Solicitation

For Participation in

Construction Services for Otter Run Water Treatment Plant Renewal and Replacement

for

Jacksonville, FL

Solicitation Number: 130-17

Mandatory Pre-Bid Meeting on August 16, 2017

Mandatory Pre-Bid Meeting Time: 9:30 AM

Mandatory Pre- Bid Meeting Location: JEA Bid Office, Customer Center 1st Floor, Room 002

21 W. Church Street, Jacksonville, FL 32202

A Mandatory Site Walkthrough will occur following the meeting at Otter Run WTP located at 96119 Otter Run Drive, Fernandina Beach, FL

Bids are due on September 12, 2017

Direct delivery or mail to JEA Bid Office, Customer Center 1st Floor, Room 002

21 W. Church Street, Jacksonville, FL 32202

JEA will publicly open all bids received from qualified Bidders on September 12, 2017, at 2:00 p.m. in the JEA Bid Office, Customer Center 1st Floor, Room 002, 21 W. Church Street, Jacksonville, FL 32206

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Solicitation

1. SOLICITATION

1.1. INVITATION

1.1.1. SCOPE OF WORK

JEA is soliciting Bids from construction contractors (hereinafter referred to as "Company") for construction services for Otter Run water treatment plant renewal and replacement (the "Work" or "Services".)

The Work specified herein includes construction and acceptance testing for the Otter Run water treatment plant (WTP) renewal and replacement project, in accordance with the engineered contract documents. The Otter Run WTP located at 96119 Otter Run Drive, Fernandina Beach, FL, has a design capacity of 590,000 gallons per day (GPD) with an average daily use of 78,264 GPD and a maximum daily use of 661,000 GPD. It is part of the Lofton Oaks service grid which serves areas of Nassau county from I-95 to the intracoastal waterway and the Duval county line to the St. Mary's River. The plant has two above-ground steel storage tanks, which are rusted and are in need of repair. In addition, the high service pumps, electrical equipment and other components need to be upgraded.

A complete scope of work is provided in Appendix A – Technical Specification.

1.1.2. QUESTIONS

All questions must be submitted in writing to the JEA Buyer listed below at least five (5) business days prior to the opening date. Questions received within five (5) business days prior to the opening date will not be answered.

For Procurement Related Questions:
Buyer: NATHAN WOYAK
E-mail: woyanj@jea.com

For Technical Questions:
Contact: BRIAN GAINES
E-mail: gainba@jea.com

1.1.3. INVITATION TO BID

You are invited to bid on the Solicitation noted below:

JEA Solicitation Title: Construction Services for Otter Run Water Treatment Plant Renewal and Replacement
JEA Solicitation Number: 130-17

To obtain more information about this Solicitation:
Download a copy of the Solicitation, PDF quality drawings (if applicable) and any required forms at jea.com.

Bid Due Time: 12:00 P.M. - ALL LATE BIDS WILL BE RETURNED UNOPENED
Bid Due Date: September 12, 2017

All Bids must reference the JEA Solicitation title and number noted above. All Bids must be made on the appropriate Bid forms as specified within this Solicitation, and placed in an envelope marked to identify the Solicitation and delivered or mailed to:

JEA Procurement, Bid Office, Customer Center 1st Floor, Room 002, Jacksonville, FL 32202

The Bidder shall be solely responsible for delivery of its Bid to the JEA Bid Office. **Please note, JEA employs a third party courier service to deliver its mail from the local U.S. Postal Service (USPS) which could cause a delay of Bid delivery if mailed through the USPS.** Therefore, JEA recommends direct delivery to the JEA Bid Office. Reliance upon the USPS, the courier service employed by JEA to make pick-ups from the local USPS, or public carriers is at the Bidder's risk.

Bids are due by the time and on the date listed above. ALL LATE BIDS FOR WHATEVER REASON WILL BE RETURNED UNOPENED.

1.1.4. MANDATORY PRE-BID MEETING AND SITE WALKTHROUGH

There will be a mandatory Pre-Bid meeting. All interested Bidders must attend the Pre-Bid meeting. Each Bidder will be required to sign in at the beginning of the meeting. A Bidder shall only sign in representing one company, unless otherwise specified by JEA. Bidders not attending the Pre-Bid meeting shall have their bids opened, however, the Bid will be rejected and JEA will send the Bidder a disqualification letter.

Bidders shall be on time to the Pre-Bid meeting and Bidders must be present at the starting time of the meeting. Bidders not arriving on time for the meeting will have their Bids rejected and returned unopened.

PLEASE BE AWARE DUE TO JEA SIGN IN AND/OR SECURITY PROCEDURES IT MAY TAKE UP TO FIFTEEN MINUTES TO OBTAIN ACCESS TO A JEA FACILITY. PLEASE PLAN ACCORDINGLY SO AS TO ARRIVE TO THE PRE-BID MEETING ON TIME.

Pre-Bid Meeting Time: 9:30 A.M.
Pre-Bid Meeting Date: August 16, 2017
Pre-Bid Location: JEA Bid Office, Customer Center 1st Floor, Room 002, 21 W. Church Street, Jacksonville, FL 32202

A Mandatory Site Walkthrough will occur following the meeting at Otter Run WTP located at 96119 Otter Run Drive, Fernandina Beach, FL

1.1.5. OPENING OF BIDS

All Bids shall be publicly opened, read aloud and recorded at 2:00 PM on September 12, 2017 at the JEA Bid Office, 21 W. Church Street, Customer Center First Floor, Room 002, Jacksonville, FL 32202.

At the opening of Bids, a JEA Representative will publicly open and announce each Bid that was received on time. Bids that have been properly withdrawn will not be opened. JEA has the right to waive any irregularities or informalities in the Bid Document.

1.2. SPECIAL INSTRUCTIONS

1.2.1. EVALUATION METHODOLOGY

1.2.1.1. BASIS OF AWARD - LOWEST BID

JEA will Award this Contract to the responsive and responsible Bidder whose Bid meets or exceeds the Minimum Qualifications set forth in this Solicitation, and the Bidder's price represents the lowest cost to JEA.

JEA will use the Bidder's Total Bid Price stated on the Bid Form when making price comparisons for Award purposes.

1.2.1.2. COMPETITIVE SEALED BIDDING (INVITATION FOR BIDS)

The Bidder shall submit its sealed Bid in response to this Solicitation no later than the Bid due date and time indicated herein. At the public opening of the Bids, the Bids from all Bidders will be publicly announced. After the public opening, JEA will subsequently review Bids to determine if they meet the minimum qualifications as stated in this Solicitation. JEA will Award the Contract to the lowest responsive and responsible Bidder whose Bid meets or exceeds the minimum qualifications, and whose Bid Price represents the lowest cost to JEA.

NO EXCEPTIONS ARE ALLOWED IN AN INVITATION TO BID. IF THE BIDDER OBJECTS IN ANY MANNER TO THE TERMS AND CONDITIONS OR TECHNICAL SPECIFICATIONS, THE OBJECTION MUST BE ADDRESSED IN WRITING FIVE (5) BUSINESS DAYS PRIOR TO THE BID OPENING DATE, AND THE OBJECTION MAY BE ADDRESSED IN AN ADDENDUM IF JEA BELIEVES THAT A CLARIFICATION OR CHANGE IS NECESSARY. ANY MODIFICATIONS, EXCEPTIONS OR OBJECTIONS STATED WITHIN THE BID DOCUMENTS SHALL SUBJECT THE BID TO BE REJECTED.

1.2.2. MINIMUM QUALIFICATIONS FOR SUBMISSION

Bidder shall have the following Minimum Qualifications to be considered eligible to submit a Bid in response to this Solicitation.

It is the responsibility of the Bidder to ensure and certify that it meets the Minimum Qualifications stated below. A Bidder not meeting all of the following criteria will have their Bids rejected:

- At the Bid Due Date and Time, the Bidder must be on the Responsible Bidder List (RBL) for category: **RBL – WP2 – Water and Sewer Plant Systems Installation, Construction, Maintenance, and Repair**

For any questions regarding RBL qualification and current status, contact Melanie Newton-Green at: 904-665-6913 or at newtmi@jea.com.

Please note, any Bidder whose contract with JEA was terminated for default within the last two (2) years shall have their Bid rejected.

1.2.3. NUMBER OF CONTRACTS TO BE AWARDED

JEA will Award this Contract to the responsive and responsible Bidder whose Bid meets or exceeds the Minimum Qualifications set forth in this Solicitation, and the Bidder's price represents the lowest cost to JEA.

JEA will use the Bidder's Total Bid Price stated on the Bid Form when making price comparisons for Award purposes.

1.2.4. JACKSONVILLE SMALL AND EMERGING BUSINESS (JSEB) PROGRAM REQUIREMENTS

1.2.4.1. JACKSONVILLE SMALL AND EMERGING BUSINESS (JSEB) GOAL (IFB)

The specific JSEB participation goal for the Scope of work described in this Solicitation is: **six percent 6%** . This percentage is the percentage of the Bidder's total bid price that must be awarded or subcontracted to JSEB firms. Failure to fully comply with the JSEB requirements stated herein may disqualify the Bid.

Bidders are required to complete and submit with their Bid the JSEB form which can be found at www.jea.com. Bidders must specify on the JSEB form how they intend to comply with the JSEB goal stated herein. Bidders that do not submit a JSEB form with their Bid may have their Bids rejected, unless they are exempted under the good faith exception described below.

In no case shall the Bidder make changes to the JSEB firms listed in its Bid, revise the JSEB Scope of work or amount of Work as stated in its Bid without prior written notice to the JEA Contract Administrator, and without subsequent receipt of written approval from the JEA Contract Administrator.

JSEB firms that qualify for this Contract are those shown on the current City of Jacksonville JSEB directory appearing at www.COJ.net. Certification of JSEB firms must come for the City of Jacksonville. No other agency or organization is recognized for purposes of this Contract.

If the Bid does not comply with the JSEB requirements established in this Solicitation, the Bidder must submit documentation as part of its Bid describing in detail its good faith efforts to comply with the JSEB requirements of the Solicitation. This documentation shall include at a minimum the following items:

A written and signed statement describing the level of effort for each of the requirements listed below. Include dates times, people whom the Bidder contacted and phone numbers to enable JEA to confirm good faith efforts.

Copies of written solicitations of participation the Bidder sent to qualified JSEB firms, showing adequate response time was provided, defining the scope and nature of the work Bidder is asked to perform, Bidder contact information for questions and follow-up, and an offer to meet to review plans, specifications and scope.

A statement of the Bidder's efforts to negotiate a suitable agreement with JSEB firms including call logs showing participants, dates, times, topics discussed, and open issues.

A statement of the Bidder's efforts to help qualified firms that may require assistance in obtaining bonding, insurance, financing, technical support, procedural information, or other items necessary to compete for and perform the Work.

For each offer received from a qualified JSEB firm but rejected by Bidder, a statement explaining why such offer was not made part of the Bid.

For each qualified JSEB firm contacted but considered unqualified by the Bidder to perform a portion of the Work, a statement of the reasons Bidder considered firm to be unqualified.

The Bidder shall contact the JEA JSEB Office for assistance when all independent attempts (emails, phone calls, faxes and letters) to contact qualified JSEB firms have failed, and shall do so in adequate time for JSEB firms to be identified and to allow JSEB firms adequate time in which to respond. Failure by the Bidder to contact the JEA JSEB Office as required herein will be considered when determining if the Bidder has made a good faith effort.

The Bidder understands and agrees that receipt of a lower bid from a non-JSEB qualified firm, will not in and of itself, be sufficient reason to justify failing to meet the JSEB requirements of the Solicitation.
The determination as to whether the Bidder made a good faith effort in trying to achieve the JSEB requirements of this Solicitation will be made solely by JEA and prior to Award.

All questions and correspondence concerning the JSEB program should be addressed to the following contact:

G. Nadine Carswell
JSEB Manager
(904) 665-6257
carsgs@jea.com

1.2.5. INSURANCE REQUIREMENTS

Prior to JEA issuing a Purchase Order to the Bidder to begin the Work or Services, the Bidder shall submit a certificate of insurance (COI) that is in compliance with amounts and requirements as indicated in the Section herein entitled "Insurance Requirements". **Note that the COI shall specifically indicate JEA (and Florida Power and Light Company ("FPL"), if applicable) as additional insured(s) on all required insurance except Worker's Compensation and Professional Liability (if applicable). Furthermore, waiver of subrogation shall be provided for all required insurance in favor of JEA, FPL (if applicable), including their board members, officers, employees, agents, successors, and assigns.**

1.2.6. PAYMENT AND PERFORMANCE BOND REQUIREMENTS

Once the Bidder is Awarded the Contract and upon receipt of the Contract Documents, the Bidder shall furnish a Payment and Performance Bond, or alternate form of security, in the amount indicated on the Bid Form, made out to JEA in forms and formats approved and provided by JEA, as security for the faithful performance of the Work or Services. No modifications to the JEA bond forms are allowed.

A fully executed Payment and Performance Bond must be recorded with the Clerk of Duval County Court and delivered to JEA before the JEA Purchase Order will be issued. JEA will send the approved bond forms to the Bidder for execution along with the Contract; however, in no case shall the date on the bond forms be prior to that of the executed Contract. The surety must be authorized and licensed to transact business in Florida. **Note, that the Bidder is responsible for the costs associated with the required Payment and Performance Bonds; therefore, the costs should be included in the Bidder's total Bid Price.** If the Bidder fails or refuses to furnish or record the required bonds, JEA will retain the Bidder's bid bond as liquidated damages.

To be acceptable to JEA as surety for Performance and Payment Bonds, a surety company shall comply with the following provisions:

- The Surety Company shall have a currently valid Certificate of Authority, issued by the State of Florida, Department of Insurance, authorizing it to write surety bonds in the State of Florida.
- The Surety Company shall have a currently valid Certificate of Authority issued by the United States Department of Treasury under Sections 9304 to 9308 of Title 31 of the United States Codes.
- The Surety Company shall be in full compliance with the provisions of the Florida Insurance Code.
- The Surety Company shall have at least twice the minimum surplus and capital required by the Florida Insurance Code during the life of this agreement.
- If the Contract Award Amount exceeds $500,000, the Surety Company shall also comply with the following provisions:

The Surety Company shall have at least the following minimum ratings in the latest issue of A.M. Best's Key Rating Guide.

POLICY HOLDER'S CONTRACT AMOUNT AND REQUIRED FINANCIAL RATING
$500,000 TO 1,000,000: A-CLASS IV
$1,000,000 TO 2,500,000: A-CLASS V
$2,500,000 TO 5,000,000: A-CLASS VI
$5,000,000 TO 10,000,000: A-CLASS VII
$10,000,000 TO 25,000,000: A- CLASS VIII

$25,000,000 TO 50,000,000: A- CLASS IX
$50,000,000 TO 75,000,000: A- CLASS X
The Surety Company shall not expose itself to any loss on any one risk in an amount exceeding ten (10) percent of its surplus to policyholders, provided:
Any risk or portion of any risk being reinsured shall be deducted in determining the limitation of the risk as prescribed in this section. These minimum requirements shall apply to the reinsuring carrier providing authorization or approval by the State of Florida, Department of Insurance, to conduct business in this state has been met.
In the case of the surety insurance company, in addition to the deduction for reinsurance, the amount assumed by any co-surety, the value of any security deposited, pledged or held subject to the consent of the surety and for the protection of the surety shall be deducted.

1.2.7. LIQUIDATED DAMAGES IN CONTRACT

The Contract issued pursuant to this Solicitation contains liquidated damages tied to project completion deadlines. The Bidder should review the specific time frames and liquidated damage amounts prior to submitting its Bid.

1.2.8. SAFETY QUALIFICATION REQUIREMENTS (IFB)

Bidder shall be approved as JEA Safety Qualified within ten (10) business days of receiving written notice from the JEA Bid Office that it is the lowest responsive and responsible Bidder. If the Bidder fails to obtain JEA approval as a JEA Safety Qualified company by 4:00 p.m. Eastern time on the 10th business day, JEA will reject the company's Bid, and proceed to Award to the next lowest responsive and responsible Bidder.

JEA Safety Qualification information is available online at jea.com. Please note that it may take up to five (5) business days for a company to be approved as JEA Safety Qualified. It is the Bidder's responsibility to ensure it is JEA Safety Qualified. A list of the JEA's Safety Qualified vendors can be found on jea.com. For additional information, contact Jerry Fulop at (904) 665-5810.

1.2.9. TIME

In computing any period of time prescribed or allowed by this solicitation, the day of the act, event, or default from which the designated period of time begins to run shall not be included. The last day of the period so computed shall be included unless it is a Saturday, Sunday, or JEA holiday, in which event the period shall run until the end of the next day which is neither a Saturday, Sunday, or JEA holiday.

1.2.10. REQUIRED FORMS TO SUBMIT WITH BID

To submit a Bid in response to this Solicitation, all of the forms listed below must be completed and submitted as part of the Bid. The Bidder must obtain the required forms, other than the forms provided in the solicitation, by downloading them from JEA.com. If the Bidder fails to complete or fails to submit one or more of the required forms, the Bid shall be rejected.
The following forms are required to be submitted at the time of Bid:

- Bid Bond
- Bid Form (including acknowledgements of all addenda) - This form can be found in Appendix B
- List of JSEB Certified Firms (if any)
- Florida Trench Safety Act Acknowledgment
- Construction and Demolition Debris Disposal (if applicable)
- Subcontractor Form This form can be found in Appendix B**,**

1. Tank Construction
2. Electrical

3. I&C

- State of Florida license number – enter on the Bid Form

If the above listed forms are not submitted with the Bid by the Bid Due Time on the Bid Due Date, JEA shall reject the Bid.

JEA also requires the following documents to be submitted prior to execution of Contract. A Bid will not be rejected if these forms are not submitted at the Bid Due Time and Date. However, failure to submit these documents at the time of Contract execution could result in Bid rejection.

- Conflict of Interest Certificate Form
- Insurance Certificate
- W-9
- Evidence of active registration with the State of Florida Division of Corporations (www.sunbiz.org)
- Any technical submittals as required by the Technical Specifications.

1.2.11. BID SECURITY/BID BOND

All Bids shall be accompanied by a bid security in the amount stated on the Bid Form. The bid security must be furnished by the Bidder at or before the opening of Bids. The bid security shall either be issued by a surety company authorized to do business in the State of Florida, or Bidder shall furnish a certified check or cashier's check in the amount of five percent (5%) of the total Bid Amount shown on the Bid Form. The JEA Bid Bond form can be found at jea.com. Failure to furnish the required bid security will disqualify the Bid. If the Bidder is Awarded the Work and fails to execute the Contract within ten (10) days of postmarked date on the Contract Documents, JEA shall retain the Bid Bond or check as liquidated damages.

1.3. GENERAL INSTRUCTIONS

1.3.1. COMPLETING THE BID DOCUMENTS

Bidders shall complete and submit all Bid Documents with responses typewritten or written in ink. ALL BIDS SUBMITTED LATE TO THE JEA BID OFFICE WILL BE REJECTED.

When a blank is marked "optional" on the bid form, the Bidder shall insert the words "No Bid" in the space provided if the Bidder does not choose to submit a price for that item. Failure to complete each blank with either a price or the words "No Bid" may disqualify the Bid. The Bidder, or its authorized agent or officer, shall sign the Bid Documents. Failure to sign the Bid Documents may disqualify the Bid. JEA approved erasures, interlineations or other corrections shall be authenticated by affixing in the margin, immediately opposite the correction, the handwritten signature of each person executing the Bid. Failure to authenticate changes may disqualify the Bid. JEA may disqualify any Bids that deviate from the requirements of this Solicitation, and those that include unapproved exceptions, amendments, or erasures.

1.3.2. CALCULATION OF THE BID PRICE

JEA will use the Bidder's Total Bid Price stated on the Bid Form when making price comparisons for Award purposes.

1.3.3. SUBMITTING THE BID FORM

The Bidder shall submit one original of all the Bid Documents and two duplicates of the original Bid Documents. It is encouraged that all submitters include an electronic version with their hardcopy submittal.

JEA will not accept Bid Documents files transmitted via email. If electronic copies of the Bid Documents are submitted, they must be submitted on a CD with the hardcopies of the Bid Documents.

1.3.4. MODIFICATION OR WITHDRAWAL OF BIDS

The Bidder may modify or withdraw its Bid at any time prior to the Bid Due Date and Time by giving written notice to JEA's Chief Procurement Officer. JEA will not accept modifications submitted by telephone, telegraph, email, or facsimile, or those submitted after the Bid Due Date and Time. The Bidder shall not modify or withdraw its Bid from time of Bid opening and for a period of ninety (90) days following the opening of Bids.

1.3.5. ADDENDA

JEA may issue Addenda prior to the Bid opening date to revise, in whole or in part, or clarify the intent or requirements of the Solicitation. The Bidder shall be responsible for ensuring it has received all Addenda prior to submitting its Bid or Proposal and shall acknowledge receipt of all Addenda by indicating where requested on the Bid Form. JEA will post all Addenda when issued online at jea.com. The Bidder must obtain Addenda from the JEA website. All Addenda will become part of the Solicitation and any resulting Contract Documents. It is the responsibility of each Bidder to ensure it has received and incorporated all Addenda into its Bid or Proposal. Failure to acknowledge receipt of Addenda may be grounds for rejection of a Bid or Proposal.

1.3.6. CONTRACT EXECUTION AND START OF WORK

Within thirty (30) days from the date of Award, JEA will present the successful Bidder with the Contract Documents. Unless expressly waived by JEA, the successful Bidder shall execute a Contract for the Work or Services within ten (10) days after receiving the Contract from JEA. If the Bidder fails to execute the Contract or associated documents as required, or if it fails to act on a JEA-issued Purchase Order (PO), JEA may cancel the Award with no further liability to the Bidder, retain the bid security or bond (if applicable), and Award to the next-ranked company.

Upon JEA's receipt of the executed Contract, certificate of insurance, and recorded Payment and Performance bonds (if applicable), JEA will issue a PO, in writing and signed by an authorized JEA representative as acceptance of the Proposal or Bid and authorization for the company to proceed with the Work, unless otherwise stated in the Contract or PO.

For Construction Services: In the event that JEA intends to authorize the successful Bidder to proceed with administrative work only, or with only a portion of the Work, then the PO shall state the specific limitations of such authorization and JEA will issue a separate written Notice to Proceed to authorize the Bidder to begin Field Work, when applicable, or to perform the remainder of the Work, or any portion thereof. The Bidder shall ensure that it is prepared to begin Field Work upon receipt of Notice to Proceed. Any Work performed outside of this partial authorization shall be at the Bidder's risk and JEA shall have no obligation to pay for such Work.

1.3.7. DEFINED TERMS

Words and terms defined in the Section entitled "Definitions" of this document are hereby incorporated by reference into the entire document.

1.3.8. EX PARTE COMMUNICATION

Ex Parte Communication is strictly prohibited. Ex Parte Communication is defined as any inappropriate communication concerning a Solicitation between a firm submitting a Bid or Proposal and a JEA representative during the time in which the Solicitation is being advertised through the time of Award. Examples of inappropriate communications include: private communications concerning the details of Solicitation in which a Bidder becomes

privy to information not available to the other Bidders. Social contact between Bidders and JEA representatives should be kept to an absolute minimum during the solicitation process.

Failure to adhere to this policy will disqualify the noncompliant Company's Bid or Proposal. Any questions or clarifications concerning a Solicitation must be sent in writing via email to the JEA Buyer at least five (5) business days prior to the opening date. If determined by JEA, that a question should be answered or an issue clarified, JEA will issue an addendum to all Bidders.

