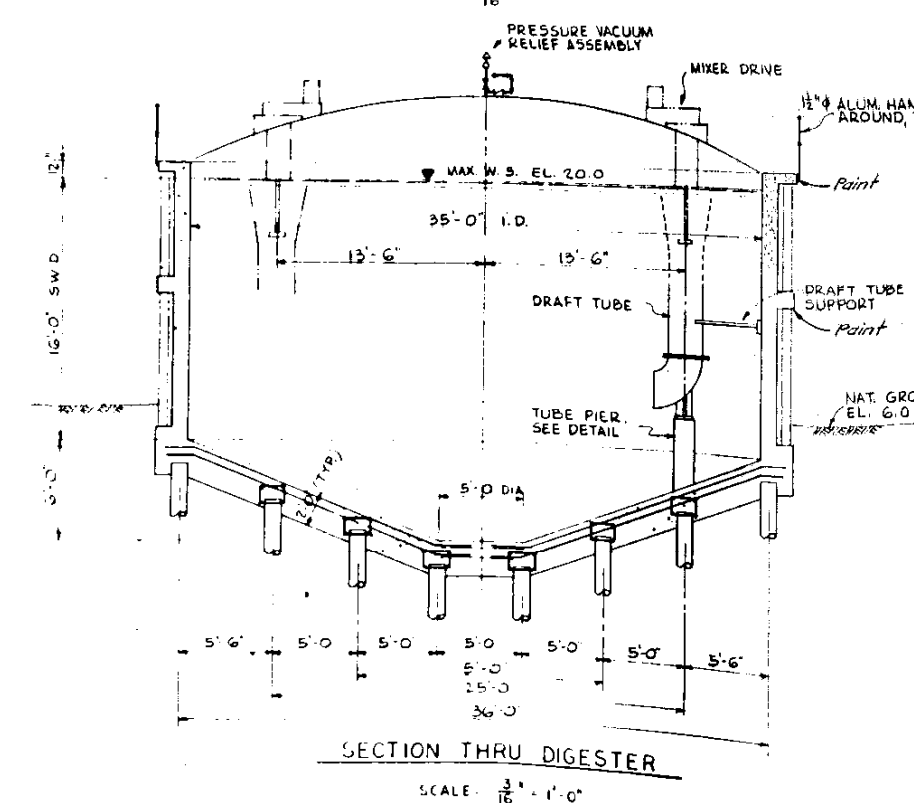
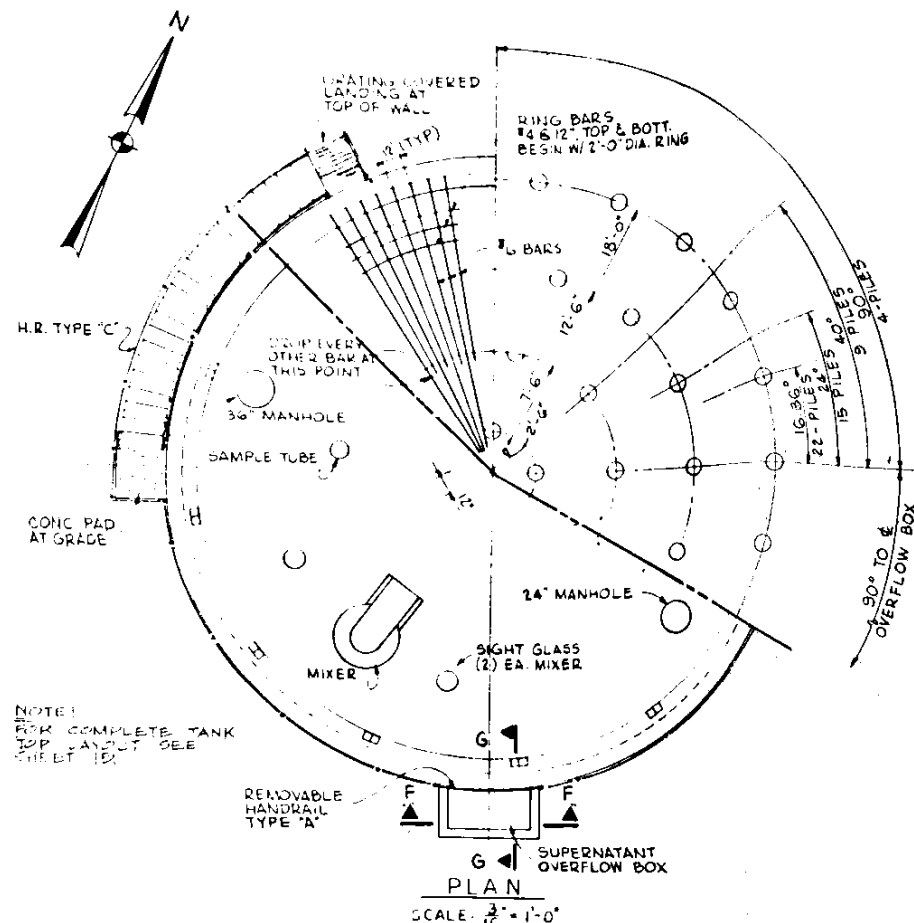
CLIENT: DAUPHIN ISLAND WATER AND SEWER AUTHORITY  
DAUPHIN ISLAND, ALABAMA  
WASTEWATER TREATMENT PLANT RENOVATIONS  
TITLE: DIGESTER & GAS BURNER  
GENERAL PLAN AND DETAILS