For more information on Ex Parte communications, see JEA Procurement Code, Article 1-110, which is available at www.jea.com.

1.3.9. JEA PUBLICATIONS

Applicable JEA publications are available at jea.com.

1.3.10. PROHIBITION AGAINST CONTINGENT FEES

The Company warrants that it has not employed or retained any company or person, other than a bona fide employee working for the Company, or an independent sales representative under contract to the Company, to solicit or secure a contract with JEA, and that it has not paid or agreed to pay any person, company, corporation, individual or Company, other than a bona fide employee working solely for the Company, or an independent sale representative under contract to the Company, any fee, commission, percentage, gift, or any other consideration, contingent upon or resulting from the Award or making of the Contract. For a breach or violation of these provisions occurs, JEA shall have the right to terminate the Contract without liability, and at its discretion, to deduct from the Contract Price, or otherwise recover, the full amount of such fee, commission, percentage, gift or consideration.

1.3.11. RESERVATIONS OF RIGHTS TO JEA

The Solicitation provides potential Companies with information to enable the submission of written offers. The Solicitation is not a contractual offer or commitment by JEA to purchase products or services.

Bids shall be good for a period of ninety (90) days following the opening of the Bids.

JEA reserves the right to reject any or all Bids, or any part thereof, and/or to waive informalities if such action is in its best interest. JEA may reject any Bids that it deems incomplete, obscure or irregular including, but not limited to, Bids that omit a price on any one or more items for which prices are required, Bids that omit Unit Prices if Unit Prices are required, Bids for which JEA determines that the Bid is unbalanced, Bids that offer equal items when the option to do so has not been stated, Bids that fail to include a Bid Bond, where one is required, and Bids from Companies who have previously failed to satisfactorily complete JEA contracts of any nature or who have been scored by JEA as "Unacceptable" and as a result, are temporarily barred from bidding additional work.

JEA reserves the right to cancel, postpone, modify, reissue and amend this Solicitation at its discretion.

JEA reserves the right to cancel or change the date and time announced for opening of Bids at any time prior to the time announced for the opening of Bids. JEA may Award the Contract in whole or in part. In such cases whenever JEA exercises any of these reservations, JEA will make a commercially reasonable effort to notify, in writing, all parties to whom Solicitations were issued. JEA may award multiple or split Contracts if it is deemed to be in JEA's best interest.

1.3.12. SUNSHINE LAW

General

Article I, Section 24, Florida Constitution, guarantees every person access to all public records and Chapter 119, Florida Statutes, provide a broad definition of public records. JEA is a body politic and corporate and subject to these laws and related statutes ("Florida's Public Records Laws"). All responses to this Solicitation are public records and available for public inspection unless specifically exempt by law.

IF A BIDDER HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT:

JEA
Attn: Public Records
21 West Church Street
Jacksonville, Florida 32202
Ph: 904-665-8606
publicrecords@jea.com

Redacted Submissions

If a Bidder believes that any portion of the documents, data or records submitted in response to this Solicitation are exempt from Florida's Public Records Law, Bidder must (1) clearly segregate and mark the specific sections of the document, data or records as "Confidential," (2) cite the specific Florida Statute or other legal authority for the asserted exemption, and (3) provide JEA with a separate redacted copy of its response (the "Redacted Copy"). The cover of the Redacted Copy shall contain JEA's title and number for this Solicitation and Bidder's name, and shall be clearly titled "Redacted Copy." Bidder should only redact those portions of records that Bidder claims are specifically exempt from disclosure under Florida's Public Records Laws. If Bidder fails to submit a redacted copy of information it claims is confidential, JEA is authorized to produce all documents, data and other records submitted to JEA in answer to a public records request for such information.

In the event of a request for public records to which documents that are marked as confidential are responsive, JEA will provide the Redacted Copy to the requestor. If a requestor asserts a right to any redacted information, JEA will notify Bidder that such an assertion has been made. It is Bidder's responsibility to respond to the requestor to assert that the information in question is exempt from disclosure under applicable law. If JEA becomes subject to a demand for discovery or disclosure of Bidder's redacted information under legal process, JEA shall give Bidder prompt notice of the demand prior to releasing the information (unless otherwise prohibited by applicable law.) Bidder shall be responsible for defending its determination that the redacted portions of its response are not subject to disclosure.

By submitting a response to this Solicitation, Bidder agrees to protect, defend and indemnify JEA from and against all claims, demands, actions, suits, damages, liabilities, losses, settlements, costs and expenses (including but not limited to reasonable attorney fees and costs) arising from or relating to Bidder's determination that the redacted portions of its response to this Solicitation are not subject to disclosure.

1.3.13. ESTIMATED QUANTITIES

On the Bid Document, JEA sets forth anticipated quantities, or estimates of anticipated purchase volumes by JEA. JEA anticipates that these quantities are reasonable and will not be exceeded. During the Bid process, if the

Bidder finds any discrepancy greater than ten percent (10%) of the estimated quantity, the Bidder shall notify the JEA Representative in writing of the discrepancy. JEA will check the estimated quantity and if it is found to exceed ten percent (10%) of the estimated quantity, JEA will issue an Addendum to all Bidders.

After Award of the Contract, JEA will make payments upon the actual quantities of Work provided and JEA shall not be obligated, in any way, to pay any amounts for quantities other than those actually provided and authorized under this Contract, regardless of amount stated in the Solicitation. In the event that quantities or scope of work change after Award, the changes to price and/or scope shall be made in accordance with the terms and conditions stated in the Contract Document.

Any item not shown on the Bid Document, but shown in the drawings or Technical Specifications section, that is required to perform the Work, or that is required as part of a complete and operable system, shall be included in the Bid Price.

1.3.14. ETHICS (IFB)

By signing the Bid Form, the Bidder certifies this Bid is made without any previous understanding, agreement or connection with any other person, firm, or corporation submitting a Bid for the same Work other than as a Subcontractor or supplier, and that this Bid is made without outside control, collusion, fraud, or other illegal or unethical actions. The Bidder shall comply with all JEA and City of Jacksonville ordinances, policies and procedures regarding business ethics.

The Bidder shall submit only one (1) Bid in response to this Solicitation. If JEA has reasonable cause to believe the Bidder has submitted more than one (1) Bid for the same Work, other than as a Subcontractor or subsupplier, JEA shall disqualify the Bid and may pursue debarment actions.

The Bidder shall disclose the name(s) of any public officials who have any financial position, directly or indirectly, with this Bid by completing and submitting the Conflict of Interest Certificate Form available at jea.com. If JEA has reason to believe that collusion exists among the Bidders, JEA shall reject any and all Bids from the suspected Bidders and will proceed to debar Bidder from future JEA Awards in accordance with the JEA Purchasing Code.

JEA is prohibited by its Charter from awarding contracts to JEA officers or employees, or in which a JEA officer or employee has a financial interest. JEA shall reject any and all Bids from JEA officers or employees, as well as, any and all Bids in which a JEA officer or employee has a financial interest.

In accordance with Florida Statutes Sec. 287.133, JEA shall reject Bids from any persons or affiliates convicted of a public entity crime as listed on the Convicted Vendor list maintained by the Florida Department of Management Services. JEA shall not make an Award to any officer, director, executive, partner, shareholder, employee, member, or agent active in management of the Bidder listed on the Convicted Vendor list for any transaction exceeding $35,000 for a period of 36 months from the date of being placed on the Convicted Vendor list.

If the Bidder violates any requirement of this clause, the Bid may be rejected and JEA may debar offending companies and persons.

1.3.15. FLORIDA TRENCH SAFETY ACT

If required, the Bidder shall complete and submit with its Bid the Florida Trench Safety Act Acknowledgment form, in accordance with Florida Statutes when the Work includes trench excavations that exceed five feet in depth and as written assurance that the Bidder shall comply with all applicable trench safety standards, laws, rules and regulations during performance of any Work awarded from this Solicitation.

1.3.16. MATHEMATICAL ERRORS

In the event of a mathematical error in calculation of the prices entered on the Bid Form, the Unit Prices will prevail. The corrected Bid Price utilizing the Unit Prices will be used to determine if the Company is Awarded the Work or the Services. Subsequently, the Unit Prices will be used throughout the term of the Contract.

1.3.17. AVAILABILITY OF BIDS AFTER BID OPENING

In accordance with the Florida Public Records Law, Florida Statutes, Chapter 119, copies of all Bids are available for public inspection thirty (30) days after the opening of Bids or on the date of Award announcement, whichever is earlier. Bidders may review opened Bids once they are available for public inspection by contacting the designated Buyer or JEA's Public Records custodian whose contact information can be found at jea.com. JEA will post a summary of the Bid results immediately after the Bid opening.

1.3.18. PROTEST OF BIDDING AND AWARD PROCESS

Companies shall file any protests regarding this Solicitation in writing, in accordance with the JEA Purchasing Code, as amended from time to time. The JEA Purchasing Code is available online at jea.com.

1.3.19. SHIPPING, FREIGHT, AND TRAVEL--F.O.B. DESTINATION

The Bidder shall include the price for travel, shipment of materials and equipment in its pricing shown on the Bid Form or Bid Workbook unless otherwise stated herein. The shipment of all materials shall be F.O.B. Destination.

If the Solicitation allows for travel expenses to be billed separately, then all Bidder's travel expenses will be reimbursed in accordance with JEA's Contractor Travel Policy.

1.3.20. LISTING OF SUBCONTRACTORS

JEA shall specify the major Subcontractors that the Company must list is the Company intends to use a Subcontractor to perform a portion of the Work, unless the Work will be self-performed by the Company. The Subcontractors that JEA requires to be listed is stated in the Section titled "Required Forms to Be Submitted with the Bid". The major Subcontractors shall be listed on the Subcontractors Form which is available at jea.com. Failure of the Company to submit the required Subcontractor information on the form with its Bid shall result in rejection of the Company's Bid.

The Company shall not use Subcontractors and subsuppliers/shop fabricators other than those shown on the Subcontractor Form unless it shows good cause and obtains the JEA Representative's prior written consent. If the Company plans to use Subcontractors or subsupplier/shop fabricators to perform over 50% of the Work, the Company shall obtain JEA's approval at least five (5) days prior to the Bid/Proposal Due Date. @ Failure to obtain JEA approval will disqualify the Company and result in rejection of Company's Bid/Proposal.

1.3.21. CERTIFICATION AND REPRESENTATIONS OF THE BIDDER

By signing and submitting a Bid, the Bidder certifies and represents as follows:

A. That it has carefully examined all available records and conditions, including sites if applicable, and the requirements and specifications of this Solicitation prior to submitting its Bid. Where the Bidder visits sites, no Work or other disturbance is to be performed while at the site without written permission by JEA in advance of the site visit. The Bidder shall comply with all safety requirements described in the Solicitation and shall be prepared to show proof of insurance

B. That every aspect of its submitted Bid, including the Bid Price and the detailed schedule for the execution of the Work, are based on its own knowledge and judgment of the conditions and hazards involved, and not upon any representation of JEA. JEA assumes no responsibility for any understanding or representation made by any of its representatives during or prior to execution of the Contract unless such understandings or representations are expressly stated in the Contract and the Contract expressly provides that JEA assumes the responsibility.

C. That the individual signing the Bid Documents is a duly authorized agent or officer of the firm. Bids submitted by a corporation must be executed in the corporate name by the President or Vice President. If an individual other than the President or Vice President signs the bid, satisfactory evidence of authority to sign may be requested by JEA. If the Bid is submitted by a partnership, the bid must be signed by a partner whose title must appear under the signature. If an individual other than a partner signs the bid, satisfactory evidence of authority to sign may be requested by JEA. The corporation or partnership must be in active status at the Florida Division of Corporations at the time of contract execution.

D. That the firm maintains an active status any and all licenses, permits, certifications, insurance, bonds and other credentials including, but not limited to, contractor's license and occupational licenses necessary to perform the Work. The Bidder also certifies that, upon the prospect of any change in the status of applicable licenses, permits, certifications, insurances, bonds or other credentials, the Bidder shall immediately notify JEA of status change.

E. That Bidder has read, understands these instructions and will comply with the Section titled Ethics.

1.3.22. CONFLICT OF INTEREST (CONSTRUCTION)

This conflict of interest policy applies to all JEA construction projects ("Project"). Any company bidding the construction phase of a Project cannot at the time of Bid submittal, be affiliated with or have any direct or indirect ownership interest in the architect/engineer ("Designer") of record. The company will also be prohibited from bidding if the Designer has any direct or indirect ownership interest in the Contractor. Should JEA erroneously award a contract in violation of this policy, JEA may terminate the contract at any time with no liability to company, and company shall be liable to JEA for all damages, including but not limited to the costs to rebid the Project. The purpose of this policy is to encourage bidding and eliminate any actual or perceived advantage that one Bidder may have over another.

1.3.23. CONSTRUCTION AND DEMOLITION DEBRIS

The Bidder shall complete and submit the Construction and Demolition Debris Disposal form which is available at www.jea.com. The Bidder shall identify, by the Certificate of Necessity number and Public Works number, the sites to which it will remove for disposal debris resulting from the Work. A list of approved sites may be obtained from the JEA Office Section or jea.com.

1.3.24. UNABLE TO SUBMIT BID FORMS

If you elect not to submit a Bid in response to this Solicitation, please complete the Unable to Submit Bid Form, available for download at www.jea.com, or by obtaining a hardcopy from the JEA Bid Office, 21 West Church St., Customer Center 1st Floor, Room 002, Jacksonville, FL 32202. The Bidder may contact the Bid Office by phone at (904) 665-6740.
Send the completed Unable to Submit Bid Form to:

JEA Bid Office

21 West Church St., CC-1, Room 002
Jacksonville, FL 32202
or fax the Unable to Submit Bid Form to: (904) 665-7095.
Do not return the entire Solicitation package; simply return the Unable to Submit Bid Form.

2. CONTRACT TERMS AND CONDITIONS

2.1. CONTRACT DOCUMENT AND TERMS AND CONDITIONS

Provided below are the Contract terms and conditions that will be incorporated by reference in the Contract Document executed by the Company and JEA. The Contract Document will incorporate by reference the terms contained in the Solicitation portion of this document provided in Section 1, the Contract Terms provided in Section 2; and the Technical Specifications provided in Section 3. An example of the Contract that the Company will be required to execute is available for review at jea.com.

2.2. DEFINITIONS

2.2.1. DEFINITIONS

Words and terms defined in this section shall have the same meaning throughout all parts of this Solicitation and Contract Documents. Where intended to convey the meaning consistent with that set forth in its definition, a defined word or term is marked by initial capitalization. The "Technical Specifications" portion of this Solicitation may define additional words and terms where necessary to clarify the Work. Unless otherwise stated in this Solicitation and/or Contract Documents, definitions set forth in the "Technical Specifications" shall apply only within the "Technical Specifications."

2.2.2. ACCEPTANCE

JEA's written notice by the Contract Administrator to the Company that all Work as specified in the Contract, or a portion of the Work as specified in a Task or Work Order, has been completed to JEA's satisfaction. Approval or recognition of the Company meeting a Milestone or interim step does not constitute Acceptance of that portion of Work. Acceptance does not in any way limit JEA's rights under the Contract or applicable laws, rules and regulations.

2.2.3. ADDENDUM/ADDENDA

A written change or changes to the Solicitation which is issued by JEA Procurement Services and is incorporated into the Solicitation as a modification, revision and/or further clarification of the intent of the Solicitation.

2.2.4. ADMINISTRATIVE WORK

Actions primarily performed in an office environment and associated with preparing to perform or administer the Work including, but not limited to, preparing Work schedules, obtaining bonds, executing Contracts, securing resources and other actions specified in the Solicitation, or otherwise prudent to ensure a timely, safe and otherwise compliant start and performance of Field Work. Administrative Work is not performed at the Work Location.

2.2.5. ANNIVERSARY DATE

The date which is twelve (12) months after the effective date of the Contract, and each date which is twelve (12) months after an Anniversary Date that occurs while the Contract is in effect.

2.2.6. APPLICATION FOR PAYMENT

The form required for payment which shall include all items required pursuant to the contract for the payment to be processed by JEA. Such form shall require the Contractor expressly state that the Contractor has fulfilled all obligations for the previous payments issued to the Contractor, including payment for subcontractors and materials. The Application for Payment includes all forms and supporting documentation as required by the Contract documents.

2.2.7. APPROVED SCHEDULE

A Critical Path Method Schedule or a Summary Schedule for the Work approved in writing by the Contract Administrator.

2.2.8. AWARD

The written approval of the JEA Awards Committee that the procurement process for the purchase of the Work was in accordance with the JEA Procurement Code and Florida Statutes. Once an Award is approved, JEA will either issue a Purchase Order or execute a Contract with the successful bidder or proposer.

2.2.9. BID DOCUMENTS

The forms required to be submitted to JEA as the Company's offer to perform the Work or Services described herein. The Bid Documents can include, but is not limited to, the Bid Form, certifications and/or other required submittals. The Bid Documents may also be referred to as the "Bid Form".

2.2.10. BID OR PROPOSAL

The document describing the Bidder's offer submitted in response to this Solicitation. Bid and Proposal shall be considered synonymous for the purpose of this Contract.

2.2.11. BID PRICE

The total dollar amount of the Bidder's offer to successfully perform the Work or Services in accordance with the Contract Documents.

2.2.12. BIDDER OR PROPOSER

The respondent to this Solicitation. Bidder and Proposer shall be considered synonymous for the purpose of this Solicitation.

2.2.13. CHANGE ORDER

A written order issued after execution of the Contract to the Company signed by the Contract Administrator, or his designated representative, authorizing an addition, deletion, or revision of the Work, or an adjustment in the Contract Price or the Contract Time. Change Orders do not authorize expenditures greater than the monies encumbered by JEA, which is shown on the associated Purchase Order(s). An executed Change Order resolves all issues related to price and time for the Work included in the Change Order. A Change Order that involves a material change to the Contract may result in a Contract Amendment.

2.2.14. COMPANY

The legal person, firm, corporation or any other entity or business relationship with whom JEA has executed the Contract. Where the word "Company" is used it shall also include permitted assigns. Prime Contractor, Contractor, Vendor, Supplier and Company shall be considered synonymous for the purpose of the Contract.

2.2.15. COMPANY REPRESENTATIVE

The individual responsible for representing the Company in all activities concerning the fulfillment and administration of the Contract.

2.2.16. COMPANY SUPERVISOR

The individual, employed or contracted by the Company, to manage the Work on a day-to-day basis and ensure the Work is performed according to the Contract. The Company Supervisor may be authorized by the Company Representative to act on Contract matters. Such authorization shall be in writing and delivered to the Contract Administrator and shall clearly state the limitations of any such authorization. In the event that the Company Supervisor and the Company Representative is the same person, the Company shall notify the Contract Administrator of such situation.

2.2.17. CONTRACT

An agreement between JEA and the Company, signed by both parties, which incorporates all the Contract Documents. The Contract shall not be altered without an Amendment to the Contract and executed by JEA and the Company, or a JEA issued Change Order.

2.2.18. CONTRACT ADMINISTRATOR

The individual assigned by JEA to have authority to administer the Contract, including the authority to negotiate all elements of the Contract with the Company, authorize Change Orders within the maximum amount awarded, terminate the Contract, seek remedies for nonperformance including termination, and otherwise act on behalf of JEA in all matters regarding the Contract. The Contract Administrator may authorize JEA Representative in writing to make minor changes to the Work with the intent of preventing Work disruption.

2.2.19. CONTRACT DOCUMENTS

Contract Documents, also referred to as the "Contract" means the executed Contract, all Solicitation documents and Bid Documents as further described in the Section of the Solicitation titled "Contract Documents", and any written Change Orders, amendments or Purchase Orders executed by JEA, and insurance and/or bonds as required by the Contract.

2.2.20. CONTRACT PRICE

The total amount payable to the Company during the initial Term of the Contract. However, this amount is not a guaranteed amount. Also referred to as the "Maximum Indebtedness" of JEA.

2.2.21. CONTRACT TIME (CONSTRUCTION)

The number of calendar days or the period of time from when the written Purchase Order is issued to the Company to Substantial Completion and Acceptance of the Work.

2.2.22. CONTRACTOR

The legal person, firm, corporation or any other entity or business relationship with whom JEA has executed the Contract. Where the word "Contractor" is used it shall also include permitted assigns. Contractor and Company shall be considered synonymous for the purpose of the Contract.

2.2.23. CRITICAL PATH METHOD (CPM) SCHEDULE

A schematic display of the sequential and logical relationship of all activities that comprise the Work. Using a combination of duration, early and late start dates, and early and late finish dates, a critical path is established as the

path of interdependent activities that must be sequentially performed and that require a longer total time to perform than any other such series. CPM Schedules suitable for use on this Contract use GANNT Precedence formats.

2.2.24. CUSTOMER SERVICE PLAN

The Company's plan to achieve customer satisfaction requirements as determined by JEA and JEA Project Outreach, which shall include, as a minimum, the name and office phone number, cell phone number, email address, Nextel Direct Connect number, and fax number of Company's Customer Service Representative, a detailed flow chart on how the Company will handle customer concerns, preemptive customer satisfaction control measures (such as door hangers provided by JEA, and neighborhood meetings in conjunction with JEA staff) and a plan to reduce the number of customer concerns surrounding construction Work addressing, as a minimum, the construction practices that will eliminate damage to customers' property including, but not limited to, cracked driveways, tire ruts in customers' yards, blocking customers' access to driveways, cutting customers' services during tie-in, excessive noise from construction equipment, and elimination of dust during construction Work.

2.2.25. DEFECT

Work that fails to reach Acceptance, or Work that fails meet the requirements of any required test, inspection or approval, and any Work that meets the requirements of any test or approval, but nevertheless does not meet the requirements of the Contract Documents.

2.2.26. ENVIRONMENTAL REGULATIONS

All laws, ordinances, statutes, codes, rules, regulations, agreements, judgments, orders, and decrees, now or hereafter enacted, promulgated, or amended, of the United States, the states, the counties, the cities, or any other political subdivisions in which the Work Location is located, and any other political subdivision, agency or instrumentality exercising jurisdiction over JEA, the Work Location, or the use of the Work Location, relating to pollution, the protection or regulation of human health, natural resources, or the environment, or the emission, discharge, release or threatened release of pollutants, contaminants, chemicals, or industrial, toxic or hazardous substances or waste or Hazardous Materials (as defined in this Contract) into the environment (including, without limitation, ambient air, surface water, ground water or land or soil).

2.2.27. EQUAL ITEM

Item a Bidder chooses to offer in place of offering the brand name or manufacturer's item specified on the Bid Document when the Bid Document clearly states that the Bidder may offer such an item.

2.2.28. FIELD WORK

Actions associated with meeting the requirements of the Contract other than Administrative Work. Field Work is primarily performed at the Work Location.

2.2.29. FINAL COMPLETION

The point in time after JEA makes the determination that the Work is completed and there is Acceptance by JEA, and the Company has fulfilled all requirements of the Contract Documents.

2.2.30. FINAL PAYMENT

The Final Payment for all Work performed. Final Payment shall not be made until the Company has complied with all the Contract requirements, and provided as necessary close-out documents as contained in the Contract.

2.2.31. HAZARDOUS MATERIALS

Any substance which is or contains (i) any "hazardous substance" as now or hereafter defined in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (42 U.S.C. '9601 et seq.) ("CERCLA") or any regulations promulgated under or pursuant to CERCLA; (ii) any "hazardous waste" as now or hereafter defined in the Resource Conservation and Recovery Act (42 U.S.C. '6901 et. seq.) ("RCRA") or regulations promulgated under or pursuant to RCRA; (iii) any substance regulated by the Toxic Substances Control Act (15 U.S.C. '2601 et seq.); (iv) gasoline, diesel fuel, or other petroleum hydrocarbons; (v) asbestos and asbestos containing materials, in any form, whether friable or non-friable; (vi) polychlorinated biphenyls; (vii) radon gas; and (viii) any additional substances or materials which are now or hereafter classified or considered to be hazardous or toxic under Environmental Requirements (as hereinafter defined) or the common law, or any other applicable laws relating to the Licensed Property. Hazardous Materials shall include, without limitation, any substance, the presence of which on the Licensed Property, (A) requires reporting, investigation or remediation under Environmental Requirements; (B) causes or threatens to cause a nuisance on the Licensed Property or adjacent property or poses or threatens to pose a hazard to the health or safety of persons on the Licensed Property or adjacent property; or (C) which, if it emanated or migrated from the Licensed Property, could constitute a trespass.

2.2.32. HOLIDAYS

The following days: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Day after Thanksgiving, Christmas Eve Day, and Christmas Day.

2.2.33. INVOICE

A document seeking payment to Company from JEA for all or a portion of the Work, in accordance with the Contract Documents, and including at a minimum the following items: the Company's name and address, a description of the product(s) or service(s) rendered, a valid JEA PO number, the amount payable, the Unit Price, the payee name and address, any associated JSEB forms and any other supporting documentation required by the Contract Documents.

2.2.34. JEA

JEA on its own behalf, and when the Work involves St. Johns River Power Park (SJRPP), as agent for Florida Power and Light Company (FPL). JEA and FPL are co-owners of SJRPP.

2.2.35. JEA ENGINEER

The individual assigned by JEA (either an employee or a third party) to provide licensing, engineering, design review, and/or construction management including, but not limited to, overseeing and resolving engineering/design issues, conveying JEA's instructions to the Company and enforcing the faithful performance of the Work. The JEA Engineer's authority includes interpreting the technical portion of the Contract Documents, deciding on matters relating to the execution and progress of the Work and evaluating the Company's performance. The JEA Engineer may stop the Work when deemed necessary by JEA. The JEA Engineer will receive and adjudicate any claim of ambiguity or error in the technical portion of the Contract Documents and shall reduce any determination to writing, and the decision shall be final and binding. The JEA Engineer is not a party to the Contract. The JEA Engineer has no authority to approve changes to the Work or Contract, or to commit JEA to any expenditure of money except as expressly designated in writing by the Contract Administrator.

2.2.36. JEA INSPECTOR

The individual(s) or company(ies) designated by the Contract Administrator to inspect and test the Company's performance and Contract compliance including materials, workmanship, safety, environmental compliance, JSEB compliance, project controls, administration and accounting, and other aspects of Contract compliance. The JEA

Inspector has no authority to approve changes to the Work or Contract, or to commit JEA to any expenditure of money except as expressly designated in writing by the Contract Administrator.

2.2.37. JEA REPRESENTATIVES

The Contract Administrator, Contract Inspector, Contract Administrator's Representative, JEA Engineer, Field Engineer, Project Manager, and other persons designated by the Contract Administrator as JEA Representatives acting in a capacity related to the Work or Contract under the authority of the Contract Administrator.

2.2.38. LUMP SUM BULK BID PRICE

The total amount payable to the Company under the Contract Documents for performing the bulk bid Work.

2.2.39. MILESTONE

A point in time representing a key or important intermediate event in the Work. A Milestone is to be capable of validation by meeting all of the items prescribed in a defining checklist as agreed to in writing by JEA.

2.2.40. NOTICE TO PROCEED

The written notice, duly authorized and delivered by JEA that authorizes the Company to begin the Work. The Notice to Proceed is normally issued in the form of a Purchase Order, unless otherwise specified in the Contract Documents.

2.2.41. OVERTIME

Work approved in writing by the Contract Administrator that is required to be performed beyond an employee's scheduled workday or work week, including Work performed on Holidays.

2.2.42. PAYMENT AND PERFORMANCE BONDS

The common-law Performance Bond and the statutory Payment Bond contemplated by Section 255.05, Florida Statutes in the form required by JEA.

2.2.43. PRE-WORK MEETING

A meeting conducted after Award and prior to the start of any Field Work between JEA and the Company. The purpose of the meeting may include, but is not limited to orientation, schedule, certification and permitting, and other preparatory or Work execution details.

2.2.44. PERFORMANCE - ACCEPTABLE PERFORMANCE/PERFORMER

The Company averages more than 2.80 and less than 4.0 across all performance scorecard evaluation metrics, and does not receive a score of less than 2.0 on any metric.

2.2.45. PERFORMANCE - TOP PERFORMANCE/PERFORMER

The Company averages 4.0 or more across all scorecard evaluation metrics and does not receive a score of less than 4.0 on any one metric.

2.2.46. PERFORMANCE - UNACCEPTABLE PERFORMANCE/PERFORMER

The Company averages less than 2.80 across all scorecard evaluation metrics, or scores a 1.0 on any one metric regardless of average, or receives a score of 2.0 on the same metric on two sequential performance evaluations.

2.2.47. PURCHASE ORDER (PO)

A commercial document issued by JEA, authorizing work, indicating types, quantities, and agreed prices for products or services the Company will provide to JEA. Sending a PO to a Company constitutes a legal offer to buy products or services. The words "Purchase Order" are clearly marked across the top, a PO number is used for reference and invoicing purposes, includes an authorized JEA signature, and states the dollar amount of the lawfully appropriated funds.

2.2.48. QUALITY ASSURANCE

Actions that JEA takes to assess the Company's performance under the Contract.

2.2.49. QUALITY CONTROL

Actions that the Company takes to ensure it successfully completes the Work in full accordance with the Contract Documents.

2.2.50. SCHEDULE

All documentation related to the planning and scheduling of the Work as described in these Terms and Conditions.

2.2.51. SHOP DRAWINGS (DEFINITION)

Drawings, electronic and hard copy, that detail the fabrication, erection, layout and setting drawings; manufacturer's standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; all other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and method of construction as may be required to show the JEA Engineer that the proposed materials, equipment or systems and the position thereof are in compliance with the requirements of the Contract Documents.

2.2.52. SOLICITATION

The documents (which may be electronic) issued by JEA's Procurement Department to solicit Bids from Bidders that includes, but is not limited to, the Bid Documents, Bid Workbook, samples of documents, contractual terms and conditions, the Technical Specifications, and associated Addenda.

2.2.53. SUBCONTRACTOR

The legal person, firm, corporation or any other entity or business relationship that provides a portion of the work, or provides supplies and materials, to the Company which has an executed Contract with JEA. JEA is not in privity of contract with the Subcontractor.

2.2.54. SUBSTANTIAL COMPLETION (DEFINITION)

The time when JEA determines that the Work (or a specified part thereof) is substantially complete, in accordance with the Contract Documents. Additionally, all work other than incidental corrective and incidental punch list work items shall be completed. Substantial Completion shall not have been achieved if all systems and parts are not functional, if utilities are not connected and operating normally, if all required regulatory permits and approvals have not been issued, or if all vehicular and pedestrian traffic routes affected by the Work have not been restored. The date of Substantial Completion shall be established in writing by JEA. Recognition of the Work as Substantially Complete, as evidenced by issuance of a Certificate of Substantial Completion, does not represent JEA's Acceptance of the Work.

2.2.55. SUMMARY SCHEDULE

A diagram displaying the Milestones for the Work graphically positioned on a timeline, showing at a minimum the calendar dates on which each Milestone is scheduled to be completed for Acceptance.

2.2.56. SUPPLEMENTAL WORK AUTHORIZATION (SWA)

A written order, issued at the sole discretion of the JEA representative, which incorporates cost or schedule changes into the Contract. The SWA shall be used for increases or decreases in the Contract Price within the SWA amount set forth on the Bid Form, or to makes changes in the schedule for performance of the Work, or to authorize the Company to perform changes in the Work.

2.2.57. TASK ORDER

A document that describes the Work or describes a series of tasks that the Company will perform in accordance with the Contract Documents. A Task Order may be issued as an attachment to a Purchase Order, but the Task Order is neither a Purchase Order, nor a Notice to Proceed.

2.2.58. TERM

The period of time during which the Contract is in force or until the Contract's Maximum Indebtedness is reached, whichever occurs first.

2.2.59. UNIT PRICES

The charges to JEA for the performance of each respective unit of Work as stated in the Response Workbook, Bid Form, or Proposal Form, and incorporated into the Contract Documents.

2.2.60. WORK LOCATION (DEFINITION)

The place or places where the Work is performed, excluding the properties of the Company and/or the Subcontractor(s).

2.2.61. WORK OR SCOPE OF SERVICES

Work includes as defined in the Contract Documents all actions, products, documentation, electronic programs, reports, testing, transport, administration, management, services, materials, tools, equipment, and responsibilities to be furnished or performed by the Company under the Contract, together with all other additional necessities that are not specifically recited in the Contract, but can be reasonably inferred as necessary to complete all obligations and fully satisfy the intent of the Contract.

2.3. CONTRACT DOCUMENTS

2.3.1. ORDER OF PRECEDENCE

The Contract shall consist of JEA's Contract and/or Purchase Order together with the Solicitation including, but not limited to, the executed Bid Documents, which shall be collectively referred to as the Contract Documents. This Contract is the complete agreement between the parties. Parol or extrinsic evidence will not be used to vary or contradict the express terms of this Contract. The Contract Documents are complementary; what is called for by one is binding as if called for by all. The Company shall inform JEA in writing of any conflict, error or discrepancy in the Contract Documents upon discovery. Should the Company proceed with the Work prior to written resolution of the error or conflict by JEA, all Work performed is at the sole risk of the Company. JEA will generally consider this precedence of the Contract Documents in resolving any conflict, error, or discrepancy:

- Executed Contract Amendments

- Exhibits to Contract Documents
- Executed Contract Documents
- Purchase Order(s)
- Addenda to JEA Solicitation
- Drawings associated with this Solicitation
- Exhibits and Attachments to this Solicitation
- Technical Specifications associated with this Solicitation
- This Solicitation
- Bid Documents
- References

The figure dimensions on drawings shall govern over scale dimensions. Contract and detailed drawings shall govern over general drawings. The Company shall perform any Work that may reasonably be inferred from the Contract as being required whether or not it is specifically called for. Work, materials or equipment described in words that, so applied, have a well-known technical or trade meaning shall be taken as referring to such recognized standards.

2.4. PRICE AND PAYMENTS

2.4.1. PAYMENTS

2.4.1.1. PAYMENT METHOD – MONTHLY

JEA shall pay the Company in monthly installments for the Work rendered during the preceding month. Company shall invoice JEA in accordance with the rates stated in the Company's Bid Form. Company's rates shall include all profit, taxes, benefits, travel, and all other overhead items.

2.4.2. OFFSET

In case the Company is in violation of any requirement of the Contract, JEA may withhold payments that may be due the Company, and may offset existing balances with any JEA incurred costs against funds due the Company under this and any other Company Contract with JEA, as a result of the violation, or other damages as allowed by the Contract Documents and applicable law.

2.4.3. DISCOUNT PRICING

JEA offers any or all of the following option payment terms, one of which may be executed at the request of the Company by sending an email to the JEA Buyer listed in this Solicitation:

- 1% 20, net 30
- 2% 10, net 30

Company may request alternate payment terms for JEA's consideration, however, alternate payment terms are not effective until acceptance by JEA in writing. Please note, all payment dates are calculated from the date of the Invoice receipt by JEA's Accounts Payable.

2.4.4. COST SAVINGS PLAN

During the Term of this Contract, JEA and Company are encouraged to identify ways to reduce the total cost to JEA related to the Work provided by the Company ("Cost Savings Plan"). JEA and Company may negotiate Amendments to this Contract that support and allow such reductions in total costs including, but not limited to, the sharing of savings resulting from implementation of cost-reducing initiatives between JEA and Company. The decision to accept any cost savings plan shall be in the sole discretion of JEA, and JEA shall not be liable to

Company for any cost that may be alleged to be related to a refusal to accept a Cost Savings Plan proposed by Company.

2.4.5. TAXES

JEA is authorized to self-accrue the Florida Sales and Use Tax and is exempt from Manufacturer's Federal Excise Tax when purchasing tangible personal property for its direct consumption.

2.4.6. GENERAL CONDITIONS/SPECIAL CONDITIONS

The line item shown on the Bid Form titled "General/Special Conditions Lump Sum Price" shall be used for general and special expenses which do not appear as separate line items on the Bid Form, including, but not limited to, costs and expenses related to the following:

- the execution and recording of the Payment and Performance Bonds
- safety requirements
- Quality Control
- preparation of daily reports
- maintenance of traffic
- attendance of meetings, project scheduling
- testing (if not included elsewhere)

Except as provided below for expenses related to Bonds and Surveying, JEA's payment for the General/Special Conditions line item shall be based upon the percentage of Work completed.

Bonds- Company will be permitted to invoice JEA, in its first payment application, for the costs associated with the execution and recording of the Payment and Performance Bonds. The amount paid by JEA for the Payment and Performance Bonds will be deducted from the General/Special Conditions line item total.

Surveying- Prior to construction, the Company will be permitted to invoice JEA for the costs associated with the survey of the existing roadway horizontal alignment. The amount paid by JEA for these costs will be deducted from the General/Special Conditions line item total.

SWA- In the event that JEA authorizes changes to the Work under a Supplemental Work Authorization (SWA), the amount of the Bid Form line item for SWA Allowance will not be increased unless the total value of all SWA Work exceeds the Original SWA Allowance provided on the Bid Form.

2.4.7. JSEB COMPLIANCE

2.4.7.1. COMPLIANCE WITH JSEB REQUIREMENTS

The Company shall achieve the JSEB participation requirements as set forth in the Solicitation, except as allowed under the good faith efforts exception as defined in the City of Jacksonville Ordinance. In no case shall the Company make changes to the JSEB firms listed in its Bid, revise the JSEB scope of Work or amount of Work as stated in its Bid without prior written notice to the Contract Administrator, and without subsequent receipt of written approval from the Contract Administrator.

The City of Jacksonville requirements as outlined in the City of Jacksonville Ordinance relating to JSEBs shall apply in their entirety to this Contract. Where the City of Jacksonville ordinance refers to "Chief", it shall be construed to mean, for purposes of this Contract, JEA's Chief Purchasing Officer. In a like manner, where it refers to "City", or "City of Jacksonville", it shall be construed to mean JEA.

Use of brokering, as defined in the City of Jacksonville Ordinance, or other techniques that do not provide a commercially useful function are strictly prohibited as means of achieving the JSEB requirements of the Contract. Only the amount of fees or commissions charged by a JSEB for providing a bona fide service such as professional, technical, consultant, or managerial services, or for providing bonds or insurance specifically required for the performance of a contract shall be counted towards a JSEB participation requirement, provided the fee is reasonable and not excessive as compared with fees customarily charged for similar services.

Payment terms for participating JSEB firms shall be the same or better than the payment terms the Company receives from JEA, except that in all cases JSEB firms shall be allowed to submit invoices to the Company at least bimonthly, and the Company shall pay proper invoices no later than 3 days after its receipt of JEA payment. The Company shall obtain written approval from the Contract Administrator prior to withholding any payment from JSEB firm.

If the Company uses a JSEB qualified firm for the performance of any part of this Work, the Company shall submit to JEA, with its Invoice, a listing of JSEB qualified firms that have participated in the Work. Such listing shall be made using the form "Monthly Report for COJ/JEA JSEB Participation" available at www.jea.com

The Company agrees to let JEA audit its financial and operating records with one day of notice, and during normal business hours, at its corporate offices for the purpose of determining compliance with all JSEB requirements of the Contract Documents.

If the Company violates any provision regarding JSEB, including, but not limited to, program intent, the Company shall be subject to any or all of the following, plus any other remedies available to JEA under law:

- Terminate the Contract for breach
- Suspend the Company from bidding any JEA projects as follows:
- First offense: six months
- Second offense: one year
- Third offense: three years
- Revoke Company's JSEB certification if the Company itself is certified as a JSEB.

2.4.8. JSEB - INVOICING AND PAYMENT

If the Company utilizes JSEB certified firms, regardless of whether these Contract Documents require or encourage the use of such firms, the Company shall Invoice for and report the use of JSEB certified firms according to the format and guidelines established by the City of Jacksonville.

2.4.9. INVOICING AND PAYMENT TERMS AND RETAINAGE

Within sixty (60) days of completion of the Work, the Company shall submit all Invoices or Applications for Payment in accordance with the payment method agreed upon in these Contract Documents. All Invoices shall be submitted to the following address:

JEA Accounts Payable
P.O. Box 4910
Jacksonville, FL 32201-4910

JEA will pay the Company the amount requested less any holdbacks or retainage set forth in herein within thirty (30) calendar days after receipt of an Invoice from the Company subject to the provisions stated below.

JEA may reject any Invoice or Application for Payment within 20 calendar days after receipt. JEA will return the Invoice or Application for Payment to the Company stating the reasons for rejection. Upon receipt of an acceptable revised Invoice or Application for Payment, JEA will pay the Company the revised amount within ten (10) days.

JEA may withhold payment if the Company is in violation of any conditions or terms of the Contract Documents.

As security for the proper performance of the Work, JEA may deduct ten percent (10%) retainage, or such other amount allowable pursuant to Florida law, from the amount stipulated in the Invoice or Application for Payment. In accordance with Florida Statutes, after completion of fifty percent (50%) of the Work, a maximum retainage of five percent (5%) may be deducted. For the purposes of this section, "completion of fifty percent of the Work" shall be defined as the point at which fifty percent of the total cost of the Work, as defined, and inclusive of authorized change orders, has been expended by JEA.

In the case of early termination of the Contract, all payments made by JEA against the Contract Price prior to notice of termination shall be credited to the amount, if any, due the Company. If the parties determine that the sum of all previous payments and credits exceeds the sum due the Company, the Company shall refund the excess amount to JEA within ten (10) days of determination or written notice.

2.4.10. PROMPT PAYMENT TO SUBCONTRACTORS, SUB-SUBCONTRACTORS AND SUPPLIERS

When the Company receives payment from JEA for labor, services or materials furnished by Subcontractors and suppliers that are hired by the Company, the Company shall remit payment due (less proper retainage) to those Subcontractors and suppliers within 10 days after the Company's receipt of payment from JEA. Nothing herein shall prohibit the Company from disputing, pursuant to the terms hereof, all or any portion of a payment alleged to be due to its Subcontractors and suppliers. In the event of such dispute, the Company may withhold the disputed portion of any such payment only after the Company has provided written notice to JEA and to the Subcontractor and supplier whose payment is in dispute, stating the amount in dispute and specifically describing the actions required to cure the dispute. The Company shall deliver such notice to JEA and to the said Subcontractor or supplier within 10 days following the Company's receipt of payment from JEA. The Company shall pay all undisputed amounts due within the time frames specified herein.

The prompt payment requirements herein shall, in no way, create any contractual relationship or obligation between JEA and any Subcontractor, supplier, JSEB, or any third-party, nor create any JEA liability for the Company's failure to make timely payments as required. The Company's failure to comply with the prompt payment requirements, however, shall constitute a material breach of its contractual obligations to JEA. As a result of such breach, JEA, without waiving any other available remedy it may have against the Company, may issue joint checks and charge the Company a 0.2% daily late payment interest charge or charges as specified within the Florida Statutes, whichever is greater.

2.4.11. PUNCH LIST: SECTION 218.735, FLORIDA STATUTES

Within 30 calendar days after reaching Substantial Completion, as defined herein, the parties shall jointly develop a final list of items required to render the Work complete, satisfactory, and acceptable (the "Punchlist"). If the parties cannot agree on the Punchlist, JEA will develop a Punchlist and deliver it to Company within 35 days after Substantial Completion. If the Work involves more than one building or structure or involves a multi-phased project, one Punchlist should be developed for each building, structure, or phase. Failure to include corrective work on the Punchlist does not relieve the Company from its responsibility to complete the Work required by the Contract.

Final Completion must be achieved within 30 days after delivery of the Punchlist to Company. Notwithstanding anything in the Contract Documents to the contrary, damages may not be assessed against Company for failing to complete the Work unless Company fails to complete the Work within such 30 day period.

2.4.12. SUBSTANTIAL COMPLETION

The Company shall notify JEA in writing when a portion of the Work is Substantially Complete. The Company shall identify any deficiencies in the Work. JEA will inspect the Work and will give the Company written notice of either acceptance or rejection of the Work as Substantially Complete and provide a list of additional deficiencies. The Company shall correct all deficiencies prior to Final Completion of the Work by JEA.

Whenever any portion of the Work is Substantially Complete, JEA may use it. Such use shall not be held in any way as an Acceptance of the Work or as a waiver of any provisions of the Contract.

2.4.13. CERTIFICATE OF CONTRACT COMPLETION AND FINAL PAYMENT

Company shall complete and submit to JEA the Certificate of Contract Completion, which can be found on jea.com, as notice that the Work, including the correction of all deficiencies outlined in the Punchlist, is complete.

By submitting the certificate, the Company certifies the following:

- the Work, including all Punchlist items, has been satisfactorily completed; and
- no liens have attached against the property and improvements of JEA; and
- no notice of intention to claim liens are outstanding; and
- no suits are pending by reason of the Work; and
- all workers' compensation claims known to the Company have been reported to JEA; and
- the surety provides a release; and
- all warranties, equipment manuals and other documentation have been provided; and
- no public liability claims are pending.

The Company shall submit its final Invoice with the completed Certificate of Contract Completion. JEA shall make Final Payment in accordance with the provisions contained herein. Final Payment includes payment of any retainage held.

2.5. SCHEDULES, REPORTING REQUIREMENTS AND LIQUIDATED DAMAGES

2.5.1. CRITICAL PATH METHOD (CPM) SCHEDULE

The Contractor shall use the Critical Path Method (CPM) to schedule and manage the Work. A qualified member of the Contractor's personnel shall create the schedule. If the Contractor does not have staff capable of preparing and managing CPM schedules, the Contractor shall obtain such qualified personnel on a subcontract basis for supporting this Contract.

All CPM scheduling will be performed using CPM precedence diagramming method (PDM) scheduling software such as Primavera P6, Primavera Contractor or a CPM scheduling software compatible with Primavera P6 import capabilities (.xer file format). The Contractor shall submit all schedules and associated reports to the Contract Administrator in paper and electronic formats as described below in order to allow both complete analysis of the schedules and accurate record keeping.

Construction contracts less than $10 million will have a cost-loaded schedule. Construction contracts equal to or more than $10 million will be cost and resource loaded.

Project Schedule Definitions

Activity – A single, continuous, and identifiable task in the total Work. The project work scope is sub-divided into work tasks that are represented in the schedule software as activities. How finely the project scope is subdivided into

tasks determines the "level of detail" within the schedule. JEA retains the right to reject a schedule for insufficient levels of activity detail.

Baseline Schedule – The Baseline Schedule comprises the plan and schedule that the Contractor intends to use to perform and complete the Work. Upon approval by the JEA Representative, the Baseline Schedule shall be the schedule of record from which entitlement for adjustments in the completion deadline(s) shall be measured until a Revised Baseline Schedule is approved by the JEA Representative.