DRAWING NUMBER: No. 2449  
DATE: 05-02-09  
SHEET: 15 OF 27

DESIGNER: J.E.N.	CHECKED BY: S.H.H.	APPROVED BY: J.B.C.	DATE: SEPT. 1999	SCALE: NOTED
DESCRIPTION	DATE	ENGR	DATE	SCALE
REVISIONS				

Montgomery  
Birmingham

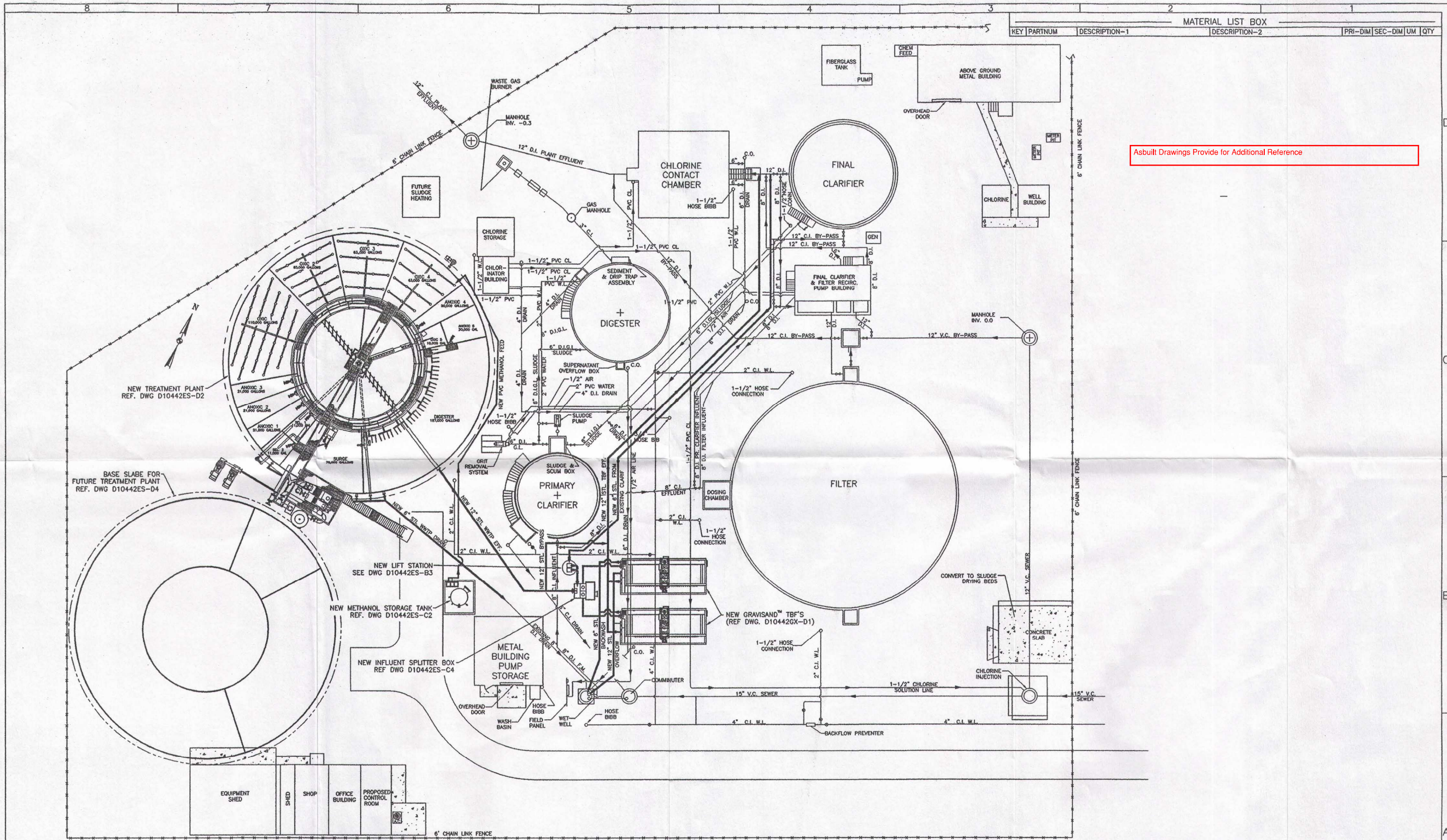
Panama City  
Albany



**EXISTING PREVIOUSLY DEMOLISHED DIGESTER BASIN ASBUILT**

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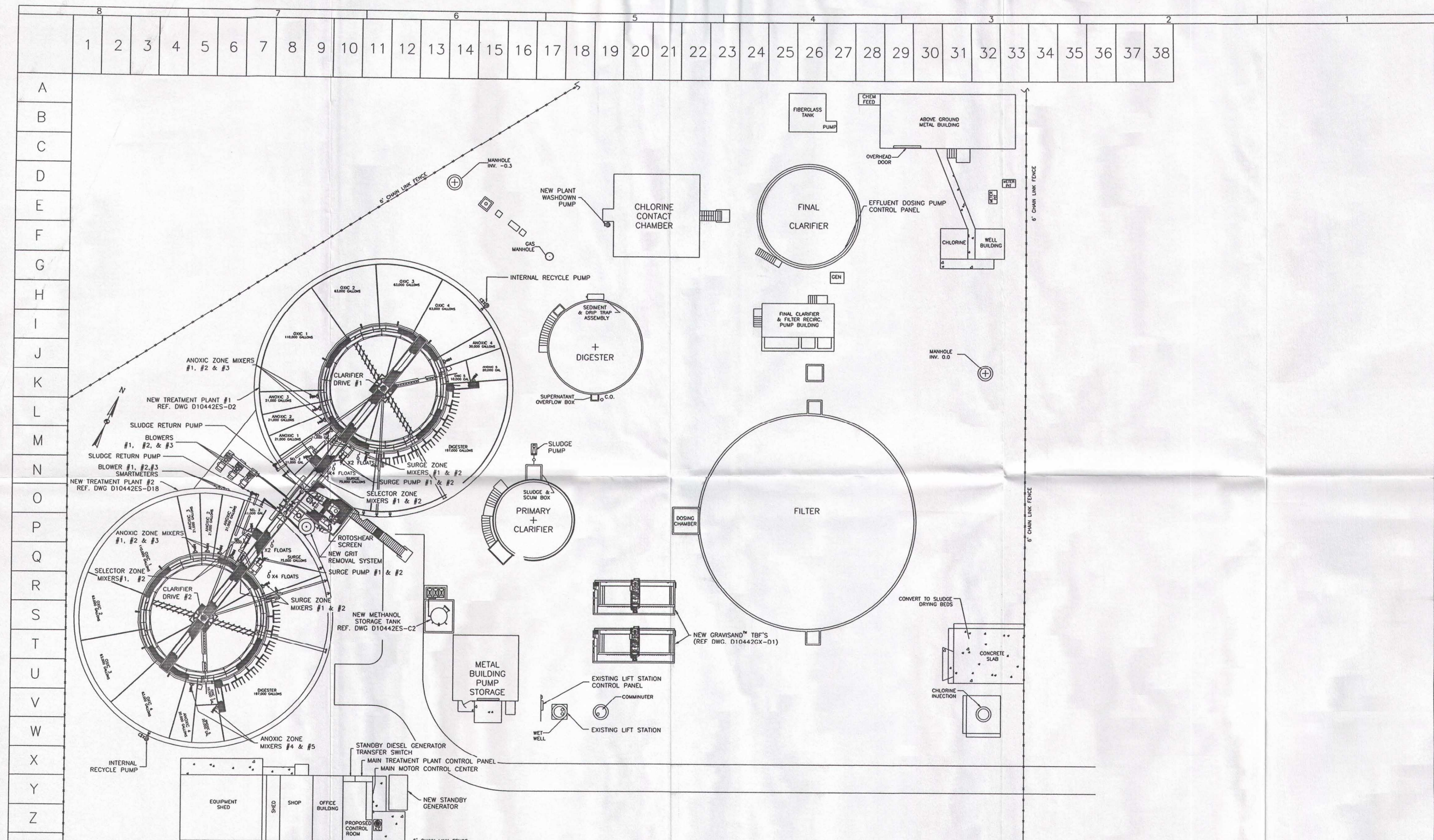
Asbuilt Drawings Provide for Additional Reference

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				CHECKER BSP	DATE 12-12-00	CLIENT DAUPHIN ISLAND WWT			
				ENGINEER	DATE	<b>USFilter</b> DAVIS PRODUCTS THOMASVILLE, GA 1-800-841-1550			
				MANAGER	DATE				
				FILE:	UPDATE:	PROJECT 10422	CODE	DRAWING D10442ED-D1	SHEET 1 OF 1
				SCALE: 1/16"	SIZE: D	REV 000			

BAR = 1" AT PLOT SCALE

REV DESCRIPTION BY DATE





BAR = 1" AT PLOT SCALE

1 CONDUIT RUNS INCLUDED FOR 2ND PLANT P.J.F. 10-14-01

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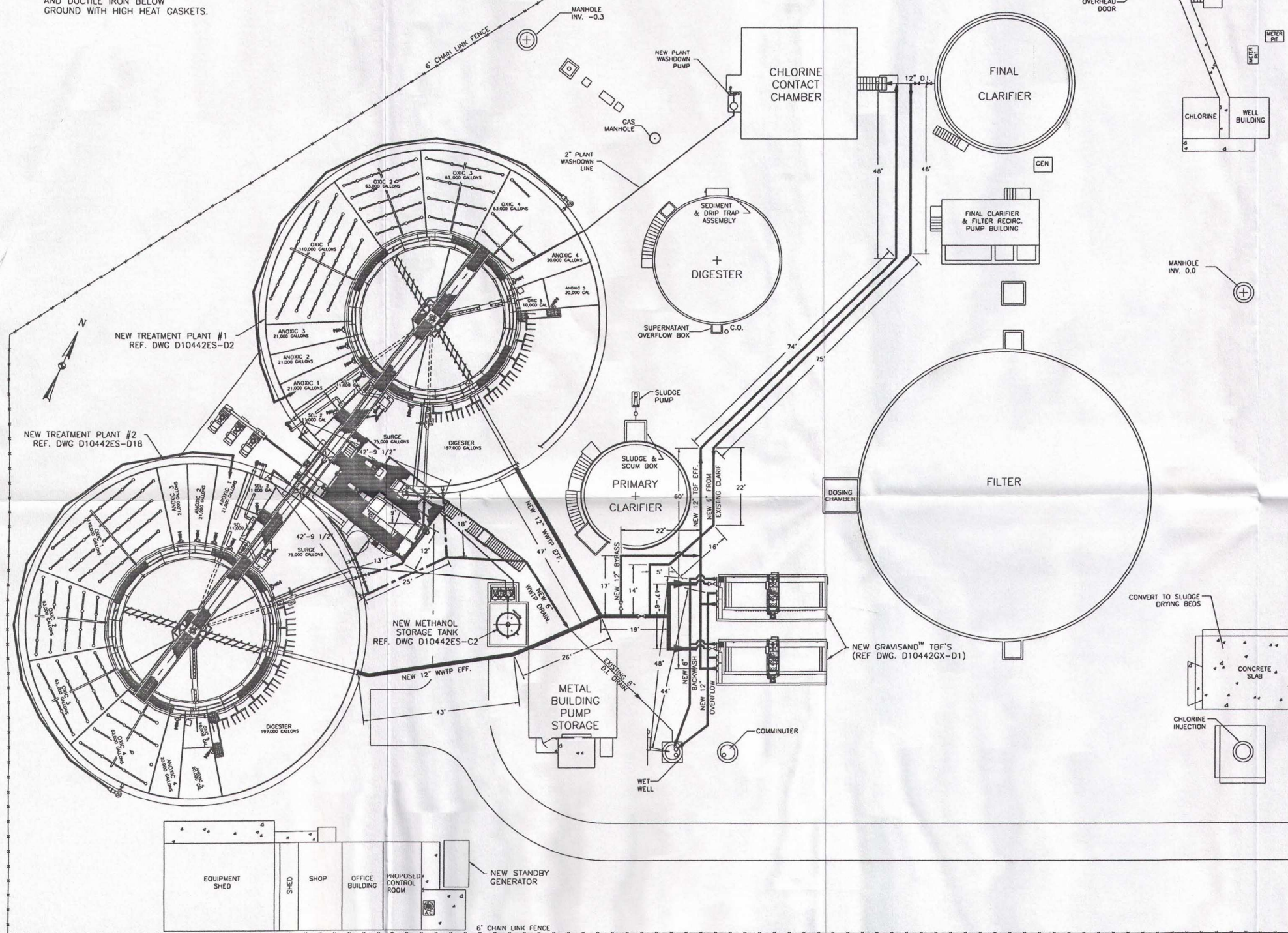
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P.J.F.	1-8-01
CHECKER	DATE
PDG	1-11-01
ENGINEER	DATE
MANAGER	DATE
FILE:	UPDATE:
SCALE: 200	SIZE: D