Contract Float – Contract Float is the number of days between the Contractor's anticipated date for early completion of the Work, or specified part, and the corresponding Contract Time.

Contract Milestone – A Contract Milestone is a Milestone required in every project schedule to identify significant Contract events. Required Contract Milestones include Notice to Proceed (NTP), Substantial Completion (SC) and Final Completion (FC).

CPM Network – The CPM Network is a transferable electronic copy of project software data and files. It includes, but is not limited to, activities, milestones, calendar definitions, precedence relationships including any relationship lag periods, date constraints, baseline schedules, project and activity code definitions, resource definitions, resource assignments, project values (e.g. the data date/time now value, settings for project-activity processing options, etc.), and all information that can be generated from such data.

Critical Path – The Critical Path is defined as the longest continuous series of activities through the network to the Substantial Completion Contract Milestone.

Current Schedule – The Current Schedule has progress information (updates) reported against in-progress and completed activities. Update information is used to re-calculate / reforecast the most likely "early start" dates of the remaining incomplete activities as sequenced by the network. This calculation establishes the earliest forecasted completion date of the project, which allows Project Managers to determine if they are ahead, on, or behind schedule to meet the Contract Milestones. A current schedule is used to evaluate Contractor progress against the Baseline Schedule.

Interim Contract Milestone – An Interim Contract Milestone is a Milestone that is specifically called out by the Contract to be included in the project schedule. Example Interim Contract Milestones could be completion of specific phases of work at a specific number of contract days from NTP or required delivery dates of material or equipment.

Interim Schedule – The Interim Schedule and schedule narrative describes the activities to be performed within the first 120 calendar days after NTP and their interdependencies subject to all requirements of the Contract. The Interim Schedule shall include a separate proposed payment plan for its duration, which upon written approval by JEA, shall be used by the Contractor for payment purposes during the Interim Schedule period.

Milestone – A task with zero duration that identifies the instant of time at which a significant task within the project is starting or stopping. Start Milestones shall be used to represent the start of a significant task while Finish Milestones shall be used to represent the completion of a significant task.

Precedence Relationships – The logical relationships created in the scheduling software to sequence the performance of the work tasks identified by activities or milestones. Precedence relationships can be categorized in 4 groups - Finish-to-start, Start-to-Start, Finish-to-Finish, and Start-to-Finish. The interface between activities created by precedence relationships creates a PDM network logic. A PDM logic where estimated durations have not been

assigned to the activities constitutes a network "Plan". Once activities are assigned estimated durations, the software interfaces durations and the network logic to calculate a "Schedule" based on the Plan.

Proposed Schedules – Proposed schedules are schedules in which the Contractor proposes revisions and/or changes to the Baseline Schedule for JEA's acceptance. If a Proposed Schedule is accepted by JEA, it shall be incorporated into a Revised Baseline Schedule and all work progress shall be reported against it going forward.

Revised Baseline Schedule – A Revised Baseline Schedule is submitted by the Contractor whenever changes in the Current Baseline Schedule are required to accurately reflect any changes in the Contractor's plan for performing the Work or the impact of any approved changes in the Work. The Revised Baseline Schedule, once approved by JEA, comes the Baseline Schedule from which progress and entitlement for adjustments to the Completion Deadline is measured.

Schedule Progress Updates – Schedule Progress Updates are submitted monthly by the Contractor to update the Current Schedule with status during the period of the update and to reflect the Contractor's current plan for performing the Work.

Three Week Look-ahead Schedule – A schedule, submitted by the Contractor, of all planned work to be performed over the next three weeks in sufficient detail to enable the tracking of the day-to-day field activities. The detail and format are as directed by the JEA project representative but a Three Week Look-Ahead produced from the Current Schedule is preferred. These Three Week Look-ahead Schedules are to be submitted weekly by the Contractor in PDF format.

Total Float – Total Float is the amount of time a scheduled activity can be delayed without delaying the completion of the Work beyond the Contract Milestones.

Purpose of the Project Schedule

Project schedules shall be used for evaluating all issues related to time for this Contract. The project schedules shall be used by JEA and the Contractor for the following purposes as well as any other purpose where the issue of time is relevant:

1. To communicate to JEA the Contractor's current plan for carrying out the Work;
2. To identify work paths that are critical to the timely completion of the Work;
3. To identify upcoming activities on the critical path(s);
4. To evaluate the best course of action for mitigating the impact of unforeseen events;
5. As the basis of establishing the predecessors for each contract milestone;
6. As the basis for analyzing the time impact of changes in the Work;
7. As a reference in determining the cost associated with increases or decreases in the Work;
8. To prioritize activities for which JEA is responsible;
9. To document the actual progress of the Work;
10. To evaluate the resource requirements of the Contractor;
11. To integrate the Work with the operational requirements of JEA's facilities;
12. To schedule and coordinate interfaces with adjacent contracts;
13. As a basis for determining valid acceleration plans;
14. To facilitate efforts to complete the Work in a timely manner;
15. To verify progress of the Work as it pertains to billing periods and invoices for payment.

The project schedules provide a basis for decisions that may affect the Work under this Contract, as well as other concurrent or future contracts. The Contractor shall submit schedule submittals per the requirements of this

specification. Project schedules should always reflect the Contractor's current plan for the Work and be updated as described in this specification.

Schedule Type

All project schedules shall be a computer generated, Critical Path Method (CPM) network utilizing the precedence diagram method of scheduling.

Software

The Project Schedule in CPM format (the "CPM schedule") shall be created in a format compatible with the latest version of Primavera P6, or as otherwise specified by JEA. The Contractor shall purchase and maintain a valid software maintenance agreement for each license of software necessary to produce the Project Schedule. The Contractor shall not upgrade to a new version of the scheduling software during a project unless previously approved in writing by JEA. If the Contractor desires, they may procure the services of a third party to provide scheduling services at no additional cost to JEA.

JEA currently uses Primavera P6 version 15.1 and would prefer Contractor's use either Primavera P6 or Primavera Contractor.

Use of Float

Total Float and Contract Float are not for the exclusive use or benefit of either JEA or the Contractor, but must be used in the best interest of completing the project within the Contract Time relative to the contract milestones. If the Early Dates in any Progress Schedule Submittal forecasts any slippage or overrun of the contract milestones, the Contractor shall indicate such slippage or overrun by reporting negative float. Total and Contract Float shall be available to JEA, consultants, or the Contractor to accommodate changes in the Work or to mitigate the effect of events which may delay performance or completion. Total and Contract Float are an expiring resource available to all parties, acting in good faith, as needed to meet the contract milestones. JEA will monitor and optimize the use of float for the benefit of the project.

Early Completion

An early completion schedule is one that anticipates completion of all or a specified part of the work ahead of the corresponding contract time. Since Contract Float belongs to the project, the contractor shall not be entitled to any extension in contract time or recovery for any delay incurred because of extensions of an early completion date until all Contract Float is used or consumed and performance or completion of the work extends beyond the contract time.

Pacing

If the Work is delayed on the Critical Path due to a delay caused by JEA, thereby creating additional float on any other path, then use of such float shall be construed as a concurrent delay to any delay caused by JEA. The Contractor shall maintain its original schedule on the other paths and activities not affected by the delay.

Non-Compliance

JEA may refuse to recommend/authorize a progress payment in the event of the Contractor's failure, refusal or neglect to provide the required schedule information, since this will preclude the proper evaluation of the Contractor's progress. Remedies for the Contractor's failure, neglect or refusal to comply with the requirements of this section are in addition, and not limited to, those provided under other sections of the Contract.

Quality Assurance

The Contractor shall perform the Work covered by this section with personnel having substantial experience in the use of scheduling software on construction projects that required the development and maintenance of the schedule throughout the project duration.

It is the responsibility of the Contractor to work with each subcontractor and supplier to obtain information pertinent to the planning and updating of their respective activities in the schedule.

Baseline Schedule Preparation and Submittal

In achieving an approved Baseline Schedule there will be no adjustment in the Contract Price. In general, the Baseline Schedule shall demonstrate a complete understanding of the Work, inclusive of all phasing and sequencing considerations and shall include, but not be limited to:

1. The order in which the Contractor intends to prosecute the Work, outlining the intended flow of Work, including submittals, submittal reviews, procurement of equipment and materials, maintenance of traffic, pollution control measures, utility interfaces, right-of-way, and other information as required by the contract;
2. All relevant work constraints to performing the Work including, but not limited to, right-of-way access constraints (with clear logical connections to the commencement of various work), accommodation of utility relocations, permitting restrictions, and environmental/seasonal constraints;
3. The dates on which the Contractor plans to start and complete various Work stages, operations, and principle items of Work, including the Contract Milestones; and
4. Interfaces with other entities such as Utility Owners, Third Parties, adjacent contractors and other stakeholders;
5. The Baseline Schedule will be accompanied by a payment breakdown. This breakdown will identify the costs associated with each schedule activity.
6. All schedule submittals shall be in accordance with Section 7: Review, Acceptance and Approval of Project Schedule Submittals.

Completion, Timeliness and Review of Baseline Schedule Submittals

To promote the efficient use of Contractor and JEA scheduling resources, the submittal requirements have been phased. The Contractor shall complete and submit schedules in accordance with the submittal deadlines contained in Table 1. For the determination of submittal deadline dates and total contract schedule duration, the date of NTP shall be working day number one.

Baseline schedule submittals will be reviewed for conformity with the Contract and the requirements in this specification. Each submittal required by this section shall reflect the incorporation of all of JEA's comments on the Baseline Schedule to date. With each submittal, the Contractor shall provide a written response to each of JEA's comments to date.

Failure of the Contractor to provide complete, timely Baseline Schedule submittals as specified, and in the sequence and timeframes specified below, may result in delays or extensions to JEA review periods. Baseline Schedule Submittals may be rejected for incompleteness or failure to meet the specification requirements and re-submittal will be required. The Contractor may submit information earlier than required in the Baseline Schedule Submittal Schedule in Table 1.

Once approved by JEA, the Baseline Schedule shall be assigned as the Project Baseline in the scheduling software used by the Contractor. All subsequent printed schedules produced by the Contractor shall show both the Current Schedule and Baseline Schedule Gantt Chart bars.

Baseline Schedule Submittals

In the course of developing the Baseline Schedule, the Contractor shall submit the deliverables below for JEA review in accordance with the following schedule:

		Construction Duration < 6 Months	**Construction Duration 6 - 12 Months**	**Construction Duration > 12 Months**
Step	**Description**	**Submittal Deadline**	**Submittal Deadline**	**Submittal Deadline**

		(Working Days after NTP)	(Working Days after NTP)	(Working Days after NTP)
1	Interim Schedule Submittal	10	10	10
2	Proposed Payment Breakdown	15	20	20
3	Baseline Schedule Submittal	20	30	60
4	Corrected Baseline Schedule Submittal	30	45	80

Table 1: Baseline Schedule Submittal Schedule

Step 1 – Interim Schedule Submittal

No later than the deadline specified in table 1, the Contractor shall submit an Interim Schedule detailing activities that are to be performed within the first 120 calendar days after NTP. JEA will review and may approve an acceptable Interim Schedule within 10 working days of submittal. JEA may require the full Interim Schedule, or parts thereof, to be resubmitted throughout the review period. The Interim Schedule Submittal shall include:

- Narrative Report describing work to be performed during the Interim Schedule period using the Baseline Schedule Narrative format described below.
- Electronic schedule file.
- A proposed payment plan, which upon written approval by JEA, shall be used by the Contractor for payment purposes during the Interim Schedule period.

APPROVAL OF THE INTERIM SCHEDULE IS A CONDITION PRECEDENT FOR PAYMENT.

Step 2 – Proposed Payment Breakdown Submittal

No later than the deadline specified in table 1, the Contractor shall submit the proposed Schedule of Values (SOV), which upon approval by JEA, shall be used by the Contractor for payment application purposes. When preparing the SOV, consideration should be given to Enterprise Asset Management reporting requirements that are required at the end of the contract.

As part of the Proposed Payment Breakdown Submittal, the contractor shall also submit a list of all submittals required by the contract.

Step 3 – Baseline Schedule Submittal

No later than the deadline specified in table 1, the Contractor shall complete the Baseline Schedule submittal for approval representing all Work required by the contract. The Baseline Schedule submittal shall include:

- Baseline Narrative Report;
- Electronic schedule file;
- Contract Payment Breakdown Report – a report forecasting monthly cash flow that details all costs loaded to the schedule;
- Cumulative and monthly total project costs curves reflecting the total contract amount.

APPROVAL OF THE BASELINE SCHEDULE IS A CONDITION PRECEDENT FOR PAYMENT BEYOND THE INTERIM SCHEDULE.

Step 4 – Corrected Baseline Schedule Submittal

In the event the Baseline Schedule submittal (Step 3) is not approved, and no later than the deadline specified in table 1, the Contractor shall complete the Corrected Baseline Schedule Submittal. The Contractor shall correct the Baseline Schedule submittal for approval by incorporating all of JEA's comments on the initial Baseline Schedule submittal. No additional changes shall be made. The corrected Baseline Schedule submittal shall be revised and resubmitted until receipt of JEA approval.

Schedule Requirements

General – For the purpose of enabling both JEA and the Contractor to readily evaluate the Project Schedule, including derived data and reports, the Project Schedules shall be administered in accordance with the following requirements.

All schedules shall be prepared by the Contractor and reflect the Contractor's plans, means and methods, techniques and sequences for performing the Work.

The schedules shall break down the Work into distinct activities with interdependencies to the extent required to clearly depict the planned approach for completion of the Work and to effectively manage the execution of the Work. The schedules shall:

1. Divide the Work into manageable and logical segments and specify the progression from Notice to Proceed (NTP) to Substantial Completion (SC) to Final Completion (FC) within the Contract Time.
2. Include, at a minimum, appropriate time allowances for submittals, procurement, coordination with others, construction, start-up/check-out (if applicable), operational and performance testing (if applicable), commissioning (if applicable), and Contract closeout.
3. The NTP activity shall be the first activity in the schedule and shall be a Start Milestone with an assigned 7-day, no holiday calendar. The SC and FC activities shall be Finish Milestones with assigned "Finish on or Before" constraints, set to the contract milestone dates, with a 7-day no holiday calendar.
4. The NTP, SC and FC milestones may include the contract milestone dates in the activity description for quick reference by all parties.

Schedule Settings and Setup – If the Contractor will be using Oracle Primavera P6, the settings shall be as follows:

1. The Project ID will be the contract number between JEA and the Contractor. It will be appended as described in the following section titled "Project ID Suffix". The Project Name shall be as defined in the contract between JEA and the Contractor.
2. The Project WBS will, at a minimum consist of the following:
    a. Level 1 – Project
    b. Level 2 – Executive Summary
        i. Shall be populated with sufficient Level of Effort activities and milestones to provide management an overview of the contract. All Contract Milestones will be included at this level.
    c. Level 3 – Submittal Preparation
    d. Level 4 – Submittal Review and Acceptance
    e. Level 5 – Fabrication & Delivery
    f. The WBS for the remaining construction related work is at the discretion of the Contractor. The Contractor must ensure that the WBS structure is sufficiently robust to segregate, manage, and present the various work types, phases, segments, elements and locations in a clear logical manner and convey the sequence at which the Contractor intends to construction the Work.
3. Project ID Suffix:
    a. Each schedule submittal shall have a unique identifier appended to the Project ID specified in the previous section titled "Project ID/Name", in the form of:
        i. For Baseline Schedules, "-BL".
        ii. For Proposed Schedules, "-Pbbb", where 'bbb' is sequential starting at 001.
        iii. For Revised Baseline Schedules, "-RBLccc", where 'ccc' is sequential starting at 001.
        iv. For Schedule Progress Updates, "-PUyymm", where 'yy' and 'mm' correspond to the year and month of the monthly submittal.
4. Activity Codes must be maintained at the Project level.
5. Calendars must be maintained at the Project level and account for all work scenarios in the Contract and planned by the Contractor.

6. Duration Type shall be “Fixed Duration & Units”.
7. Percent Complete Type shall be “Physical”.
8. Make Open Ended Activities Critical should be checked.
9. Scheduling method for progressed activities shall be set to “Retained Logic”.
10. Total Float Calculations shall be set to “Finish Float = Late Finish – Early Finish”.
11. Define Critical Activities as “Longest Path”.

Activity Identification – each activity in the Project Schedules shall have an activity identifier (Activity ID). The Contractor shall utilize an Activity ID that is simple and allows space between existing activities for the future addition of activities for continuing sort and display capability. The Activity ID of an existing activity shall not be modified or assigned to another activity. The scope of work for an activity shall not be substantially changed once the Baseline Schedule is approved since this would result in re-use of the Activity ID for a different scope of work. If the Contactor opts to use an intelligent Activity ID, the contractor must provide a breakdown of what each character of the Activity ID represents.

Activity Description – the activity description shall identify the unique scope of the activity. There shall not be any two activities with the same activity description. It shall not be necessary to investigate activity code assignments or logic relationships to identify the scope of an activity. For example, the description “POUR FOOTINGS” or “INSTALL MANHOLE” will not be acceptable; the description “POUR FOOTINGS OF BIOSOLIDS BUILDING” or “INSTALL MANHOLE – Sta. 112+00” will be acceptable. At the same time, the Activity Description shall be concise enough to not require excessive column width in the Oracle Primavera P6 layout. The terms “Miscellaneous,” “Misc.” or other vague adjectives shall not be used as an activity description. The Contractor shall standardize the use of terms and their spelling in all activity descriptions. Abbreviations used in activity descriptions shall be consistent with the abbreviations used throughout the Contract and the design drawings. Once the Baseline Schedule is approved, activity descriptions shall not be modified except at the direction or with the consent of JEA.

Activity Duration – unless otherwise specified, construction activities shall have a duration between one (1) and fifteen (15) working days. At the request of JEA, the Contractor shall substantiate the need for specific activities having shorter or longer durations than stated herein. Certain non-labor activities such as procurement or delivering of materials may have durations in excess of fifteen (15) working days. After approval of the Baseline Schedule, changes in activity durations shall be addressed exclusively with the Duration Remaining data field. JEA shall be the final authority regarding the appropriate level of schedule detail for all schedules submitted for approval.

Activity Dates – Early and Late start and finish dates of activities shall be calculated for each activity based upon the schedule data date, actual dates, schedule logic, schedule constraints, calendars, original duration or remaining duration, in accordance with the schedule parameters defined in this specification.

Activity Predecessors and Successors – every activity shall have logically assigned predecessors and successors in conformance with the requirements of this section. The logical predecessors for each activity will be limited to those activities whose scope of work necessarily must be completed in order to perform the current activity. Unless otherwise specified, NTP shall be the only activity in the Project Schedules without predecessors and the Final Completion activity shall be the only activity in the Project Schedules without a successor.

Activity Constraints – Activity Constraints can affect activity float calculations and will not be used unless approved by JEA or allowed by this specification. The imposition of a date constraint on any activity other than the contract completion deadlines will only be permitted when the Contractor substantiates the need for the constraints to the satisfaction of JEA.

Activity Percent Complete – Activity remaining durations and percent complete shall be entered in the Project Schedules by the Contractor as appropriate to indicate activity progress and status as of the current Data Date for the update. The Contractor is to insure that progress is based on a current estimate of remaining duration to complete the Work and not the activity’s percent complete which calculates the remaining duration based on the original estimated duration.

Activity Codes – The Project Schedules shall contain activity code classifications and code values. The coding shall also incorporate the appropriate JEA provided data elements to allow reporting by any individual element or a combination thereof. These activity codes shall be the first codes defined for the activities, followed by any other codes, and shall use the values provided by JEA following award. The Contractor may add additional codes to satisfy its own requirements. In addition to JEA's activity codes, the Contractor shall propose a coding structure for JEA's review and acceptance. The activity code structure combined with the activity identification number shall provide the capability to organize information by location, road or ramp, structure, work type, subcontractor, discipline, etc.

Activity Calendar - The planning unit for the Work shall be whole working days. The use of other calendars may be used as required with a clear definition within the calendar description and/or the Baseline Schedule Narrative as to what the calendar is intended to be used for and/or what specific non-working periods they include. Level of Effort or WBS Summary activities used to show project durations from NTP to a Contract Milestone shall use a seven-day no holiday calendar. A common calendar base time of eight (8) consecutive hours (e.g., 8 AM to 4 PM) will be used on all calendars unless approved by JEA. To ensure activity start and finish dates are accurately calculated, time will be turned on when performing updates to the Project Schedule. This ensures activity durations are not inadvertently calculated as a partial workday or result in a 1-day duration activity spanning multiple dates.

Resource Loading - All Project Schedules on contracts in excess of $10 million shall be resource loaded with labor man-hours for both the Contractor and all of its sub-contractors.

Cost Loading – Project Schedules shall be cost loaded. All costs necessary to meet the particular requirements of each payment activity will be included in the payment breakdown and that breakdown will total up to the Contract Price.

Change Orders/SWA – New activities will be added to the project schedules upon approval of a Change order or SWA. These new activities will also include the costs associated with the Change Order/SWA. The Activity ID of these new activities should clearly show it represents a Change Order or SWA. For example, an activity with an ID of "CO1-100" indicates that it represents Change Order #1. If multiple activities are to be added under a single Change Order or SWA they shall be sequentially numbered such as CO1-100, CO1-110, CO1-120, etc.

CPM Logic – The Contractor shall be responsible for developing the CPM logic of the Baseline Schedule and for updating that CPM logic each month to accurately reflect the progress of the Work to date and the Contractor's current plan for completion of the work. All paths through the Project Schedules shall proceed in the direction representing the progression of time. Activity lag durations shall not have a negative value. Activity lags shall not be used in lieu of activities. Redundant ties to preceding activities in a sequential series of activities will not be permitted. For example, if activity C is the successor in a Finish-Start relationship to activity B, and activity B is the successor in a Finish-Start relationship to activity A, then activity A shall not have a redundant Finish-Start relationship to activity C. A tie representing a different constraint will not be considered redundant. For example, a logic tie showing that the completion of the work scope of a predecessor is required before the successor can start is different from a logic tie representing a resource limitation and will not be considered redundant.

Timely Completion – Unless otherwise specified, timely completion shall refer to completion on or before a date that supports the Contract Milestones.

Use of Constraints or Float Suppression Techniques – Any use of Start constraints within the schedule shall be documented in the schedule narrative. The only instance where a Late Finish constraint may be used is for the Substantial Completion or Final Completion Milestones. Any other use of constraints is prohibited. The use of negative lags or the use of any other float suppression techniques is also prohibited from use in project schedules.

Resource Leveling – In schedule submittals to JEA, the Contractor shall not use restraints or constraints to optimize and/or level manpower and equipment requirements. Activities shall be duration and logic driven.

Default Progress Data – Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM scheduling software systems.

Out-of-Sequence Logic – The Contractor shall correct all incorrect logic relationships in the schedule update to eliminate any out-of-sequence logic. The Contractor shall make all changes in the logic or other adjustments found to be incorrect by JEA.