TITLE		CONDUIT SCHEDULE LAYOUT MAP	
CLIENT		DAUPHIN ISLAND WWTP	
PROJECT		D10442ES	
DRAWING		D10442ES-D-18	
SHEET		1 OF 1	
REV		001	

**USFilter** DAVIS PRODUCTS  
THOMASVILLE, GA  
1-800-841-1550

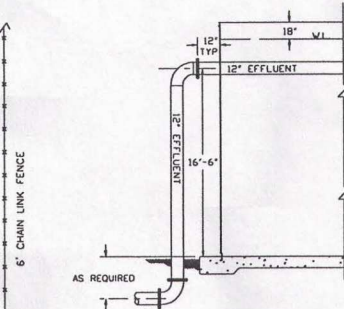


NOTE:  
ABOVE GROUND PIPING IS TO  
BE STEEL. ALL PIPING BELOW  
GROUND IS TO BE PVC WITH  
TRANSITIONAL MEK JOINTS.  
THE EXCEPTION BEING THE  
BLOWER PIPING WHICH IS TO  
BE STEEL ABOVE GROUND  
AND DUCTILE IRON BELOW  
GROUND WITH HIGH HEAT GASKETS.

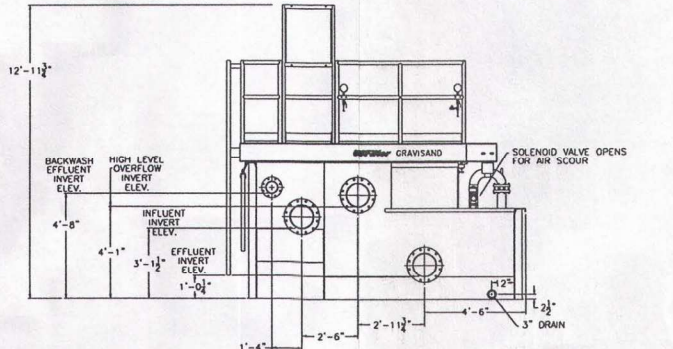
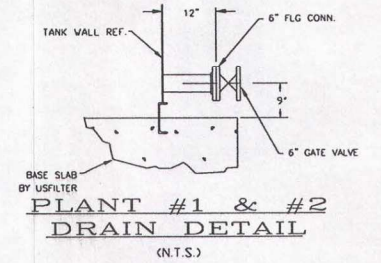


SITE PLAN VIEW

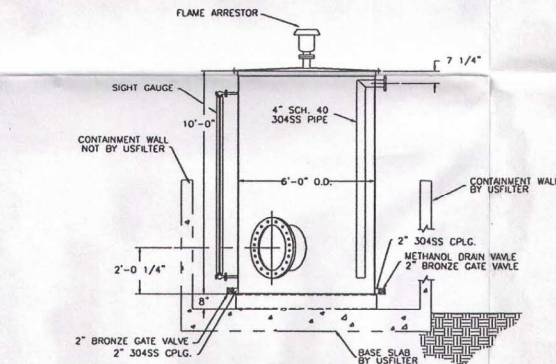
MATERIAL LIST BOX		DESCRIPTION-1		DESCRIPTION-2		PRI-DIM	SEC-DIM	UM	QTY
KEY	PARTNUM								



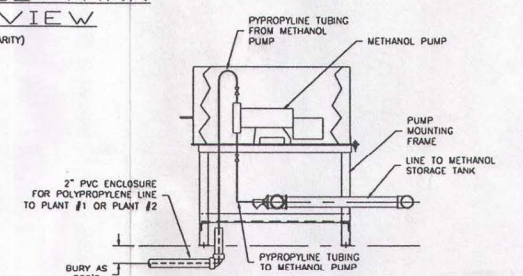
PLANT #1 & #2  
EFFLUENT ELEVATIONS  
(N.T.S.)