3.8 Narratives

3.8.1 Baseline Schedule Narrative

The Baseline Schedule narrative shall demonstrate a feasible approach to achieving or improving the planned schedule and contains the following information:

a. Identification of the Data Date and schedule file name.
b. A description of the planned flow of work, identifying all key or driving resources. Identify key constraints and potential problems influencing the Contractor's approach to the work. Describe all construction interfaces with third parties at the Project site. Also identify temporary Contractor plants, facilities or fixed equipment that the Contractor or subcontractor plan to use within the right-of-way. Include in this discussion the length of time the plant is to be used, any planned moves, and any potential conflicts that could arise, if the plan is not adhered to.
c. A summary of planned labor utilization for the Contract, identifying the average and maximum number of workers on site each month based on the resource loaded Project Schedules. Identify actual and potential labor resource limitations. A summary of planned equipment utilization for the Contract, identifying each type of operated equipment to be used on the Work, the planned quantity of each type of operated equipment utilized each month, and the criteria for mobilizing and demobilizing each piece of equipment to and from the site. Identify actual and potential equipment resource limitations.
d. An explanation of how adverse weather conditions have been addressed in the Baseline Schedule. Identify all activities, if any, that contain contingency days for adverse weather conditions and the duration of such contingency included for each.
e. An explanation of special calendars that only allow work to take place during a pre-defined window of time.
f. The narrative shall address the Contractor's material procurement plan and identify the strategy for any long lead item(s). There shall be no fabrication and delivery activities for concrete and asphalt concrete. Fabrication and delivery activities for short lead-time items shall not be included in the project schedules. "Short lead-time" shall be defined as a period of two weeks or less from placement of order to delivery of material to the Project site.

3.8.2 Schedule Progress Update Narrative

All Schedule Progress Update submittals shall include a narrative containing the following information:

a. Identification of the update period, the Data Date, and the schedule file name.
b. Identification of activities with critical or near critical float (within 14 Days of the Critical Path) that were planned to occur during the update period, of which did not occur or occurred later than the scheduled Early Start or Early Finish date, and an explanation of these delays. Provide a listing of all activities that

may overrun or have overrun their planned duration by more than 20 percent and any justification for maintaining original planned durations for future activities of like Work.

c. Identification of delays occurring to activities taking place off the Project site, e.g., submittal preparation, fabrication, and delivery activities.
d. A summary of planned labor utilization for the Contract, identifying the average and maximum number of workers on site each month. Identify actual and potential labor resource limitations. A summary of the actual labor utilization used over the past month.
e. A summary of planned equipment utilization for the Project, identifying each type of operated equipment to be used on the Work, the planned quantity of each type of operated equipment utilized each month, and all changes to the criteria for mobilizing and demobilizing each piece of equipment to and from the Project site. Identify actual and potential equipment resource problems. A summary of the actual equipment utilized over the past month.
f. Revisions to logic or duration(s) by the Contractor to effectively use labor and resources that have no adverse effect on Completion Deadlines or Contract Price shall be detailed in the update. These revisions shall contain the following information:
    a. Identification of the activities changed.
    b. A description of the scope of the logic change and identification of the advantages and disadvantages of implementing the change.
    c. Identification of all driving resources, if any.
    d. Identification of key constraints influencing the Contractor's approach to the Work.

3.9 Required Submittal and Delivery Activities

3.9.1 Submittal List

The Contractor shall submit a list of all submittals required by the Contract, as part of Step 2 no later than the deadline identified in Table 1.

The submittal list shall conform to the following format or any other format approved by JEA:

Submittal List		
Submittal Reference Number	**Description of Submittal**	**Activity ID**

Table 2 Submittal List Format

3.9.2 Submittal Activities

Submittal activities shall be included in the Project Schedules in a manner consistent with the level of detail shown below:

Activity	Abbreviation in Activity Description
Prepare and Submit	P/S

Review and Approve	R/A
Revise and Re-submit	R/R
Fabricate and Deliver (Material or Equipment)	F/D or FAB or DEL

Table 3 Submittal Activity Detail

3.9.3 Submittals with Multiple Activities

When multiple items are included in a single submittal, that submittal shall be represented in the schedule by an activity in accordance with the following conditions:

a. The “Review and Approve" activity for that submittal shall be a predecessor to every activity representing the fabrication and delivery of any of the materials submitted.
b. If the submittal is returned and the disposition is sufficient to enable the commencement of a successor activity, then the original submittal activity shall be broken down into multiple activities, as necessary, to accurately reflect the logic of the Contractor's current plan.
c. As part of the monthly update procedure, submittal activities shall be reviewed and modified to ensure that the scope and logic of the activities are consistent with the Contractor’s current plan.

3.9.4 Delivery Activities

Activities representing the delivery of materials or equipment for more than one installation activity will be permitted in accordance with the following conditions:

a. The material delivery activity shall be a predecessor to the first activity representing the installation of that material in each area;
b. When partial deliveries are received and those deliveries are adequate to enable the commencement of some, but not all, successor activities, then the original delivery activity shall be broken down into multiple activities, as necessary to accurately reflect the logic of the Contractor’s current plan;
c. As part of the monthly update procedure, a discussion of delivery activities shall be reviewed and modified to ensure that the scope and logic of delivery activities are consistent with the Contractor’s current plan; and
d. There shall be no fabrication and delivery activities for concrete and asphalt concrete. Fabrication and delivery activities for short lead-time items shall not be included in the project Schedules. “Short-lead time" shall be defined as a period of two weeks or less from placement of order to delivery of material to the Project site.

3.10 Timely Completion

Unless otherwise specified, timely completion shall refer to completion on or before a date that supports the Completion Deadlines.

3.11 Use of Constraints or Float Suppression Techniques

Any use of constraints within the schedule shall be documented in the schedule narrative. The only instance where a constraint may be used is a Finish on or before constraint on Contract Milestones. Any other use of constraints is prohibited. This includes the following: Start On, Mandatory Start or Finish. The use of

negative lags or the use of any other float suppression techniques is also prohibited from use in the project schedules.

3.12 Resource Leveling

In schedule submittals to JEA the Contractor shall not use restraints or constraints to optimize and/or level manpower and equipment requirements. Activities shall be duration and logic driven.

3.13 Default Progress Data

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in the CPM scheduling software systems.

3.14 Out-of-Sequence Logic

The Contractor shall correct all incorrect logic relationships in the schedule update to eliminate any out-of-sequence logic. The Contractor shall make all changes in the logic or other adjustments found to be incorrect by JEA.

3.15 Electronic Schedule Naming and Formatting

JEA will provide guidance on schedule name designation to be used. The Contractor shall not submit any two schedules with the same file name.

3.16 Electronic Project Schedule Files

Electronic schedule files shall be in ".xer" format compatible with Oracle Primavera P6. Electronic narrative files shall be in readable PDF format (not scanned).

3.17 Printed Project Schedules

PDF or printed schedules shall be no larger than 11"x17" in landscape format and no more than one page wide. PDF or printed schedules should show Activity ID, Activity Name, Original Duration, Remaining Duration, Start, Finish and Total Float columns. The Gantt Chart shall show bars for Actual Work, Remaining Work, Critical Remaining Work, Current Bar Labels, Milestones, Project Baseline and Baseline Milestone. The Data Date line shall also be displayed on the Gantt Chart.

The header of PDF or printed schedules shall contain the project name, the run date and the data date at a minimum. The footer shall contain a Gantt Chart legends, page number, total pages number and active filters at a minimum.

4 Schedule Progress Updates

The Contractor shall update the Current Baseline Schedule in the form of a Schedule Progress Update on a monthly basis for the duration of the Contract. This shall not constitute a modification of the Current Baseline Schedule. The purpose of Schedule Progress Updates shall be to accurately document the progress of the Work to-date and to correct the schedule to accurately reflect the Contractor's current plan for the timely completion of the Work. Schedule Progress Updates shall be used to record progress for payment purposes and to reflect how the Work is being performed.

Schedule Progress Updates shall never be used as the basis for any adjustment in the Completion Deadlines. Any acceptance of the Schedule Progress Update by JEA, either expressed or implied, shall only apply to the issue of progress and not to any issue of acceptability or accuracy of the Schedule Progress Update for use as a basis for measuring adjustments in Completion Deadlines. The Schedule Progress Update submittal shall be due with Contractor's invoice for payment, and shall be a prerequisite to payment by JEA.

4.1 Monthly Schedule Progress Update Period

A monthly Schedule Progress Update of the Current Baseline Schedule shall be submitted for each calendar month from the date of the NTP through the date of Final Acceptance. The Data Date of each monthly Schedule Progress Update shall be coordinated with the JEA Project Manager but is typically one of three options:

a. The last calendar day of the month, meaning that the progress of the Work to date shall be documented and progressed through the last day of the month; or
b. The last day of the pay application billing period so that schedule progress and billing are in alignment; or
c. The day of monthly progress meetings where the contractor will supply the updated monthly schedule.

4.2 Monthly Schedule Progress Update Data

A joint monthly schedule update meeting shall be held in conjunction with the construction progress update meeting. The purpose of this meeting is to review and discuss the contents of the most recent Schedule Progress Update submittal. The JEA review period for the monthly Schedule Progress Update data submittal is ten (10) working days. The Schedule Progress Update data submittal shall consist of the following submittal components:

a. A schedule narrative consistent with Section 3.8.2 above;
b. Electronic files with record schedule incorporating all submitted Schedule Update Data (PUXXX);
c. The actual progress achieved on each operation and its effect upon the timing of the remaining work;
d. All required documentation required under the Contract in support of the invoice;
e. A comparison report showing all changes made to the schedule since the last Schedule Update;
f. Production curves showing the approved baseline production (planned) values and the actual production values; and
g. Should any Work be conducted on a time and materials basis then this update shall contain all necessary data to record progress;

In the event of discrepancies between the submitted data and JEA's records of progress, JEA's records shall govern. JEA's decision shall be final regarding all Schedule Progress Update data. The submittal of incomplete, illegible, or unchecked data or of reports that do not conform to the requirements of this specification may result in the rejection of Schedule Progress Update data, and as such will require a revision and re-submittal.

SUBMITTAL TO JEA OF THE CONTRACTOR'S MONTHLY SCHEDULE PROGRESS UPDATE IS A CONDITION PRECEDENT FOR PAYMENT TO BE INITIATED.

Acceptance of the Schedule Progress Update shall not relieve the Contractor of its obligation to make appropriate corrections to all of the Project Schedules.

JEA shall not be liable for delays to the Contractor's Work that occur during a time when the Contractor has failed to provide a Schedule Progress Update in accordance with the requirements of the Contract, when having the Schedule Progress Update at the specified time could have influenced JEA's decisions or actions.

The Schedule Progress Update submittal shall reflect updated progress to the Data Date, forecasted finish for in-progress activities, and re-forecasted Early Dates and Late Dates for remaining activities. The Contractor shall submit any changes in activity durations, logic ties or constraints for review and acceptance by JEA prior to inclusion of the change into the current Schedule Progress Update. JEA may also submit changes to the Contractor for inclusion in the current Schedule Progress Update. These changes should be forwarded to the Contractor for review prior to the monthly construction progress meeting for discussion in that meeting.

4.4 Progress Delays

The Contractor shall identify and promptly report to JEA as soon as they become aware of any matter that could:

a. Increase the project budgeted cost or Contract Price,
b. Delay the Substantial Completion Deadline,
c. Delay meeting a key date or Interim Contract Milestone (if applicable),
d. Impair the performance of the work in progress,
e. Affect the work of JEA or third parties.

The Contractor shall promptly develop a schedule recovery or mitigation plan whenever the Contractor's actual physical progress is behind schedule by thirty (30) days when compared to the Current Baseline Schedule or could potentially be delayed by thirty (30) days, or within ten (10) days of a written request by JEA. The Contractor shall submit a schedule recovery or mitigation plan in the form of a Proposed Schedule, whenever the Project Schedule becomes thirty (30) or more Days late to Substantial Completion. The submission of the recovery or mitigation plan shall be at no cost to JEA and shall be submitted within thirty (30) days of the submittal of the Schedule Progress Update that indicates the Project is thirty (30) or more Days late or at JEA's request. Failure to submit such a recovery plan within the stated timeframe shall provide a basis for future withholdings for payment, either in whole, or in part, by JEA.

4.5 Monthly Progress and Invoice Procedure

On a monthly basis, prior to formal submittal of the monthly invoice, the Contractor shall confirm with JEA the percent complete of work performed prior to submitting the invoice, including the following:

a. Activity percent completes, which are based on physical percent complete estimated by the field personnel relating to a resource and cost loaded schedule activity. To streamline this process, earning rules will be established to detail how various activities are progressed and partially paid. These rules will describe how discrete elements of work are to be measured for the purposes of measuring percent completion and be submitted in conjunction with the resource and cost loaded baseline schedules.
b. Incorporation of approved Change Orders as individual activities with proper title, coding by Change Order number, associated logic, duration, as well as cost/resource loading.
c. Verification of any unit price or time and material items.
d. Backup documentation for cost reimbursable procurement and Change Order schedule activities.

5 Revised Baseline Schedules

Any proposed changes and/or revisions to the Current Baseline Schedule approved by JEA pursuant to its review of Change Orders shall be incorporated into the Current Baseline Schedule and submitted as a Revised Baseline Schedule Submittal. A Revised Baseline Schedule Submittal shall be due with the invoice for payment following JEA's approval of the changes and/or revisions, as submitted in executed Change Orders. The Revised Baseline Schedule shall include a cost distribution for added Work and will be submitted for review and approval by JEA.

Revised Baseline Schedule Submittals shall include a comprehensive listing of all activities added to or deleted from the Current Baseline Schedule as well as a complete listing of all logic and activity relationship changes that have

been made. All changes in the schedule must be fully described in an accompanying narrative. No Revised Baseline Schedule Submittal will be approved unless it satisfies the following:

a. Any out-of-sequenced logic is corrected or explained to the satisfaction of JEA;
b. Start and Finish dates are verified for accuracy; and
c. The schedule accurately reflects the Contractor's plan for completing the remaining Work.

Once a Revised Baseline Schedule Submittal is approved by JEA it shall become the Current Baseline Schedule of record (and be used for subsequent Schedule Progress Update Submittals), and shall be referred to by its revision number.

Except as otherwise designated by Change Order, no Revised Baseline Schedule that extends performance beyond a Completion Deadline shall qualify as a Current Baseline Schedule, or schedule of record, allowing it to be used to demonstrate entitlement to an extension in a Completion Deadline. In no case shall a Schedule Progress Update be construed as a Revised Baseline Schedule or schedule of record unless it is specifically submitted and approved as such by JEA pursuant to this section.

6 Short Term Schedule

Short Term Schedules shall be submitted by the Contractor upon request from JEA and shall be provided for within the Contract Price. JEA will specify the period the Short Term Schedule shall encompass. The Contractor shall produce the Short Term Schedule electronically and it will include a Gantt Chart and details of the daily work activities, including multiple shift work, that the Contractor intends to conduct. The daily activities shall correspond to the Current Baseline Schedule activities but shall be at a greater level of detail. The Contractor shall be prepared to discuss the Short Term Schedules, in detail, with JEA to coordinate field inspection staffing requirements, scheduling of Work affecting any adjacent work by other utilities or contractors.

The Three Week Look Ahead Schedule is an example of a Short Term Schedule. Three Week Look Ahead Schedules are to be submitted weekly by the Contractor in addition to the Contractor's monthly Schedule Progress updates.

7 Review, Acceptance and Approval of Project Schedule Submittals

Failure to meet any of the following conditions shall result in the non-acceptance of the schedule submittal:

a. The project budgeted cost shall equal the Contract Price;
b. The schedule submittal shall show the timely completion of each activity, as well as, reflect all contractual access requirements and limitations of operations specified;
c. All activity relationships and date constraints shall comply with the requirements of the Contract Documents; and
d. The Submittal shall be complete in accordance with the requirements of this Specification.

If the schedule submittal is returned to the Contractor with comments, the submittal shall not be considered accepted until all of JEA's comments are incorporated into the schedule to JEA's satisfaction. If the comments are not satisfactorily incorporated into the schedule by the Contractor, the submittal shall be deemed unacceptable by JEA.

It is the Contractor's responsibility to ensure that all Project Schedule documents comply with the requirements of the Contract. Errors in any Project Schedule document accepted by JEA, including but not limited to activity durations, relationships between activities, resource allocation or other float suppression techniques that do not accurately reflect the Work, may be identified at any time and once identified, shall be corrected by the Contractor.

JEA is not responsible for any erroneous assumptions or information in any Project Schedule document, regardless of origin.

During the review of any Project Schedule document, if any of the following conditions are discovered, the document may be returned by JEA without further review for correction and re-submittal:

a. The document is incomplete.
b. The document does not comply with the specified format.
c. A component of the document has not been prepared in accordance with the requirements of this section.
d. The quality of the document indicates that the Contractor has failed to perform an internal quality control review prior to submission.
e. There is an inconsistency between electronic files and printed material.
f. The Contractor has made unauthorized changes to any Project Schedule document.
g. The Contractor has failed to incorporate JEA comments concerning the Project Schedule document.

JEA's failure to return a submittal shall not be construed to mean that the submittal complies with the requirements of the Contract. JEA may, at its discretion, choose to complete a review even though the submittal fails to meet one or more of the conditions for rejection stated herein. The Contractor shall be responsible for all delays due to its failure to submit complete Project Schedule submittals in accordance with the requirements of the Contract.

JEA's acceptance or approval of a Project Schedule document indicates only that the submittal appears to comply with the requirements of the Contract. It is the Contractor's responsibility to ensure that each submittal complies with the requirements of the Contract. Inconsistencies or errors in any Project Schedule document, including but not limited to activity durations, relationships between activities, resource allocation or other float suppression techniques that do not accurately reflect the Work, may be identified at any time and once identified, shall be immediately corrected by the Contractor.

JEA shall review schedule submittals for conformance with the requirements of the Contract. Review comments by JEA may address whether items of Work are omitted, activity durations are reasonable or that the level of labor, materials, and equipment, the means, methods, timing and sequencing of the Work are practical. The planning, scheduling or execution of the Work and the accuracy of any Project Schedule shall remain the sole responsibility of the Contractor.

Notwithstanding any review, review comments, approval, acceptance, scheduling assistance or direction to change and/or revise any Project Schedule by JEA the Project Schedules shall at all times be the Contractor's schedule for performing the Work and not be considered as any JEA direction constituting a change. The Contractor shall not be relieved from completing the Work within the Completion Deadlines due to the failure of the Contractor to submit acceptable Project Schedule documents.

9 Requirements for Demonstrating Entitlement to an Adjustment in the Contract Time or Obtaining Approval of a Plan to Recover Delay

9.1 Schedule Analysis Requirements

The Contractor shall develop and submit a time impact analysis and a Proposed Schedule when one (1) or more of the following conditions occur:

a. The Contractor's plan for the Work as reflected in the Current Baseline Schedule is materially changed;
b. JEA has approved a Change Order that affects the Critical Path of the Work necessitating an adjustment in a Completion Deadline;

c. The Contractor's progress on the Work is behind the Substantial Completion date by thirty (30) days or more;
d. In JEA's opinion, the Current Baseline Schedule no longer accurately reflects the Contractor's plan for performing the Work;
e. The Contractor is required by the Contract or chooses to submit a time impact analysis demonstrating entitlement to an adjustment to a Completion Deadline or to submit a plan demonstrating how the Contractor intends to recover delay; or
f. Any allowable change has occurred according to the Contract.

The Contractor shall use *AACEi Recommended Practice 52R-06 Time Impact Analysis – As Applied to Construction* when preparing a time impact analysis.

The Contractor shall submit a time impact analysis and a Proposed Schedule within fourteen (14) days following a request by JEA. This required fourteen (14) day period may be extended as necessary subject to the approval of JEA. The Proposed Schedule shall be developed using duplicate electronic files of the Current Baseline Schedule and shall include all status' to reflect current progress using information from agreed to Schedule Progress Updates, but shall not allocate costs to any proposed activities. Multiple delays will be analyzed chronologically in the order of occurrence. Costs may be allocated to activities only when the Change Order Proposal has been approved by JEA. Under no circumstances shall a time impact analysis based on Schedule Progress Update(s) be acceptable as a basis for an adjustment to a Completion Deadline.

Proposed Schedules shall be used by the Contractor to:

a. Request revisions to logic ties and activities in the Current Baseline Schedule,
b. Propose changes in the Current Baseline Schedule required to implement schedule recovery plans,
c. To negotiate the schedule impact of a Change Order Proposal with JEA, or
d. To propose changes for any other reason in the Current Baseline Schedule.

Proposed Schedules shall code affected and added activities to each Change Order Proposal or schedule recovery plan. Furthermore, Proposed Schedules shall accurately reflect all revisions and/or adjustments made to activities, logic ties and restraints that are necessary to reflect the Contractor's current approach for Work remaining. At a minimum, Proposed Schedules shall:

a. Incorporate all proposed activities and logic ties required to implement any proposed revisions,
b. Detail all impacts on pre-existing activities and logic ties,
c. Include a narrative describing the causes of any delay and actions planned to recover the schedule to meet Contract Deadlines.

Each Proposed Schedule shall include a subnet demonstrating how the Contractor plans to incorporate a Change Order Proposal or other change and/or revision into the Current Baseline Schedule. A subnet is defined as a sequence of new or revised activities that are proposed to be added to the Current Baseline Schedule.

Notwithstanding any other provision or provisions to the contrary, the Contractor shall have no claim for damages of any kind, or extension or increase to a Completion Deadline, or adjustment of Contract Price, on account of any delay, interruption or suspension of the Work or any portion thereof (herein after collectively referred to as "Delay"), due to whatever cause, unless in addition to all other requirements of the Contract Documents the prerequisites of this section are strictly complied with.

If the Contractor does not submit a time impact analysis for a specific change order or delay within the specified period, the Contractor shall be deemed to have irrevocably waived any rights to additional time and cost.

9.2 Mitigation of Delays

The Contractor shall be responsible to develop mitigation measures for all delays, regardless of responsibility for the delays, and to identify all time and cost impacts to the Work associated with those mitigation measures. Unless circumstances otherwise require, the Contractor shall not pursue mitigation action for which it expects JEA to be liable, prior to notifying JEA and receiving JEA authorization to proceed with the mitigation action.

All Contractor proposals for mitigation action, including proposed revisions for timely completion, shall confirm that the Contractor has verified the accuracy of all critical paths to the Substantial Completion Deadline.

Whenever it is possible for the Contractor to mitigate delay without added cost, the Contractor shall do so. The Contractor shall mitigate all delays as efficiently and economically as possible, with the objective of minimizing both the time and cost impact of the delay, regardless of responsibility for the delay. JEA will not be liable for damages that the Contractor could have avoided by reasonable means, such as prudent scheduling of the Work and judicious handling of forces, equipment, or materials.

2.5.2. LIQUIDATED DAMAGES UNTIL ACCEPTANCE

If the Company fails to obtain Substantial Completion of the Work on or before 270 days after date of Notice to Proceed, the Company shall pay JEA the sum of $500 per day for each and every calendar day, including Sundays and Holidays, starting on this day until the date the Work is Substantially Completed.

If the Company fails to obtain JEA's Acceptance of the Work on or before 310 days after date of Notice to Proceed, the Company shall pay JEA the sum of $1,000 per day for each and every calendar day, including Sundays and Holidays, starting on the day the Work was deemed by JEA to be Substantially Complete until the date the Work is Accepted by JEA.

Liquidated Damages are capped at a maximum of ten percent (10%) of the Contract Price.

The Company understands and agrees that said daily sum is to be paid not as a penalty, but as compensation to JEA as a fixed and reasonable liquidated damages for losses that JEA will suffer because of such default, whether through increased administrative and engineering costs, interference with JEA's normal operations, other tangible and intangible costs, or otherwise, which costs will be impossible or impractical to measure or ascertain with any reasonable specificity.

Liquidated damages may, at JEA's sole discretion, be deducted from any monies held by JEA that are otherwise payable to Company.