FILTER END ELEVATIONAL VIEW  
(N.T.S.)



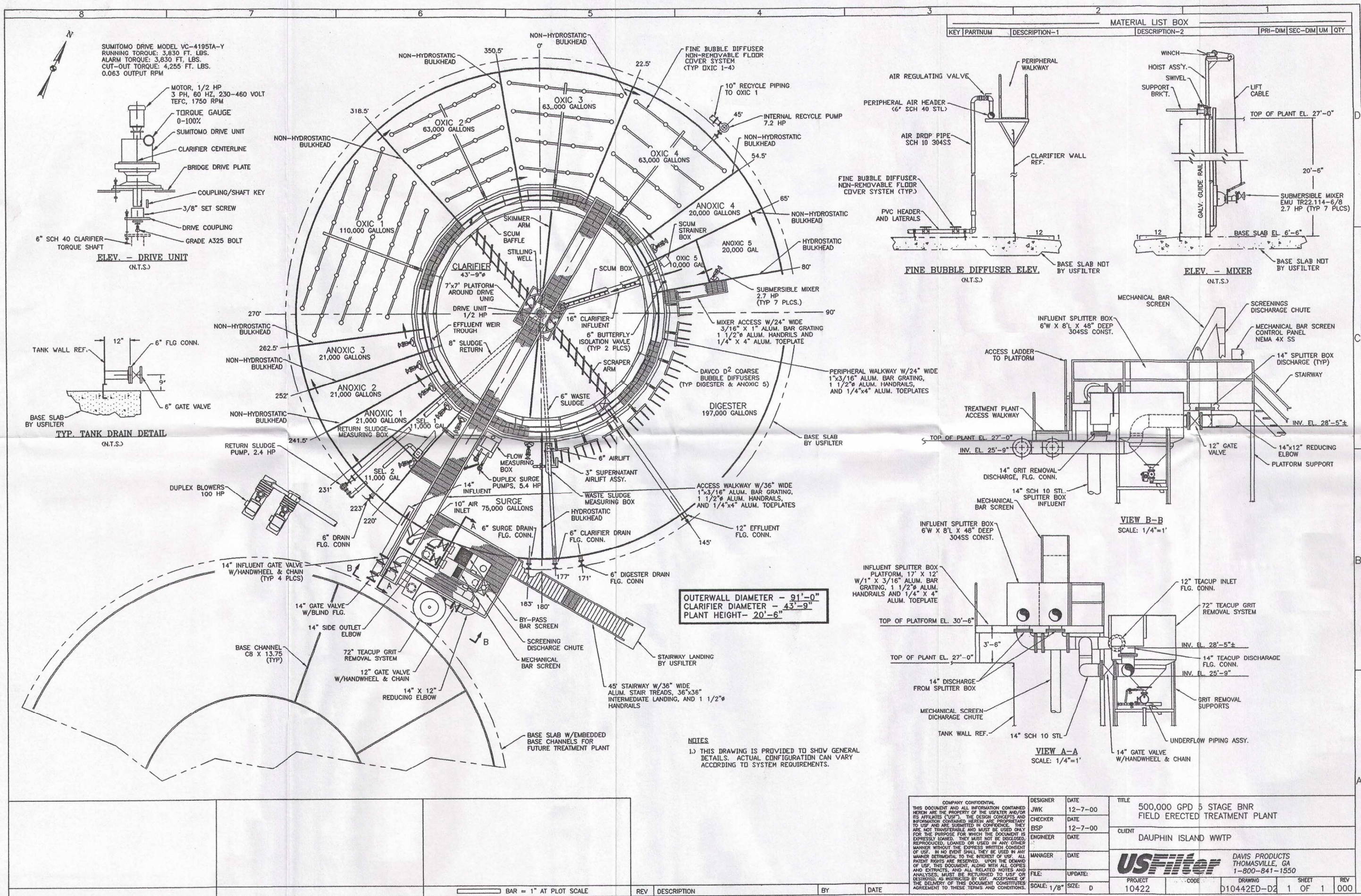
METHANOL STORAGE TANK  
ELEVATIONAL VIEW  
(SOME ITEMS ROTATED OR ROTATED FOR CLARITY)



METHANOL PUMP  
ELEVATIONAL VIEW

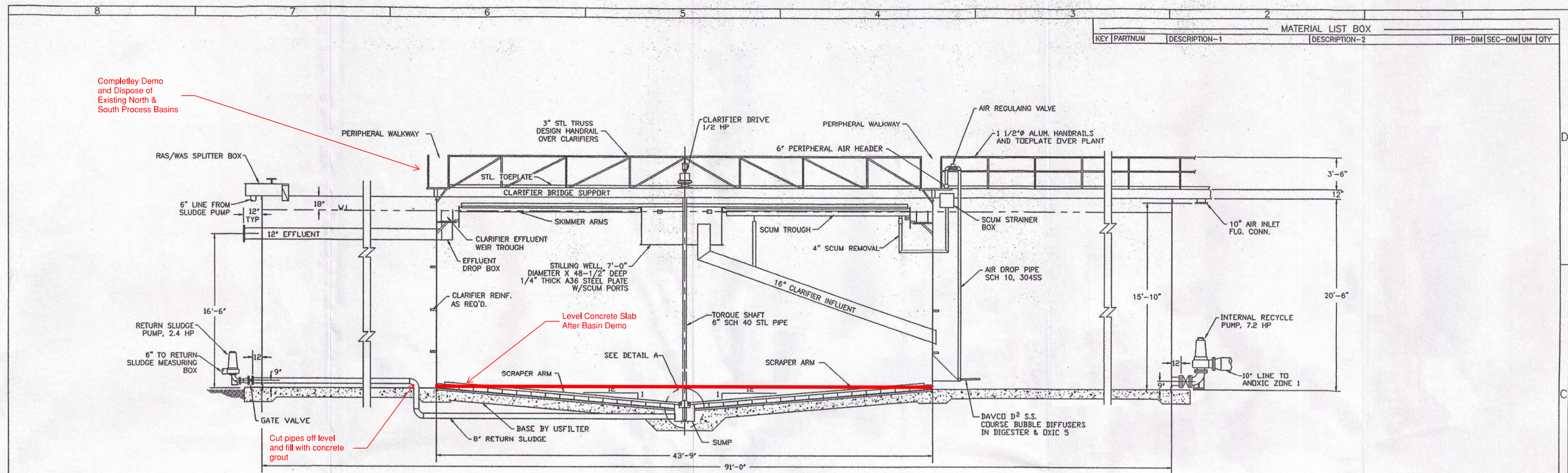
COMPANY CONFIDENTIAL		DESIGNER	DATE	TITLE		
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		CHECKER	DATE			
		ENGINEER	DATE	CLIENT DAUPHIN ISLAND WWTP		
		MANAGER	DATE			
		FILE:	UPDATE:			
		SCALE: 200	SIZE: D	PROJECT 10422	CODE	
					DRAWING 010442ED-D19	SHEET 1 OF 1
					REV 000	





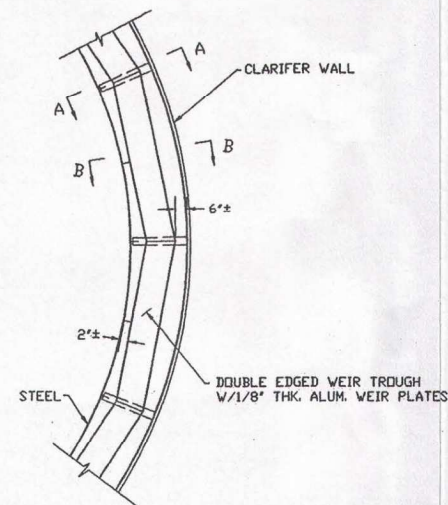
COMPANY CONFIDENTIAL		DESIGNER	DATE	TITLE			
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		CHECKER					
		BSP	12-7-00	CLIENT			
		ENGINEER	DATE	DAUPHIN ISLAND WWTP			
		MANAGER	DATE	 DAVIS PRODUCTS THOMASVILLE, GA 1-800-841-1550			
FILE:	UPDATE:						
SCALE: 1/8"	SIZE: D						
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		10422		D10422ED-D2	1	OF 1	



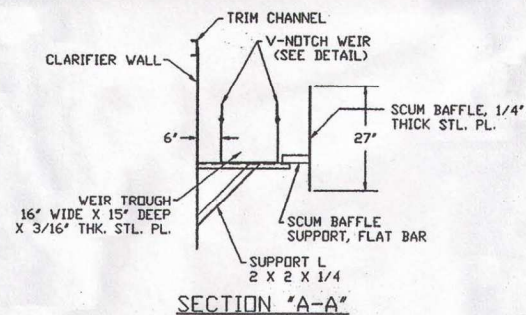


### SECTIONAL ELEVATION

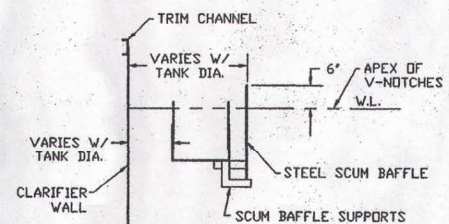
( SOME ITEMS ROTATED OR OMITTED FOR CLARITY )



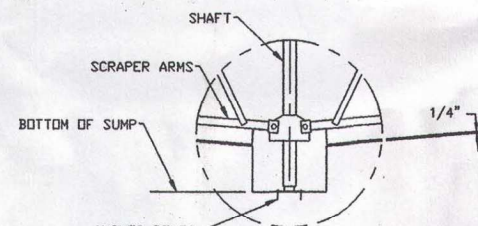
PARTIAL PLAN VIEW



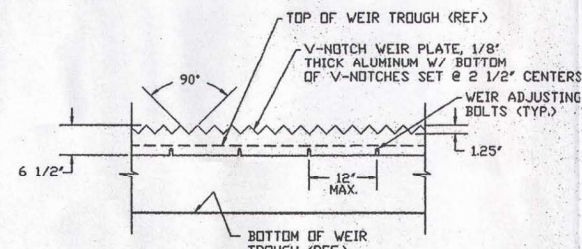
SECTION "A-A"



SECTION "B-B"



DETAIL A



WEIR PLATE DETAILS

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DESIGNER	DATE
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CHECKER	DATE
BSP	12-11-00
ENGINEER	DATE
MANAGER	DATE
FILE:	UPDATE:
SCALE: NONE	SIZE: D

TITLE	
SECTIONAL ELEVATION & DETAILS	
CLIENT	
DAUPHIN ISLAND WWTP	
PROJECT	
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CODE	
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THOMASVILLE, GA  
1-800-841-1550

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	BY	DATE
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# MANUFACTURING

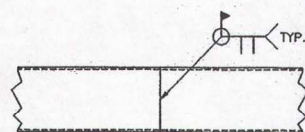
1. THE OUTER WALL BASE RING CHANNEL WHEN MEASURED AROUND THE OUTSIDE ARC SURFACE OF THE CHANNEL WEB BETWEEN FLANGES WILL HAVE A CIRCUMFERENCE OF 3426.24
2. THE INNER WALL BASE RING CHANNEL WHEN MEASURED AROUND THE OUTSIDE ARC SURFACE OF THE CHANNEL WEB BETWEEN FLANGES WILL HAVE A CIRCUMFERENCE OF 1644.96
3. FOR SHIPPING, USFILTER SHALL CUT ALL SECTIONS OF CHANNELS TO NOT OVER 216" ARC LENGTH.