The Company's responsibility for liquidated damages shall in no way relieve the Company of any other obligations under the Contract.

2.5.3. REPORTING (CONSTRUCTION)

The Company shall provide all reports as defined in the Contract Documents.

Where the reporting frequency is daily, reports shall be submitted by noon of the following workday. Where the reporting frequency is weekly, reports are due by Monday at noon, covering the prior workweek. Where Monday is a Holiday, the reports are due at noon on the next workday. Where reports are due monthly, reports are due by noon on the first business day of each month. Sample forms for reports may be included in the Contract Documents. Where they are included, they are to be used. Where they are not included, the Company shall provide a sample of

its proposed report format for each report to the Contract Administrator at least one-week prior to its initial due date. The Contract Administrator will review and either approve or reject use of the report. Where proposed report is rejected, Company shall resubmit revised report formats, until Contract Administrator approves format. Reporting cycle shall begin upon the Purchase Order date, or, if used, the issuance date of the Notice to Proceed.

Where the Contract calls for reports to be submitted by Company, such reports shall be in both paper and electronic format, with the electronic version submitted electronically via email to the Contract Administrator.

2.5.4. WORK SCHEDULES

The Approved Schedule is referenced in the Technical Specifications attached to this Solicitation. If no schedule is provided, then the established schedule is based on working five (5) days per week, single shift, eight (8) hours per day or four (4) days per week, single shift, ten (10) hours per day. JEA may require the Company to base its schedule on an accelerated Work schedule or multiple shifts. The Company shall not schedule work on Holidays without obtaining prior written approval from JEA.

The Company shall, at no additional cost to JEA, increase or supplement its working force and equipment and perform the Work on an overtime or multiple shift basis when directed by JEA and upon notification that the Company is behind schedule. The Company shall submit a revised schedule in writing demonstrating the Company's schedule recovery plans.

The Company understands and agrees that the rate of progress set forth in the Approved Schedule already allows for ordinary delays incident to the Work. No extension of the Contract Term will be made for ordinary delays, inclement weather, or accidents, and the occurrence of such events will not relieve the Company from requirement of meeting the approved schedule.

2.6. WARRANTIES AND REPRESENTATIONS

2.6.1. WARRANTY (CONSTRUCTION)

Unless otherwise stated herein, the Company unconditionally warrants to JEA for a period of not less than two (2) year(s) from the date of issuance of the Certificate of Substantial Completion, that all Work furnished under the Contract, including but not limited to, materials, equipment, workmanship, and intellectual property, including derivative works will be:

- performed in a safe, professional and workman like manner; and
- free from Defects in design, material, and workmanship; and
- fit for the use and purpose specified or referred to in the Contract; and
- suitable for any other use or purpose as represented in writing by the Contractor; and
- in conformance with the Contract Documents; and
- merchantable, new and of first-class quality.

The Company warrants that the Work shall conform to all applicable standards and regulations promulgated by federal, state, local laws and regulations, standards boards, organizations of the Department of State, and adopted industry association standards. If the Work fails to conform to such laws, rules, standards and regulations, JEA may return the Work for correction or replacement at the Company's expense, or return the Work at the Company's expense and terminate the Contract.

If the Company performs services that fail to conform to such standards and regulations or to the warranties set forth in the first paragraph of this Section, the Company shall make the necessary corrections at Company's expense. JEA

may correct any services to comply with standards and regulations at the Company's expense if the Company fails to make the appropriate corrections within a reasonable time after notice of the Defect from JEA.

If Work includes items covered under a manufacturer's or Subcontractor's warranty that exceeds the requirements stated herein, Company shall transfer such warranty to JEA. Such warranties, do not in any way limit the warranty provided by the Company to JEA.

If, within the warranty period, JEA determines that any of the Work is defective or exhibit signs of excessive deterioration, the Company at its own expense, shall repair, adjust, or replace the defective Work to the complete satisfaction of JEA. The Company shall pay all costs of removal, transportation, reinstallation, repair, and all other associated costs incurred in connection with correcting such Defects in the Work. The Company shall correct any Defects only at times designated by JEA. The Company shall extend the warranty period an additional 12 months for any portion of the Work that has undergone warranty repair or replacement, but in no case shall the maximum warranty period be extended beyond thirty six (36) months.

JEA may repair or replace any defective Work at the Company's expense when the Company fails to correct the Defect within a reasonable time of receiving written notification of the Defect by JEA, when the Company is unable to respond in an emergency situation or when necessary to prevent JEA from substantial financial loss. Where JEA makes repairs or replaces defective Work, JEA will issue the Company a written accounting and invoice of all repair work required to correct the Defects.
Where spare parts may be needed, Company warrants that spare parts will be available to JEA for purchase for at least 75 percent of the stated useful life of the product.

The Company's warranty excludes any remedy for damage or Defect caused by abuse, improper or insufficient maintenance, improper operation, or wear and tear under normal usage.

Note that JEA intends to perform a warranty inspection prior to the expiration of the warranty period. JEA will notify the Company and the Company Representative shall attend the inspection. All discrepancies identified at said inspection shall be corrected by the Company within a reasonable timeframe.

2.7. INSURANCE, INDEMNITY AND RISK OF LOSS

2.7.1. INSURANCE

INSURANCE REQUIREMENTS
Before starting and until acceptance of the Work by JEA, and without further limiting its liability under the Contract, Company shall procure and maintain at its sole expense, insurance of the types and in the minimum amounts stated below:

Workers' Compensation
Florida Statutory coverage and Employer's Liability (including appropriate Federal Acts); Insurance Limits: Statutory Limits (Workers' Compensation) $500,000 each accident (Employer's Liability).

Commercial General Liability
Premises-Operations, Products-Completed Operations, Contractual Liability, Independent Contractors, Broad Form Property Damage, Explosion, Collapse and Underground, Hazards (XCU Coverage) as appropriate; Insurance Limits: $1,000,000 each occurrence, $2,000,000 annual aggregate for bodily injury and property damage, combined single limit.

Automobile Liability
All autos-owned, hired, or non-owned; Insurance Limits: $1,000,000 each occurrence, combined single limit.

Excess or Umbrella Liability
(This is additional coverage and limits above the following primary insurance: Employer's Liability, Commercial General Liability, and Automobile Liability); Insurance Limits: $4,000,000 each occurrence and annual aggregate.

Company's Commercial General Liability and Excess or Umbrella Liability policies shall be effective for two years after Work is complete. The Indemnification provision provided herein is separate and is not limited by the type of insurance or insurance amounts stated above.

Company shall specify JEA as an additional insured for all coverage except Workers' Compensation and Employer's Liability. Such insurance shall be primary to any and all other insurance or self-insurance maintained by JEA. Company shall include a Waiver of Subrogation on all required insurance in favor of JEA, its board members, officers, employees, agents, successors and assigns.

Such insurance shall be written by a company or companies licensed to do business in the State of Florida and satisfactory to JEA. Prior to commencing any Work under this Contract, certificates evidencing the maintenance of the insurance shall be furnished to JEA for approval. Company's and its subcontractors' Certificates of Insurance shall be mailed to JEA (Attn. Procurement Services), Customer Care Center, 6th Floor, 21 West Church Street, Jacksonville, FL 32202-3139.

The insurance certificates shall provide that no material alteration or cancellation, including expiration and non-renewal, shall be effective until 30 days after receipt of written notice by JEA.

Any subcontractors of Company shall procure and maintain the insurance required of Company hereunder during the life of the subcontracts. Subcontractors' insurance may be either by separate coverage or by endorsement under insurance provided by Company. Note: Any JSEB firms identified by Bidders for this Solicitation are considered "Subcontractors" under the direct supervision of the Prime or General Contractor (herein referred to as "Company"). Companies should show good faith efforts in providing assistance to JSEB firms in the securing of the Subcontractors' insurance requirements stated herein. Company shall submit subcontractors' certificates of insurance to JEA prior to allowing Subcontractors to perform Work on JEA's job sites.

Builder’s Risk

During construction of the Renewal and Replacement at Otter Run WTP (hereinafter referred to as “Project”), JEA shall provide All Risk Builder’s Risk insurance at its sole expense (insurance premiums and insurance deductibles unless otherwise specified in this Section 2.7.1) for itself, Company and its Subcontractors of all tiers while performing Work at JEA’s Project site (Otter Run Water Treatment Plant, 96119 Otter Run Drive, Fernandina Beach, FL 32034). The planned period of coverage for this Builder’s Risk insurance is estimated to begin on or about November 1, 2017. JEA shall obtain a Waiver of Subrogation on this Builder’s Risk insurance in favor of Company and its Subcontractors, including their employees, agents, successors and assigns. Certificates of Insurance shall be issued to Company and its Subcontractors on request to JEA’s Director Risk Management Services at (904) 665-7781. JEA’s Builder’s Risk insurance does not provide coverage for loss or damage for either: (a) Company’s or its Subcontractor’s tools, equipment, personal property, protective fencing, scaffolding, temporary structures, framework, forms and equipment owned, leased, rented or borrowed by Company and its Subcontractors or (b) materials, supplies and equipment in transit to JEA’s Project site or located on JEA’s Project site which does not become a permanent part of JEA’s Otter Run WTP. JEA’s Builder’s Risk insurance shall be

excess above any other property insurance or self-insurance maintained by vendors and suppliers who have agreed to be responsible for risk of loss for JEA's equipment, materials and supplies (F.O.B. destination: JEA's Project site).

Company and its Subcontractors shall be responsible to reimburse JEA for the first $100,000 (each occurrence) of any property damage to the Work at JEA's Project site, including JEA's existing Otter Run WTP, caused by the negligence, error or omission of Company and its Subcontractors. This reimbursement requirement applies regardless if an insurance claim is submitted to Factory Mutual Insurance Company above JEA's Builder's Risk property insurance deductibles. All other insurance deductibles are the responsibility of JEA.

2.7.2. BOND AMOUNT

The Company shall furnish a Payment Bond and Performance Bond in the amount of indicated on the Bid Form, made out to JEA in forms and formats approved and provided by JEA, as security for the faithful performance of the Work of Contract. JEA will send the approved bond forms to the Company for execution along with the Contract, however, in no case shall the date on the bond forms be prior to that of the executed Contract. The surety must be authorized and licensed to transact business in Florida. A fully executed Payment Bond and Performance Bond must be recorded with the Clerk of Duval County Court and delivered to JEA before JEA will issue a Purchase Order to begin the Work. No Purchase Order shall be issued until the Payment and Performance Bonds are recorded and delivered to the JEA Procurement Department. If the Company fails or refuses to furnish or record the required bonds, JEA will retain the Company's Bid Bond as liquidated damages.

2.7.3. ENVIRONMENTAL INDEMNIFICATION

The Company shall hold harmless and indemnify JEA including without limitation, its officers, directors, members, representatives, affiliates, agents and employees, successors and assigns (the "Indemnified Parties") and will reimburse the Indemnified Parties from and against any and all claims, suits, demands, judgments, losses, costs, fines, penalties, damages, liabilities and expenses (including all costs of cleanup, containment or other remediation, and all costs for investigation and defense thereof including, but not limited to, court costs, reasonable expert witness fees and attorney fees) arising from or in connection with (a) the Company's, including, but not limited to, its agents, affiliates or assigns ("Parties"), actions or activities that result in a violation of any environmental law, ordinance, rule, or regulation or that leads to an environmental claim or citation or to damages due to the Company's or other Parties' activities, (b) any environmental, health and safety liabilities arising out of or relating to the operation or other activities performed in connection with this Contract by the Company or any Party at any time on or after the effective date of the Contract, or (c) any bodily injury (including illness, disability and death, regardless of when any such bodily injury occurred, was incurred or manifested itself), personal injury, property damage (including trespass, nuisance, wrongful eviction and deprivation of the use of real property) or other damage of or to any person in any way arising from or allegedly arising from any hazardous activity conducted by the Company or any Party. JEA will be entitled to control any remedial action, any proceeding relating to an environmental claim. This indemnification agreement is separate and apart from, and is in no way limited by, any insurance provided pursuant to this Contract or otherwise. This section relating to indemnification shall survive the Term of this Contract, and any holdover and/or Contract extensions thereto, whether such Term expires naturally by the passage of time or is terminated earlier pursuant to the provisions of this Contract.

2.7.4. INDEMNIFICATION (JEA STANDARD)

For ten dollars ($10.00) acknowledged to be included and paid for in the contract price and other good and valuable considerations, the Company shall hold harmless and indemnify JEA against any claim, action, loss, damage, injury, liability, cost and expense of whatsoever kind or nature (including, but not by way of limitation, reasonable attorney's fees and court costs) arising out of injury (whether mental or corporeal) to persons, including death, or damage to property, arising out of or incidental to the negligence, recklessness or intentional wrongful misconduct

of the Company and any person or entity used by Company in the performance of this Contract or Work performed thereunder. For purposes of this Indemnification, the term "JEA" shall mean JEA as a body politic and corporate and shall include its governing board, officers, employees, agents, successors and assigns. This indemnification shall survive the term of a Contract entered into pursuant to this solicitation, for events that occurred during the Contract term. This indemnification shall be separate and apart from, and in addition to, any other indemnification provisions set forth elsewhere in this Contract.

2.7.5. NOTIFICATION OF SURETY

The Company shall notify its surety of any changes affecting the general scope of the Work or altering the Contract Price. The amount of the applicable bonds shall be adjusted accordingly and the Company shall furnish proof of such adjustment to JEA within ten (10) days of date of Purchase Order.

2.8. ACCEPTANCE

2.8.1. DELAY IN ACCEPTANCE OR DELIVERY

JEA may delay delivery or acceptance of goods in the event of any unforeseen event. The Company shall hold the goods pending JEA's direction, and JEA will be liable only for direct increased costs incurred by the Company by reason of JEA's instructions.

2.8.2. ACCEPTANCE OF WORK - RECEIPT, INSPECTION, USAGE AND TESTING

The Contract Administrator will make the determination when Work is completed and there is Acceptance by JEA. Acceptance will be made by JEA only in writing, and after adequate time to ensure Work is performed in accordance with Contract Documents. JEA will reject any items delivered by Company that are not in accordance with the Contract, and shall not be deemed to have accepted any items until JEA has had reasonable time to inspect them following delivery or, if later, within a reasonable time after any latent defect in the items has become apparent. JEA may partially accept the Work items. If JEA elects to accept nonconforming items, it may in addition to other remedies, be entitled to deduct a reasonable amount from the price as compensation for the nonconformity. Any Acceptance by JEA, even if nonconditional, shall not be deemed a waiver, or settlement or acceptance of any Defect.

Items specifically required prior to Acceptance are:

- Hydraulic inspection of Ground Storage Tank
- Pump performance testing
- Finite element analysis of pumps
- Amperage testing of VFDs and MCC

2.9. TERM AND TERMINATION

2.9.1. TERM

2.9.1.1. TERM OF CONTRACT - THROUGH COMPLETION OF WORK

The Contract shall be in force through completion of all Work, Acceptance and final payment, including resolution of all disputes, claims, or suits, if any. Certain provisions of this Contract may extend past termination including, but not limited to, Warranty and Indemnification provisions.

This Contract, after the initial year, shall be contingent upon the existence of lawfully appropriated funds for each subsequent year of the Contract.

2.9.2. TERMINATION FOR CONVENIENCE

JEA shall have the absolute right to terminate the Contract in whole or part, with or without cause, at any time after the Award effective date upon written notification of such termination.

In the event of termination for convenience, JEA will pay the Company for all disbursements and expenses that the Company has incurred, or has become obligated prior to receiving JEA's notice of termination.
Upon receipt of such notice of termination, the Company shall stop the performance of the Work hereunder except as may be necessary to carry out such termination and take any other action toward termination of the Work that JEA may reasonably request, including all reasonable efforts to provide for a prompt and efficient transition as directed by JEA.

JEA will have no liability to the Company for any cause whatsoever arising out of, or in connection with, termination including, but not limited to, lost profits, lost opportunities, resulting change in business condition, except as expressly stated within these Contract Documents.

2.9.3. SUSPENSION OF WORK

JEA may suspend the performance of the Work by providing the Company with five days' written notice of such suspension. Schedules and compensation for performance of the Work shall be amended by mutual agreement to reflect such suspension. In the event of suspension of Work, the Company shall resume full performance of the Work when JEA gives written direction to do so. Suspension of Work for reasons other than the Company's negligence or failure to perform, shall not affect the Company's compensation as outlined in the Contract Documents.

2.9.4. TERMINATION FOR DEFAULT (WITH A BOND)

JEA may give the Company written notice to discontinue all or part of the Work under the Contract or a Notice to Cure a material breach in the event that:

- The Company assigns or subcontracts the Work without prior written permission;
- Any petition is filed or any proceeding is commenced by or against the Company for relief under any bankruptcy or insolvency laws;
- A receiver is appointed for the Company's properties or the Company commits any act of insolvency (however evidenced);
- The Company makes an assignment for the benefit of creditors;
- The Company suspends the operation of a substantial portion of its business;
- The Company suspends the whole or any part of the Work to the extent that it impacts the Company's ability to meet the Work schedule, or the Company abandons the whole or any part of the Work;
- The Company, at any time, violates any of the conditions or provisions of the Contract Documents, or the Company fails to perform as specified in the Contract Documents, or the Company is not complying with the Contract Documents;
- The Company attempts to willfully impose upon JEA items or workmanship that are, in JEA's sole opinion, defective or of unacceptable quality;
- The Company breaches any of the representations or warranties;
- The Company is determined, in JEA's sole opinion, to have misrepresented the utilization of funds or misappropriate property belonging to JEA; or
- There is an adverse material change in the financial or business condition of the Company.

If within thirty (30) days after service of such notice to discontinue or notice to cure upon the Company an arrangement satisfactory to JEA has not been made by the Company for continuance of the Work or the material breach has not been remedied, JEA may declare the Company to be in default and terminate the Contract.

Once Company is declared in default and the Contract has been terminated, JEA will notify the Surety in writing of the termination. The Surety shall, at JEA's sole option take one (1) of the following actions:

(a) Within a reasonable time, but in no event later than thirty (30) days, from JEA's written notice of termination for default, arrange for Company with JEA's consent, which shall not be unreasonably withheld, to complete the Contract and the Surety shall pay JEA all losses, delay and disruption damages and all other damages, expenses, costs and statutory attorney's fees, including appellate proceedings, that JEA sustains because of a default by the Company under the Contract;
(b) Within a reasonable time, but in no event longer than sixty (60) days after JEA's written notice of termination for default, award a contract to a completion contractor and issue notice to proceed or alternatively, JEA may elect, to have the Surety determine jointly with JEA the lowest responsible qualified bidder, to have the Surety arrange for a contract between such bidder and JEA, and for the Surety to make available as Work progresses sufficient funds to pay the cost of completion less the balance of the Contract price; or
(c) Within a reasonable time, but in no event later than thirty (30) days from JEA's notice of termination for default, JEA may waive its right to complete or arrange for completion of the Contract and, within twenty-one (21) days thereafter, determine the amount for which the Surety may be liable to JEA and tender payment to JEA of any amount necessary in order for JEA to complete performance of the Contract in accordance with its terms and conditions less the balance of the Contract price.

JEA shall have the right to take possession of and use any of the materials, plant, tools, equipment, supplies and property of any kind provided by the Company for the purpose of this Work.

JEA will charge the expense of completing the Work to the Company and will deduct such expenses from monies due, or which at any time thereafter may become due, to the Company. If such expenses are more than the sum that would otherwise have been payable under the Contract, then the Company or Surety shall pay the amount of such excess to JEA upon notice of the expenses from JEA. JEA shall not be required to obtain the lowest price for completing the Work under the Contract, but may make such expenditures that, in its sole judgment, shall best accomplish such completion. JEA will, however, make reasonable efforts to mitigate the excess costs of completing the Work.

The Contract Documents shall in no way limit JEA's right to all remedies for nonperformance provided under law or in equity, except as specifically set forth herein. In the event of termination for nonperformance, the Company shall immediately surrender all Work records to JEA. In such a case, JEA may set off any money owed to the Company against any liabilities resulting from the Company's nonperformance.

JEA has no responsibility whatsoever to issue notices of any kind, including but not limited to deficient performance letters and scorecards, to the Company regarding its performance prior to default by Company for performance related issues.

JEA shall have no liability to the Company for termination costs arising out of the Contract, or any of the Company's subcontracts, as a result of termination for default.

Immediately upon termination or expiration of this Agreement, Company must return to JEA all materials, documents and things used by Company and belonging to JEA, including proposals, computer files, borrower files, building keys, and any other property or information regarding continued business compliance or goodwill, whether

in electronic or hard-copy form. Furthermore, upon JEA's request, Company shall certify in writing that all of the foregoing documents or materials, including archival or backup copies, whether in electronic of hard-copy form, have been returned to JEA, deleted from any computer system, or otherwise destroyed.

Any other provision in this Agreement to the contrary notwithstanding the duration of this Agreement after the initial year, shall be contingent upon the existence of lawfully appropriated funds for each subsequent year of the term.

2.9.5. UNAUTHORIZED WORK

JEA will consider any Work done without lines and grades given, Work done beyond the lines and grades shown on the Contract or as given, or any extra Work done without written authority, as unauthorized Work and will not pay the Company for such Work. If so ordered by the Contract Administrator, the Company shall remove such Work and properly replace it at the Company's own expense.

2.10. PRELIMINARY MATTERS

2.10.1. MAINTENANCE OF TRAFFIC

The Company, when required by the governing agency such as the City of Jacksonville or the Florida Department of Transportation (FDOT), shall maintain traffic in accordance with an approved Maintenance of Traffic (MOT) plan ("MOT Plan") submitted by the Company, on streets, roads, private ways, and walks. The Company shall assume full responsibility for the adequacy and safety of provisions made. The Company shall be solely responsible for the placement, maintenance and removal of the minimum number of devices required by the MOT Plan, or specified by the FDOT, for the control of traffic at the Work Location including, but not limited to signs, cones, lights, barricades, concrete barrier walls, police officers, flaggers, etc. ("MOT Items").

Company shall be responsible for all costs associated with MOT. There will not be a separate line item for MOT on the Bid Form.

2.10.2. LIMITATION OF ACCURACY OF INFORMATIONAL MATERIALS

For all drawings, test results, inspections, and other informational materials included as part of the Contract Documents, the Company understands and agrees that any existing facilities shown, including underground, overhead, and surface structures, and other delineations, and any other informational items provided as part of the Contract Documents are for reference only and are not to be used by the Company as the only indication of Work conditions. The Company understands and agrees that it is its sole responsibility to verify all Work conditions, measurements, dimensions, obstructions and other causes for existing or potential changes to the Work prior to initiating Work. In the event the Work must be changed due to the Company not fulfilling the above requirements, the Company understands and agrees that it will be responsible for all costs associated with the changed condition. Changes associated with conditions that are clearly unforeseen and that could not have been discovered by a reasonable verification of the above listed items, shall be covered as stated in Changes to Work.

2.10.3. PERMITS TO BE OBTAINED BY THE CONTRACTOR

Unless otherwise specified in the Contract Documents, the Contractor shall secure, maintain, post as required, and pay for all building, plumbing, electrical, water, sewer, right-of-way, parking, roadway, railroad, shipping, freight, hazardous materials, and any other permits which may be required for performance of the Work in full compliance with all applicable laws, rules and regulations. The Contractor shall perform all actions necessary to identify where permits are to be obtained and properly file for the permits, except those specifically listed in the Contract Documents as being provided by JEA.