# SHOP PAINTING INSTRUCTIONS

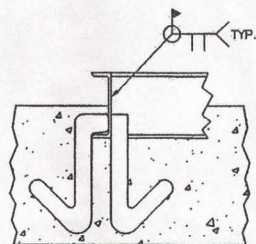
1. ALL STEEL SURFACES TO BE PAINTED SHALL HAVE A NEAR WHITE BLAST FINISH, CHIP AND GRIND REMAINING SPATTER & WELDS, REMOVE ALL DUST AND OILY DEPOSITS.
2. BASE RINGS SHALL HAVE A USFILTER PRIME COAT OF 3.0 MILS MINIMUM DRY THICKNESS.

# ERECTION:

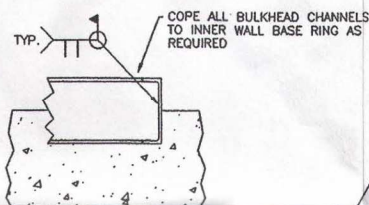
1. BASERINGS TO BE INSTALLED WITH THE TOP OF ALL SECTIONS OF EACH RING LEVEL WITHIN 1/8" ( $\pm 1/16"$ ).
2. BULKHEAD BASES TO BE INSTALLED WITH TOP SURFACE LEVEL WITH BASE RING TOP SURFACES.
3. ENDS OF BASE RING SECTIONS TO BE BUTT WELDED TOGETHER, CONTINUOUS WELD ALL AROUND.
4. BULKHEAD BASES ARE TO BE WELDED AT EACH END TO BASE RINGS, CONTINUOUS WELD ALL AROUND.
5. USFILTER IS NOT RESPONSIBLE FOR THE DESIGN AND CONSTRUCTION OF THE CONCRETE PADS AND THE INSTALLATION OF THE PARTS OF THE PLANT SHOWN IMBEDDED IN CONCRETE.
6. USFILTER PROVIDES THE HARDWARE LISTED IN THE BILL OF MATERIAL.
7. STORAGE & HANDLING  
ROLLED STRUCTURAL STEEL SECTIONS FOR THE BASE AND TRIM AND STEEL PLATES FOR THE CIRCULAR WALLS OF THIS PLANT WILL BE DELIVERED TO THE JOB SITE BY USFILTER PROPERLY ROLLED TO THE SPECIFIED RADIUS. IT IS IMPERATIVE THAT THESE ITEMS BE PROPERLY UNLOADED FROM THE DELIVERING TRUCK, STORED & HANDLED DURING ERECTION TO ASSURE THAT THEY ARE NOT SPRUNG BEYOND THE ELASTIC LIMIT AND THUS BENT TO ANOTHER RADIUS. ROLLED STRUCTURAL STEEL SHAPES SHOULD BE HANDLED WITH CARE AND STACKED FLAT WITH NO INDUCED LOAD TENDING TO SPRING THEM OUT OF SHAPE. USFILTER WILL NOT BE RESPONSIBLE FOR ERECTION PROBLEMS RESULTING FROM POOR HANDLING, STACKING OR STORING OF COMPONENTS AND PARTS OF THIS PLANT.
8. ALL DEGREES ARE TO THE CENTERLINE OF ALL BULKHEAD CHANNELS.
9. ALL DIMENSIONS ARE GIVEN IN INCHES UNLESS OTHERWISE SPECIFIED.
10. PRIME ALL WELDED SURFACES WITH ITEM 1 PRIOR TO POURING CONCRETE.
11. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO INSTALL EACH BASE RING TO THE RADIUS SHOWN (TOLERANCE  $\pm 1/2"$ ).
12. REINFORCING HOOKS SPACED 24 INCHES, STAGGERED TYPICAL ALL HYDROSTATIC BULKHEADS.
13. 48 INCHES TYPICAL ON INSIDE OF BASE RING CHANNEL.
14. 24 INCHES TYPICAL ON OUTSIDE OF BASE RING CHANNEL.
15. ALL IMBEDDED HOOKS TO BE TIED INTO THE BASE SLAB REBAR MATS.



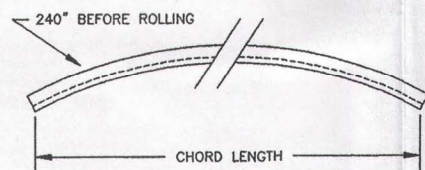
SECTION A-A  
(TYPICAL)



SECTION B-B  
(TYPICAL)

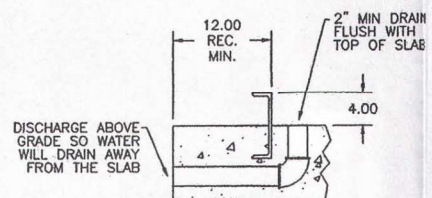


SECTION C-C  
(TYPICAL)

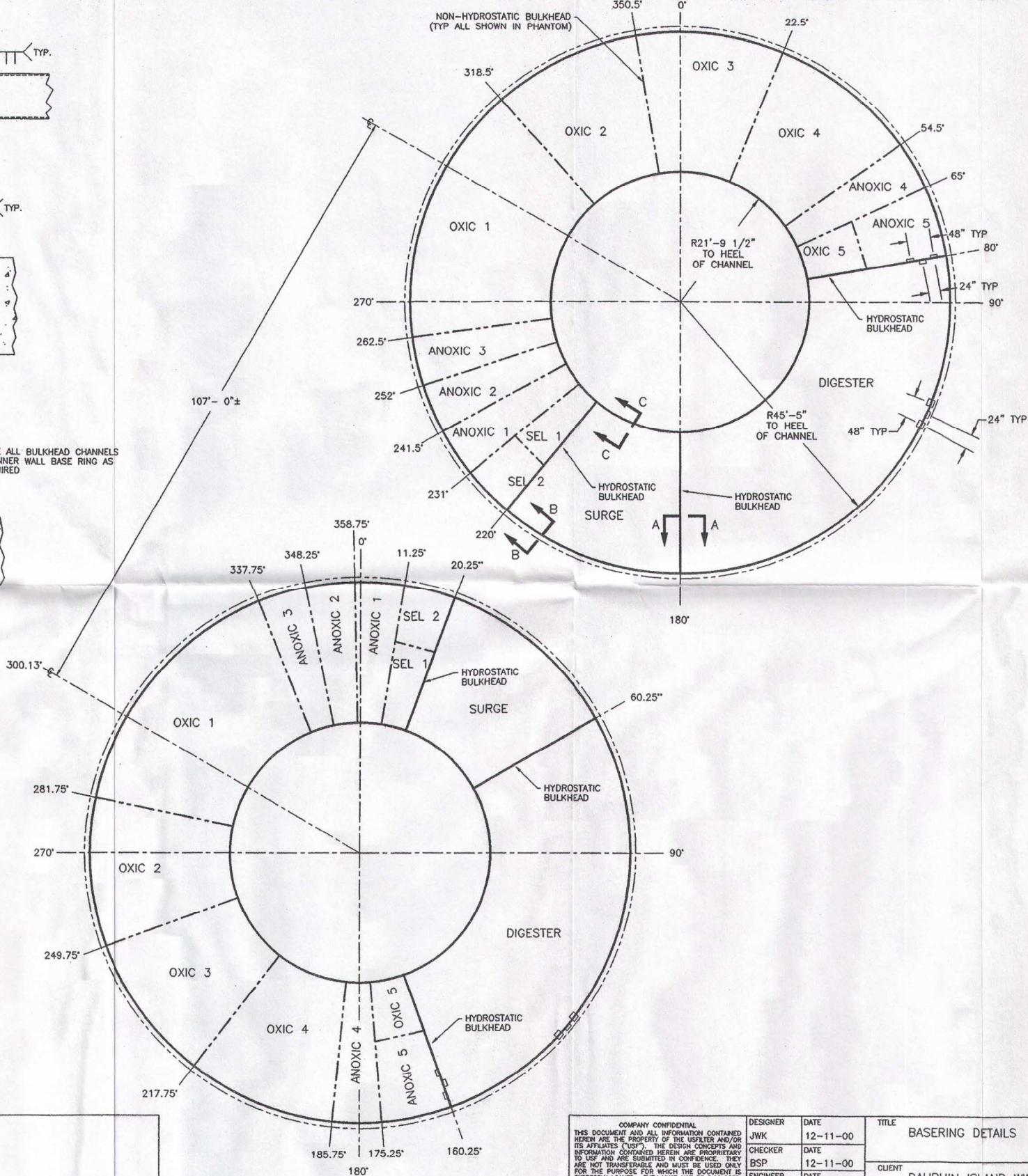


CHORD LENGTH OUTER WALL CHANNEL SEGMENT: 238.07  
CHORD LENGTH INNER WALL CHANNEL SEGMENT: 231.67

THE CHORD LENGTH SHOWN IS BEFORE CHANNEL ENDS ARE CUT AND SQUARED. THIS WILL NOT BE THE ACTUAL CHORD LENGTH OF CHANNEL DELIVERED TO THE JOB SITE.



NOTE:  
USFILTER SUGGESTS THAT THE CONTRACTOR IMBED A DRAIN IN EACH COMPARTMENT (EXCEPT CLARIFIER) SIMILAR TO THE DETAIL ABOVE. DRAINS ARE FOR REMOVAL OF WATER FROM EACH COMPARTMENT DURING THE ERECTION AND PAINTING STAGES. DRAINS TO BE SEALED WATER TIGHT BEFORE FILLING PLANT. MATERIALS FOR DRAINS AND SEALANT ARE NOT PROVIDED BY USFILTER.



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DESIGNER  
JWK  
CHECKER  
BSP  
ENGINEER  
DATE  
12-11-00  
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12-11-00  
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MANAGER  
DATE  
FILE:  
UPDATE:  
SCALE: 3/32" SIZE: D

TITLE  
BASERING DETAILS  
CLIENT  
DAUPHIN ISLAND WWTP  
PROJECT  
10442  
CODE  
DRAWING  
D10442ES-D4  
SHEET  
OF  
REV  
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DAVIS PRODUCTS  
THOMASVILLE, GA  
1-800-841-1550

BAR = 1" AT PLOT SCALE

REV DESCRIPTION BY DATE