The Contractor shall comply with all conditions of permits issued for the Work, either directly or indirectly, issued by federal, state, or local governmental agencies, which are hereby incorporated as part of these Contract Documents. The Contractor shall be solely responsible for resolving any issues and bearing all expenses including any damages suffered by JEA that result from a finding of noncompliance during performance of the Work by any of the respective regulatory agencies including, but not limited to, all costs for delays, litigation, fines, fees of any kind, and other costs.

2.10.4. PRE-WORK MEETING AND PROGRESS MEETINGS (CONSTRUCTION)

Before starting the Field Work, a Pre-Work or Pre-Construction meeting may be held to review procedures for the Work, review the Work schedule, establish procedures for invoicing, approving Invoices and making payments, and establish a working relationship between JEA and the Company.
The JEA Contract Administrator may, at his or her discretion, request Pre-Work Meetings to be held prior to start of any Field Work. Such meeting(s) shall be attended by, but not limited to, the Company Representative and Company Supervisor. The JEA Contract Administrator will notify the Company in writing of the meeting time and location at least two (2) days prior to the meeting date. In addition, construction progress meetings will be held at a frequency as determined by JEA. Such meeting(s) shall be attended by, but not limited to, the Company's Representative and Company's Supervisor.

2.10.5. TEMPORARY CLOSURE OF ROADWAYS

The Company shall not close or obstruct any portion of a street, road, or private way without first obtaining permits. If any street or private way is rendered unsafe by the Company's operations, the Company shall make such repairs or provide such temporary ways and guards necessary for the protection and safety of persons on the Work and the public and for the orderly maintenance of traffic. All costs associated with temporary closure of roadways shall be included in Bid Price.

The Company shall notify the police and fire departments in writing if it will be necessary to close a street. The Company shall copy JEA on all correspondence relating to street closure. The Company shall notify the police and fire departments prior to closure of the street. The Company shall be responsible for maintaining proper coordination with the proper authorities.

Temporary closure of business entrances must be approved in writing by and coordinated with JEA.

2.10.6. TEMPORARY UTILITIES

The Company shall furnish and install all temporary water, electricity and other utilities required to accomplish the Work. The Company shall obtain the water required for carrying out the Work from fire hydrants, existing water main connections, or new connections approved by JEA. The Company shall install a back flow preventer and water meter assembly if construction water is necessary. Upon Substantial Completion of Work, the Company shall remove all evidence of temporary connections and lines.

Prior to initiating any construction Work, the Company shall coordinate and schedule the provision of temporary utility service required during construction and arrange for the permanent installation and connection of utilities for the completed Work.

2.10.7. WORK LOCATION

Work shall be performed at the following location(s): Otter Run WTP located at 96119 Otter Run Drive, Fernandina Beach, FL

2.10.8. UNFORESEEN CONDITIONS

The Company understands and agrees that it is its responsibility to conduct due diligence prior to the Work. Such due diligence includes, but is not limited to, verifying all Work conditions, measurements, dimensions and latent and patent obstructions, the accuracy of drawings, test results, inspections and other informational materials provided in the Contract Documents, and any other causes for existing or potential changes to the Work prior to initiating the Work. In the event that the Work must be changed due to the Company's failure to fulfill the above requirements, the Company understands and agrees that it will be responsible for all costs associated with the changed condition.

In the event, however, that the Company exercises the requisite due diligence and a change to the Work becomes necessary resulting from conditions that are clearly unforeseen and that could not have been discovered, the costs for adjusting the Work in response to such unforeseen conditions shall be addressed in a Change Order or an amendment to the Contract executed by JEA and Company. Any Work the Company performs prior to receipt of such Change Order or approved Contract amendment will be at the Company's sole risk.

2.10.9. COMMERCIAL ACTIVITIES ON THE WORK LOCATION

The Company shall not establish any commercial activities, or issue concessions or permits of any kind to third parties to establish commercial activities on lands owned or controlled by JEA, or within the boundaries of the Work Location. The Company shall not allow its employees to engage in any commercial activities on the Work Location.

2.10.10. COMPLETION OF WORK

The Company shall begin Work within ten (10) days after the date of written Notice to Proceed from JEA to begin Work, and shall complete the Work by the date set forth in the Contract Documents. The Company further understands and agrees that time is of essence and should the Company fail to complete the Work on or before the date established for Substantial Completion and Final Acceptance, the Company shall be solely responsible for additional costs as defined in the Contract.

2.10.11. COMPANY LAYDOWN AREA

In the event the Company decides to utilize public or private property as a laydown area, the Company shall enter into a written agreement with the entity who owns the property. JEA shall have access to all laydown areas. Upon submission of Company's first Invoice or application for payment to JEA, the Company shall provide to JEA a copy of such signed written agreement. The Company shall submit to JEA a letter of release from the entity in connection with Company's final Invoice or application for payment to JEA.

2.10.12. COMPANY REPRESENTATIVE

The Company shall provide JEA with the name and responsibilities of the Company Representative, in writing after Award of the Contract and before starting the Work under the Contract. Should the Company need to change the Company Representative, the Company shall promptly notify JEA in writing of the change.

2.10.13. COMPANY'S DOCUMENTS AT THE WORK LOCATION

The Company shall maintain at the Work Location for JEA one record copy of all Contract Documents in good order and marked currently to record all Addenda and changes made during Contract Term. These shall be available to JEA Representatives and shall be delivered to the Contract Administrator upon completion of the Work and at the request of the Contract Administrator.

The Company shall also maintain detailed records of the Work for its own files. The Company shall make these records available to JEA for inspection upon request. The Company shall maintain such records for three years after date of Final Completion.

2.10.14. COMPANY'S FIELD OFFICE

The Company shall provide its own office facilities at the Work Location, as required. Unless specifically listed herein, JEA provides no Work Location facilities or Work Location area for the Company facilities of any kind such as field office and material storage. If the Company establishes a Work Location-based office, the Company shall provide and maintain adequate telephone facilities at this office during the full Term of the Contract. If the Company has a local business office, this office may serve as a Work Location office for this Contract, but the Company must maintain an operational cellular phone at the Work Location while performing Work.

2.11. CONFIDENTIALITY AND OWNERSHIP OF DOCUMENTATION

2.11.1. PUBLIC RECORDS LAWS

Access to Public Records.

All Documents, data and other records received by JEA in connection with the Contract are public records and available for public inspection unless specifically exempt by law. The Company shall allow public access to all documents, data and other records made or received by the Company in connection with the Contract unless the records are exempt from Section 249(a) of Article I of the Florida Constitution or subsection 119.07(1), Florida Statutes. JEA may unilaterally terminate the Contract of the Company refuses to allow public access as required under the Contract.

Redacted copies of Confidential Information.

If the Company believes that any portion of any documents, data or other records submitted to JEA are exempt from disclosure under Chapter 119, Florida Statutes, the Florida Constitution and related laws ("Florida's Public Records Laws"), Company must (1) clearly segregate and mark the specific sections of the document, data and records as "Confidential", (2) cite the specific Florida Statute or other legal authority for the asserted exemption, and (3) provide JEA with a separate redacted copy of the documents, data, or records (the "Redacted Copy"). The Redacted Copy shall contain JEA's contract name and number, and shall be clearly titled "Redacted Copy". Bidder should only redact those portions of records that Bidder claims are specifically exempt from disclosure under Florida's Public Records Laws. If the Company fails to submit a redacted copy of documents, data, or other records it claims is confidential, JEA is authorized to produce all documents, data, and other records submitted to JEA in answer to a public records request for these records.

Request for Redacted Information.

In the event of a public records or other disclosure request under Florida's Public Records Laws or other authority to which the Company's documents, data or records are responsive, JEA will provide the Redacted Copy to the requestor. If a Requestor asserts a right to any redacted information, JEA will notify the Company that such an assertion has been made. It is the Company's responsibility to respond to the requestor to assert that the information in questions is exempt from disclosure under applicable law. If JEA becomes subject to a demand for discovery or disclosure of the redacted information under legal process, JEA shall give the Company prompt notice of the demand prior to releasing the redacted information (unless otherwise prohibited by applicable law). The Company shall be responsible for defending it determination that the redacted portions of the information are not subject to disclosure.

Indemnification for Redacted Information.

The Company shall protect, defend, and indemnify JEA from and against all claims, demands, actions, suits, damages, liabilities, losses, settlements, judgments, costs, and expenses (including but not limited to reasonable

attorney's fees and costs) arising from or relating to the Company's assertion that all or any portion of its information is not subject to disclosure.

Public Records Clause for Service Contracts.

If, under the Contract, the Company is providing services and is acting on behalf of JEA as contemplated by subsection 119.011(2), Florida Statutes, the Company shall:

Keep and maintain public records that ordinarily and necessarily would be required by JEA in order to perform service;

- Provide the public with access to public records on the same terms and conditions that JEA would provide the records and at a cost that does not exceed the cost provided in Chapter 119, Florida Statues, or otherwise prohibited by law;
- Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law; and
- Meet all requirements for retaining public records and transfer, at no cost, to JEA all public records in possession of the Company upon termination of the contract and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically shall be provided to JEA in a format that is compatible with the information technology systems of JEA.

IF THE COMPANY HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE COMPANY'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT:

JEA
Attn: Public Records
21 West Church Street
Jacksonville, Florida 32202
Ph: 904-665-8606
publicrecords@jea.com

2.11.2. INTELLECTUAL PROPERTY

The Company grants to JEA an irrevocable, perpetual, royalty free and fully paid-up right to use (and such right includes, without limitation, a right to copy, modify and create derivative works from the subject matter of the grant of the right to sublicense all, or any portion of, the foregoing rights to an affiliate or a third party service provider) the Company's intellectual property (including, without limitation, all trade secrets, patents, copyright and know-how) that is contained or embedded in, required for the use of, that was used in the production of or is required for the reproduction, modification, maintenance, servicing, improvement or continued operation of any applicable unit of Work.

If the Work contains, has embedded in, requires for the use of any third party intellectual property, or if the third party intellectual property is required for the reproduction, modification, maintenance, servicing, improvement or continued operation of the Work, the Company shall secure for JEA an irrevocable, perpetual, royalty free and fully paid-up right to use all third party intellectual property. The Company shall secure such right at its expense and prior to incorporating any third party intellectual property (including, without limitation, all trade secrets, patents, copyright and know-how) into any Work, including, without limitation, all drawings or data provided under the Contract, and such right must include, without limitation, a right to copy, modify and create derivative works from

the subject matter of the grant of the right and a right to sublicense all or any portion of the foregoing rights to an affiliate or a third party service provider.

Should JEA, or any third party obtaining such work product through JEA, use the Work or any part thereof for any purpose other than that which is specified herein, it shall be at JEA's sole risk.

The Company will, at its expense, defend all claims, actions or proceedings against JEA based on any allegation that the Work, or any part of the Work, constitutes an infringement of any patent or any other intellectual property right, and will pay to JEA all costs, damages, charges, and expenses occasioned to JEA by reason thereof. JEA will give the Company written notice of any such claim, action or proceeding and, at the request and expense of the Company, JEA will provide the Company with available information, assistance and authority for the defense.

If, in any action or proceeding, the Work, or any part thereof, is held to constitute an infringement, the Company will, within 30 days of notice, either secure for JEA the right to continue using the Work or will, at the Company's expense, replace the infringing items with noninfringing Work or make modifications as necessary so that the Work no longer infringes.

The Company will obtain and pay for all patent and other intellectual property royalties and license fees required in respect of the Work.

2.11.3. PROPRIETARY INFORMATION

The Company shall not copy, reproduce, or disclose to third parties, except in connection with the Work, any information that JEA furnishes to the Company. The Company shall insert in any subcontract a restriction on the use of all information furnished by JEA. The Company shall not use this information on another project. All information furnished by JEA will be returned to JEA upon completion of the Work.

2.11.4. PUBLICITY AND ADVERTISING

The Company shall not take any photographs, make any announcements or release any information concerning the Contract or the Work to any member of the public, press or official body unless prior written consent is obtained from JEA.

2.12. LABOR

2.12.1. NONDISCRIMINATION

The Company represents that it has adopted and will maintain a policy of nondiscrimination against employees or applicants for employment on account of race, religion, sex, color, national origin, age or handicap, in all areas of employee relations, throughout the Term of this Contract. The Company agrees that on written request, it will allow JEA reasonable access to the Company's records of employment, employment advertisement, application forms and other pertinent data and records for the purpose of investigation to ascertain compliance with the nondiscrimination provisions of this Contract; provided however, the Company shall not be required to produce, for inspection, records covering periods of time more than one year from the effective date of this Contract.

The Company shall comply with the following executive orders, acts, and all rules and regulations implementing said orders or acts, which are by this reference incorporated herein as if set out in their entirety:

- The provisions of Presidential Order 11246, as amended, and the portions of Executive Orders 11701 and 11758 as applicable to Equal Employment Opportunity;
- The provisions of section 503 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA); and

- The provisions of the Employment and Training of Veterans Act, 38 U.S.C. 4212 (formerly 2012).

The Company agrees that if any of the Work of this Contract will be performed by a Subcontractor, then the provisions of this subsection shall be incorporated into and become a part of the subcontract.

2.12.2. JEA ACCESS BADGES

If the scope of work described in this Contract requires a Company to access JEA facilities, each Company employee shall apply for a JEA access badge through JEA's Security Department. An appointment to obtain a JEA access badge can be made by contacting JEA Security at securitybadge@jea.com. Finally, JEA does not allow Company employees to share JEA access badges. A Company whose employees are found to be sharing JEA access badges, will result in the Contract being terminated immediately for default. Additionally, JEA shall be notified within 6 hours of a lost or stolen JEA security badge or when an employee leaves the Company. Report badge termination notifications to JEA Security at (904) 665-8200.

2.12.3. LEGAL WORKFORCE

JEA shall consider the Company's employment of unauthorized aliens a violation of section 274A(e) of the Immigration and Nationalization Act. Such violation shall be cause for termination of the Contract for default upon thirty (30) days' prior written notice of such termination, notwithstanding any other provisions to the contrary in the Contract Documents.

2.12.4. JEA WORKPLACE TOBACCO USE POLICY

It is JEA's policy to maintain a healthy work environment and JEA's goal is to become a tobacco-free workplace. Therefore, JEA prohibits Company employees from using tobacco products while on JEA property or during the performance of JEA Work. JEA reserves the right to require Company to remove an employee who violates this policy from JEA property or JEA Work site upon notice from the JEA Representative.

2.12.5. PROHIBITED FUTURE EMPLOYMENT

It shall be unlawful and a class C offense for any person, who was an officer or employee of JEA, after his or her employment has ceased, to be employed by or enter into any contract for personal services, with a person or company who contracted with, or had a contractual relationship with JEA, while the contract is active or being completed, or within two years of the cessation, completion, or termination of the person's or company's contractual relationship with JEA, where (1) the contract with JEA had a value that exceeded $250,000, and (2) the officer or employee had a substantial and decision-making role in securing or negotiating the contract or contractual relationship, or in the approval of financial submissions or draws in accordance with the terms of the contract; except that this prohibition shall not apply to an employee whose role is merely as a review signatory, or to contracts entered into prior to January 1, 2008, or to contracts that have been competitively procured. With respect to this subsection a contract is competitively procured if it has been obtained through a sealed low bid award. A "substantial and decision-making role" shall include duties and/or responsibilities that are collectively associated with: (i) approving solicitation or payment documents; (ii) evaluating formal bids and proposals; and (iii) approving and/or issuing award recommendations for JEA Awards Committee approval. The contract of any person or business entity who hires or contracts for services with any officer or employee prohibited from entering into said relationship shall be voidable at the pleasure of JEA. This prohibition shall not apply to any former officer or employee after two years from cessation from JEA employment.

2.12.6. HIRING OF OTHER PARTY'S EMPLOYEES

Each party recognizes that the other party has incurred or will incur significant expenses in training its own employees and agrees that it will not pursue or hire, without the other party's consent, the other party's employees or the employees of its subsidiaries for a period of two (2) years from the termination date of this Contract.

2.12.7. MINIMUM QUALIFICATION OF COMPANY PERSONNEL

At a minimum, all Company personnel shall be qualified for the tasks they are assigned. All Company personnel assigned to work at a JEA facility or job site shall be able to read, write, speak and understand English. All Company personnel shall act in a professional manner, with due sensitivity to other persons at the Work Location. If JEA, at its sole discretion, determines that a Company person is unqualified, unfit, or otherwise unsuitable for the tasks assigned, the Company shall immediately stop the person from performing the tasks, and replace the person with a qualified individual. The Company shall pay all costs associated with replacing the unqualified person including, but not limited to, termination, recruiting, training, and certification costs.

The Company personnel assigned supervisory roles, and those with increased authority shall be held to strict scrutiny of their qualifications and suitability for their positions. In addition to the other provisions of this Section, the Company shall provide written documentation as to experience, education, licenses, certifications, professional affiliations, and other qualifications of the individual, within one day of request from the Contract Administrator. Any changes to such personnel after approval shall require the written permission of the Contract Administrator.

2.12.8. PAYMENT OF OVERTIME

Any Overtime required for Company to complete the Work within the Contract Time shall be at the sole cost and expense of Company. However, if JEA requires the Company to perform Overtime Work in order to complete the Work prior to the Contract Time, the Company shall bill JEA for the Overtime such that only the actual costs incurred by the Company relating to the payment of Overtime premiums, in accordance with its labor policies and applicable laws. Such actual costs include Overtime wage premium, and additional taxes and insurance directly associated with the Overtime wage premium. The Company agrees that it will not charge for personnel paid a salary, or other form of compensation such that the Company incurs no direct costs as a result of the Overtime.

The Company shall total the direct Overtime charges, and add the agreed upon overhead rate, but in no case, shall such overhead rate exceed 10 percent of the total overtime costs.

Overtime may only be charged to JEA if the Company was directed in writing by the Contract Administrator to incur the Overtime. Such authorization for Overtime shall be accompanied by a Change Order.

2.12.9. SCHEDULING OF OVERTIME

Whenever the Company schedules Work beyond eight hours per day for a five day week, beyond 10 hours per day for a four day week, beyond 40 hours per week, or on Saturdays, Sundays, or Holidays, then the Company shall arrange, in advance, for the JEA Representative to inspect the Work performed during Overtime. The Company shall not perform Overtime Work or after-hours Work without a JEA Representative at the Work Location or available to perform the inspections, as directed by the Contract Administrator. Except where JEA has requested the Company schedule Overtime to perform additional Work, the Company shall reimburse JEA for any additional costs associated with JEA Representatives' Overtime pay.

2.12.10. SHOW-UP PAY

In the event that inclement weather prevents the Company from performing Work, the Company may be obligated to pay its crew a show-up pay. The Company shall be solely responsible for providing this pay.

2.12.11. COMPANY'S LABOR RELATIONS

The Company shall negotiate and resolve any disputes between the Company and its employees, or anyone representing its employees. The Company shall immediately notify JEA of any actual or potential labor dispute that may affect the Work and shall inform JEA of all actions it is taking to resolve the dispute.

2.13. COMPANY'S RESPONSIBILITIES AND PERFORMANCE OF THE CONTRACT

2.13.1. COMPANY REPRESENTATIVES

The Company shall provide JEA with the name and responsibilities of the Company Representative, in writing after Award of the Contract and before starting the Work under the Contract. Should the Company need to change the Company Representative, the Company shall promptly notify JEA in writing of the change.

2.13.2. COMPANY REVIEW OF PROJECT REQUIREMENTS

The Company shall review the Work requirements and specifications prior to commencing Work. The Company shall immediately notify the Contract Administrator in writing of any conflict with applicable law, or any error, inconsistency or omission it may discover. JEA will promptly review the alleged conflicts, errors, inconsistencies or omissions, and issue a Change Order or Purchase Order as appropriate if JEA is in agreement with the alleged conflict, and issue revised specifications. Any Work the Company performs prior to receipt of approved Change Order will be at the Company's sole risk.

2.13.3. LICENSES

The Company shall comply with all licensing, registration and/or certification requirements pursuant to applicable laws, rules and regulations. The Company shall secure all licenses, registrations and certifications as required for the performance of the Work and shall pay all fees associated with securing them. The Company shall produce written evidence of licenses and other certifications immediately upon request from JEA.

2.13.4. PERFORMANCE OF THE WORK

The Company represents and warrants that it has the full corporate right, power and authority to enter into the Contract and to perform the acts required of it hereunder, and that the performance of its obligations and duties hereunder does not and will not violate any Contract to which the Company is a party or by which it is otherwise bound. The Company warrants that all items provided under the Contract shall be free from Defect and services shall be performed in a professional manner and with professional diligence and skill, consistent with the prevailing standards of the industry. The Company warrants that the Work will meet the functional and performance requirements defined in the Contract.

2.13.5. DAMAGED MATERIALS OR EQUIPMENT

The Company shall report to the Contract Administrator any materials issued by JEA or delivered by the JEA material supplier and received by the Company that are later found to be faulty, damaged or discrepant in some manner. The Contract Administrator will obtain appropriate replacement materials upon written notification from the Contract Administrator. The Company shall not, under any circumstances, make a material replacement without written approval of the Contract Administrator.

The Company understands and agrees that damage to material and discrepancy of material is an expected part of performing the Work, and as such, the Company agrees it shall be solely responsible for any additional costs incurred as a result of damaged or discrepant materials, including, but not limited to, the costs to keep or get the Work on the Approved Schedule.

JEA will bill the Company for materials or equipment that are damaged while in the Company's custody. In such a case, the Company shall be charged the current JEA cost plus an inventory handling fee.

2.13.6. DELIVERY LOCATION

The delivery address for items provided under this Contract is: Otter Run WTP located at 96119 Otter Run Drive, Fernandina Beach, FL

2.13.7. EMERGENCY PROCEDURES

In emergencies affecting the safety of persons, the Work or property at the Work Location or any other area adjacent thereto, the Company, without special instructions or authorization from JEA Representatives, is obligated to act to its best ability to prevent threatened damage, injury or loss to the Work, any persons, or property. The Company shall give the Contract Administrator prompt written notice describing the emergency, its cause, actions taken, injuries and casualties, property damage, other damages, and impact on continued performance under this Contract.

2.13.8. LAW ENFORCEMENT/SECURITY

Onsite law enforcement shall be provided by the Company to ensure safe working conditions for site personnel. Any work activities performed at night shall have onsite law enforcement present. Company shall submit with corresponding pay application verification of the number of hours of law enforcement utilized during each pay period, including any associated fees. Company agrees to invoice JEA for law enforcement at its cost with no markup.

2.13.9. ENCROACHMENTS ON RIGHTS OR PROPERTY

The Company shall be solely responsible for any encroachments on public property or on the rights or property of adjoining property owners to the Work Location, and shall hold JEA harmless because of any encroachments that may result because of the Company's improper layout. In this regard, the Company shall, without extra cost to JEA, remove any Work or portion of any Work that encroaches on the property other than that of the Work Location, or that is built beyond legal building or setback limits. The Company shall rebuild the affected Work or portion of Work at the proper location and in full compliance with the Contract Documents.

2.13.10. REMOVAL OF WORK

The Company shall not sell, assign, mortgage, hypothecate or remove Work that has been delivered to or installed at the Work Location.

2.13.11. FREE AND CLEAR TITLE

The Company warrants that it has title to all equipment and materials furnished under the Contract where title will pass to JEA, and that the equipment and materials passed to JEA are free and clear of all liens, claims, security interests and encumbrances.

2.13.12. INSPECTIONS AND TESTING

JEA, or its designated representatives, will perform inspections at the Company facilities during normal business hours and in a manner that minimizes disruption to the normal day-to-day work activities of the Company. Company shall provide safe and proper facilities for inspection access and observation of the Work and also for any inspection or testing by others.

If the Company has covered or concealed any Work from inspection in any way that the JEA Representative has not specifically requested prior to the JEA Representative’s inspection, or if the JEA Representative considers it necessary or advisable that covered Work be inspected or tested by others, the Company, at the JEA Representative's request, shall uncover, expose or otherwise make available the portion of the Work in question for observation, inspection or testing as the JEA Representative may require. The Company shall furnish all necessary labor, material and equipment to make such Work available.

If such Work is defective, the Company shall bear all expenses of uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, including, but not limited to, compensation for additional professional services required by JEA, and no change in Contract Time will be considered as a result of the foregoing.

If such Work is not defective, JEA will reimburse the Company for actual time, material, and equipment costs for uncovering and reconstruction of the portion of the Work in question. JEA may also, at its sole discretion, grant the Company an extension of the Contract Time directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction.
All materials and equipment used in the construction of the Contract shall be subject to adequate inspection and testing in accordance with accepted standards. The Company shall select the laboratory or inspection agency for making all tests required by the specifications, and shall pay for this laboratory service direct, as a part of this Contract.

The Company shall pay for all required testing of materials and equipment. Two copies of each test showing certification of each test shall be furnished to the JEA Engineer immediately after such test has been made and with the exception of concrete, prior to delivery of the materials or equipment tested to the Work Location. JEA will not accept the materials or equipment until tests have been approved.

Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended. Test requirements for all materials are set out in the detailed specifications for that particular material. All materials and equipment prior to being incorporated in the Work, and required by the JEA Engineer to be tested, shall be tested for conformance with contractual requirements. Standard items of a uniform nature may be accepted on the manufacturer's certification. Where specific performance and/or quality is referred to, it is the Company's responsibility to have the necessary tests performed by qualified persons to show that the contractual requirements are being met except those tests named in the Contact Documents to be performed by JEA. Certified test results shall be submitted promptly in quadruplicate to the JEA Engineer for review. All tests shall be performed in accordance with referenced standards. Where no reference is made, tests shall be performed in accordance with the methods prescribed by the American Society for Testing and Materials or such other organization as would be applicable.

The Company shall pay for any retests resulting from its failure to provide Work that passes required tests.

The JEA Engineer may appoint JEA Inspectors to inspect any and all materials and Work. Such inspection may extend to any or all parts of the Work and to the preparation and manufacture of the materials to be used. The JEA Inspectors shall not be authorized to alter, revoke, enlarge or relax the provisions of the Contract, nor will they be authorized to approve or accept any portion of the completed Work, nor to issue instructions contrary to the Contract. The JEA Inspector shall inform the JEA Engineer of the progress of the Work and the manner in which it is being done, and notify the Company of any infringement upon the Contract Documents. The JEA Inspector will have the authority to reject defective materials or to suspend any Work that is being improperly done subject to the final decision of the JEA Engineer.

2.13.13. INTERFERENCE WITH EXISTING UTILITIES

The Company acknowledges and agrees that there is a possibility that existing JEA or other utility facilities may cross and/or lie parallel to excavations in the area where Work will occur. Although JEA may indicate recorded obstacles on the drawings, it does not warrant that other subsurface obstacles do not exist. The Company shall be responsible for verifying the data furnished by JEA and for fully investigating and locating additional obstructions including every type below, on or above the ground. The Company should regard these impediments as normal to construction. All costs for performing such work shall not be paid for separately, but shall be included in the Company's costs on the Bid Document.

The Company shall comply with all requirements of the Sunshine State One-Call program.

In the event the Company encounters an unidentified utility during performance of the Work, the Company shall promptly cease Work in the affected area and shall immediately notify the JEA Representative in writing. JEA will investigate the area and propose remedial actions in accordance with the provisions stated herein in "Changes to the Work".
The Company shall work in cooperation with JEA and representatives of existing utilities to plan and coordinate putting new Work into service so as not to interfere with the operation of the existing utilities. Such plans shall be adhered to unless deviations therefrom are expressly permitted in writing by the Contract Administrator.

The Company shall at all times conduct the Work in a manner that interferes as little as possible with the existing utilities. Any cables exposed during construction, whether energized or not, must be handled and protected as if they are energized. The Company shall so conduct its operations and maintain the Work in such condition that adequate drainage shall be in effect at all times. The Company shall not obstruct existing gutters, ditches and other runoff facilities. When working in the vicinity of overhead lines, the Company shall request line rubber protection from JEA at least 10 days in advance of performing the work.

The Company shall be solely responsible for any damages, interferences, and interruptions of service caused to any utility's assets and services including water, sewer, electric, telephone, gas, cable, and other utility services, that result from the Company's failure to fulfill the above stated requirements.

In the event the Company damages an existing utility, the Company shall immediately notify the property owner, the owner of the damaged utility and the JEA Representative. Should the damage cause an interruption of service, the Company shall be responsible for restoring service as soon as possible; however, the Company shall not make repairs, other than any required to restore safe conditions, without the approval of the property owner, or the owner of the damaged utility. The Company shall be responsible for coordinating any repair effort, and any associated costs should the utility owner or a licensed repair contractor be required to make the repair. JEA reserves the right to deduct any unsettled claim amount from Company's invoices until such time as the claim is satisfactorily resolved.

2.13.14. INTERFERENCE WITH OTHER JEA WORK OR OTHER COMPANIES

The Company shall perform the Work in a manner that minimizes the interference with other JEA work, City of Jacksonville work, or with work performed by other companies. The Company shall coordinate the Work with other persons and companies employed by JEA. If a difference of opinion regarding scheduling or coordination of the Work arises between the Company and another JEA contractor(s) performing work at the Work Location, JEA may arbitrate the matter. In such cases where JEA makes a decision regarding the scheduling or coordination of the work, the Company agrees to fully abide by JEA's decision. Unless otherwise agreed in writing by JEA, JEA will not be responsible for additional costs.

Any claims arising against the Company from damages to other companies' work, equipment, machinery, tools or other property shall be settled directly between the Company and the other companies involved. JEA will not, in any way, be a party to arbitrating or mediating any such disputes, nor shall JEA be responsible for any costs associated with such disputes.

2.13.15. INTERFERENCE WITH RAILROADS

The Company shall not build across, into, over or under, either temporarily or permanently, any portion of a railway or railway right-of-way without first obtaining all required permits. If the Company's operations render any railroad unsafe, the Company shall immediately notify the Contract Administrator and the railroad owner and take appropriate actions and such temporary safeguards as required to protect life, limb, and property, and to maintain orderly traffic.

The Company shall procure all railroad permits required for the Work beyond those procured by JEA and the costs for such permits shall be included in the Bid Documents. All costs associated with railroad fees for railroad flagmen, watchouts, inspectors, supervisors, any additional training of Company's employees that is required by applicable laws, rules and regulations when performing Work in association with railways, any certifications required for successful completion of the Work and all other associated costs shall be included in the Bid Document.

2.13.16. MATERIAL DELIVERED TO COMPANY SITES

The Company shall be responsible for all unloading, handling and storage of Work-related materials at the Work Location. Where the Company is to use a JEA-designated supplier to deliver materials to the Work Location, JEA will provide the Company, upon request, with contact names and information, along with required material lead-times. The Company is solely responsible for taking into account required material lead-times when planning its performance of the Work, and for communication and coordination of materials delivered to the Work Location by JEA suppliers. The Company shall be responsible for any additional delivery costs charged by the JEA material supplier for any Company delays.

If, for any reason, the Company is unable to receive, unload, handle or store materials it has ordered or caused to be ordered, the Company shall be responsible for any and all additional costs incurred by JEA for unloading, handling, storing, or additional shipping costs. In such cases where JEA is receiving items when the Company is unable to, such receipt does not indicate JEA's Acceptance of items.

2.13.17. OBLIGATIONS OF THE COMPANY

The Company shall provide everything necessary to successfully complete the Work except the materials and services specifically stated in the Contract to be provided by JEA. No payments, other than those shown in the Bid Documents, will be made to the Company for performance of any requirements of the Contract Documents. The Company shall perform all Work in accordance with the Contract Documents and the applicable JEA standards manuals, safety manuals, policies, accepted commercial work practices, local, state, and federal, rules regulations and laws which may be amended from time to time. The Company shall provide all permits, certifications, insurances, and bonds necessary or required by good practice, except where specifically stated in the Contract to be provided by JEA.

The Company's personnel shall perform all Work in a professional, efficient, and competent manner. The Company is obligated to provide personnel possessing the skills, certifications, licenses, training, tools, demeanor, motivation, and attitude to successfully complete the Work. The Company is obligated to remove individuals from performing Work under this Contract when the Company recognizes an individual to not be working in a manner consistent with the requirements of this Contract, or when JEA notifies the Company that JEA has determined an individual or group of individuals to not be working in a manner consistent with the requirements of this Contract. The Company is obligated to ensure that their officers and executives interact with JEA, JEA customers, whether direct or indirect customers of JEA, with the utmost level of professionalism and integrity.

In the event the Contractor chooses to use Subcontractors, the Contractor is obligated to provide Subcontractors possessing the skills, certifications, licenses, training, tools, demeanor, motivation and attitude to successfully perform the work for which they are subcontracted. The Contractor is obligated to remove Subcontractors from performing Work under this Contract when the Contractor recognizes that a Subcontractor is failing to work in a manner consistent with the requirements of this Contract, or when JEA notifies the Contractor that JEA has determined a Subcontractor is failing to work in a manner consistent with the requirements of this Contract.

The Contractor is obligated to ensure that sufficient supervision of the Work is provided. This includes ensuring that the Contractor Supervisor is at the Work Location when Work is being performed.

The Contractor shall bear sole responsibility for the efficiency, adequacy and safety of the performance of the Work, including temporary Work and facilities, until Acceptance. The Contractor shall be solely responsible for any loss or damage to materials, tools, labor, and equipment used during the performance of, or in connection with, the Work. Any JEA comments or approval regarding the Contractor's performance, materials, working force, or equipment will not relieve the Contractor of any responsibility.

2.13.18. PROTECTION OF COMPANY PROPERTY

The Company shall bear sole responsibility for the efficiency, adequacy and safety of the performance of the Work, including temporary Work and facilities, until Final Completion. The Company shall be solely responsible for any loss or damage to materials, labor, and equipment used during the performance of, or in connection with, the Work. Any JEA comments or approval regarding the Company's performance, materials, working force, or equipment will not relieve the Company of any responsibility for such loss.

2.13.19. PROTECTION OF EXISTING FACILITIES AND GROUNDS

The Company shall be responsible for protecting all the existing facilities including, but not limited to, buildings, lawns, landscaping, sprinkler systems, and pavements, both public and private, that are encountered during the performance of the Work. At all times, the Company shall cooperate with the owners of such facilities by arranging and performing the Work in and around such facilities in a manner that facilitates their preservation, relocation, and/or reconstruction. The Company shall be responsible for the full restoration or replacement if the Company damages such facilities during or resulting from performance of the Work.

The Company shall verify the existing dimensions and clearances before laying out the Work. When the Work involves the laying of utility lines across landscaped areas and grassed areas, which may include, but is not limited to, irrigation systems, streets, sidewalks, and other paved areas, the Company shall protect and preserve all trees, shrubs, palms, landscaping, etc., and restore such areas and all paved areas to their original sound conditions using construction techniques and materials that are the same as existing including replacing plants and trees with those of similar size and age. In the case of planted areas, the Company shall maintain the restoration Work until positive growth has been acknowledged in writing by the Contract Administrator.

All costs for such restoration and replacement work shall be included in the associated lines on the Bid Documents.

The Company shall not (except upon written consent from the property owner and Contract Administrator) enter or occupy with workers, tools, equipment or vehicles any land outside the permitted easements, right-of-ways, JEA property or the City of Jacksonville property.

2.13.20. QUALITY CONTROL AND QUALITY ASSURANCE

The Company shall provide Quality Control to ensure the Work is performed in accordance with the Contract. Quality Control shall be appropriate for the nature of the Work, and shall be conducted in a manner consistent with sound quality management and industrial engineering principles. The Company shall have only personnel trained in Quality Control techniques and experienced with the nature of the Work perform the Quality Control function.

JEA may perform Quality Assurance activities. Such activities, whether performed or not, do not in any way limit or reduce the Company's requirements. JEA may become aware of quality related problems during its performance of Quality Assurance, but has no obligation to notify the Company of its findings. The Company shall provide access to all areas of Work, including the Company's facilities, for JEA Quality Assurance personnel and JEA Representatives. JEA will conduct Quality Assurance activities so as not to excessively interfere with the Work, however, where JEA Quality Assurance personnel request specific actions of the Company, the Company shall comply with the request and agrees that such compliance is included as part of its Contract Price.

2.13.21. SAFETY AND PROTECTION PRECAUTIONS (CONSTRUCTION)

The Company shall comply with all applicable federal, state and local laws, ordinances, all JEA procedures and policies including, but not limited to, JEA's Contractor Safety Management Process (available at JEA.com), and orders of any public body having jurisdiction for the safety of persons or protection of property. The Company understands and agrees that a violation of any provision of this Section e is grounds for an immediate termination of the Contract for default, with no requirement for JEA to provide Company with advanced notice and opportunity to cure. Additionally, the Company shall be responsible for all JEA damages associated with such termination.

The Company shall only use those Subcontractors who have met JEA Safety Prequalification requirements in the JEA Contractor Safety Management Process. The Company shall ensure that Subcontractors and their personnel have all the necessary personal protective equipment and training needed to perform the Work safely.

The Company understands and agrees that JEA Representatives may stop Work at any time that JEA, at its sole discretion, considers the Company's Work to be unsafe or a risk to person or property, and to direct the Company to, at a minimum, perform as directed in such a way as to render the Work environment safe. The Company understands and agrees that it is responsible for paying all costs associated with providing a safe work environment including, but not limited to, any costs associated with any JEA directed safety improvements. The Company also understands and agrees that it is solely responsible for the safety of personnel and property associated with the Work, and that any actions taken by JEA to prevent harm to persons or damage to equipment does not, in any way, relieve the Company of this responsibility.

The Company Representative, or alternatively, the Company Supervisor, shall be designated as the Company's representative responsible for the prevention of accidents.

If the nature of the Work requires, the Company shall notify the police and fire departments as to its Work Location in order to ensure prompt response in an emergency.

2.13.22. SAFETY REPRESENTATION

The Company represents and warrants to JEA that it has the capacity to train and supervise its employees, Subcontractors and suppliers to ensure the Work complies with all safety requirements of the Contract Documents. The Company shall be responsible for executing the necessary safety training and supervision of its employees and Subcontractors, and acknowledges that JEA is not responsible for training or supervising the Company's employees, except when noted for the purpose of enforcing compliance with these safety requirements.

2.13.23. SALVAGE AND EXCESS MATERIALS AND EQUIPMENT PROVIDED BY JEA

The Company shall protect salvaged or salvageable equipment and material from loss and damage. The Company shall protect excess materials and equipment provided by JEA to the Company for use in the Work from loss and damage. The Company shall inventory, sort and return salvage and excess materials, and shall weigh conductors. The Company shall return salvage and excess materials and equipment to the appropriate JEA Service Center accompanied by the Contractor Material Returns Form, in accordance with the JEA's inspector and the instructions and authorization of the JEA's storeroom foreman.

2.13.24. SHIPPING - FOB DESTINATION

Items are purchased F.O.B. destination. The Company shall ensure the following:

- Pack and mark the shipment to comply with the Contract Documents; or in the absence of specifications in the Contract Documents, prepare the shipment in conformance with carrier requirements;

- Prepare and distribute commercial bills of lading;
- Deliver the shipment in good order and condition to the point of delivery specified in the Contract;
- Be responsible for any loss of and/or damage to the goods occurring before receipt of the shipment by JEA Representative at the delivery point specified in the Contract;
- Be responsible for obtaining any permits required for transportation to the installation site;
- Furnish a delivery schedule and designate the mode of delivering carrier; and
- Pay and bear all charges to the specified point of delivery.

2.13.25. SHOP DRAWINGS

The Company shall promptly submit all required Shop Drawings in accordance with the provisions provided herein. JEA will not grant an extension of Contract Time due to the Company's failure to submit Shop Drawings in ample time to allow for checking, revisions, reviews, and approval.

A letter of transmittal and four copies of each shop drawing shall accompany each submittal. Shop drawings shall be forwarded to the JEA Engineer. Each drawing shall be listed separately on the letter. The Company shall also note distinctively on the transmittal letter any deviations that the Shop Drawings may have from the requirements of the Contract Documents.

The JEA Engineer's approval of Shop Drawings shall not be construed as a complete check, nor shall it relieve the Company from responsibility for any deficiency that may exist, or from any departures or deviations from the requirements of the Contract unless the Company has, in writing, called the JEA Engineer's attention to such deviations at the time of submission and obtained written approval for the deviation. The JEA Engineer's approval shall not relieve the Company from the responsibility for errors of any sort in Shop Drawings or schedules, nor from responsibility for proper fitting of the Work, nor from the necessity of furnishing any Work, materials, equipment or tools, required by the Contract Documents that may not be indicated on Shop Drawings when approved. The Company shall be solely responsible for all quantities and dimensions shown on the Shop Drawings. The Company shall not execute any Work until the JEA Engineer approves the Shop Drawings and a copy stamped "Approved" is at the Work Location. The Company shall, at no extra cost to JEA, make all changes and alterations whatsoever in Work performed or in subcontracts or orders placed prior to the approval of any and all Shop Drawings.

The Company shall allow a minimum of 14 days for the review of Shop Drawings. This shall be the period for new Shop Drawings and Shop Drawings that are revised and resubmitted.

As used herein, the term "manufactured" applies to standard units usually mass produced, and "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements. Shop drawings shall establish the actual details of all manufactured or fabricated items; indicate proper relation to adjoining Work; amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure; and incorporate minor changes of design or construction to suit actual conditions.

Shop drawings shall be complete in every detail, properly identified with the Contract name, Contract and subsection number for identification of each item, and state the qualifications, departures or deviations from the Contract, if any. Shop drawings for each section of the Work shall be numbered consecutively and the numbering system shall be retained throughout all revisions. Each drawing shall have a clear space above the title block in the lower right-hand corner for the approval stamps of the Company and the JEA Engineer.

If the materials are not listed in JEA's Approved Materials Manual, then prior to purchase of material or fabrication, the Company shall forward to the JEA Engineer for review, five sets of each shop drawing plus the number of prints it desires returned.

In checking the Shop Drawings, the Company shall verify all dimensions and field conditions and shall check and coordinate the Shop Drawings of any section or trade with the requirements of all other sections or trades whose Work is related thereto, as required for proper and complete installation of the Work. All rough-in and connections for utilities shall conform to approved equipment Shop Drawings.

The JEA Engineer will review the Shop Drawings and will return them to the Company stamped to indicate the action taken. The stamp will indicate that the shop drawing is "Approved", "Approved as Noted", "Returned for Correction", or "Disapproved". Only those Shop Drawings stamped "Returned for Correction" or "Disapproved" shall be resubmitted for subsequent review. Resubmittals shall be in the same form and number of copies as original submittals, with notation indicating a revised submittal. The Shop Drawings stamped "Approved" or "Approved as Noted" will be returned to the Company, who will be responsible for obtaining prints thereof and distributing them to the field and Subcontractors.

At the same time the JEA Engineer returns a reviewed submittal to the Company, it will forward two copies of each item stamped "Approved" or "Approved as Noted" together with any conditions of approval, to JEA for field and office use. The JEA Engineer may revoke approval of Shop Drawings, should field conditions so dictate.

2.13.26. STORAGE

With the approval of the JEA Engineer, a limited amount of temporary indoor storage space may be made available, but only for the equipment that must be protected from the weather. Equipment for which arrangements have been made for indoor storage shall be packed separately and the container clearly marked "For Indoor Storage." For equipment that will be stored indoors and that will require special storage precautions, the storage instructions shall be shown on the outside of each container, or in a durable envelope identified as containing storage instructions and attached to the container.

2.13.27. STORAGE OF EQUIPMENT

The Company shall be responsible for all storage of materials, equipment, vehicles, tools, and all other items associated with the Work. Such storage shall comply with applicable regulations appropriate for the items being stored to ensure suitable care for items and protection from theft, vandalism, or inappropriate use. The Company is solely responsible for the costs for such storage, unless otherwise indicated in the Contract Documents, and any costs associated with noncompliant storage including, but not limited to, loss and damage to items. In the event that JEA directs the Company to stop the Work, costs associated with storing equipment or materials will be compensated in accordance with the Contract Documents. The Company shall ensure that JEA Representatives have access to Work-related storage on an as needed basis during regular work hours and Overtime.

2.13.28. STORM PREPAREDNESS

In the event of a Hurricane Warning, Tropical Storm Warning, or other large storm affecting the Work Location, the Company shall secure, or shall remove and store all equipment and materials at the Work Location including, but not limited to, cones, barricades, lights and signs. The Company shall begin taking such precautions as necessary to secure the Work Location upon official issuance of mandatory evacuation of the area of the Work Location and no later than 24 hours prior to predicted arrival of tropical storm or hurricane force winds, or when notified by a JEA Representative to do so. These activities are considered a regular part of the Work, regardless of the frequency they are required.

2.13.29. SUBSTITUTIONS

Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function and quality required.

Materials or equipment of other suppliers may be accepted by the JEA Engineer if sufficient information is submitted by the Company to allow the JEA Engineer to determine that the material or equipment proposed is equivalent or equal to that named.

The Company shall make written application to the JEA Engineer for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified.

The application shall state that the evaluation and acceptance of the proposed substitute will not prejudice the Company's completion of the Work within the time prescribed by the Contract, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other Contract directly with JEA for Work on the Contract) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fees, royalties, permits or any other costs.

All variations of the proposed substitute from that specified shall be identified in the application and available maintenance, repair and replacement service shall be indicated.

The application shall also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other Companies affected by the resulting change, all of which shall be considered by the JEA Engineer in evaluating the proposed substitute.

Requests for review of substitute items of material and equipment will not be accepted by the JEA Engineer from anyone other than the Company.

The JEA Engineer may require the Company to furnish, at the Company's expense, additional data about the proposed substitute.

If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract, the Company may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to the JEA Engineer, if the Company submits sufficient information to allow the JEA Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract.

The JEA Engineer will be allowed a reasonable time within which to evaluate each proposed substitute; such time shall not be deemed justification for an extension of the Company's time for completion of the Contract.

The JEA Engineer will be the sole judge of acceptability, and no substitute shall be ordered, installed or utilized without the JEA Engineer's prior written notice, which shall be evidenced by either a Change Order or an approved shop drawing.

JEA may require reimbursement for the costs associated with JEA's evaluation of substitutions.

JEA may require the Company to furnish, at the Company's expense, a special performance guarantee bonds or other surety with respect to any substitution.

2.13.30. TOOLS AND EQUIPMENT

All tools and equipment used in the performance of the Work shall be used as intended by the manufacturer and in accordance with manufacturer operating manuals and industry practices, whichever is more stringent. The Company shall ensure that all tools and equipment used in the performance of the Work shall be of the size and quality suitable for safe and efficient performance of the Work. If the Company-provided tools and equipment do not meet these requirements, or if in the sole opinion of JEA formed after considering relevant factors, the tools or equipment are inappropriate for performance of the Work, the Company agrees to remove the unacceptable tools and equipment and obtain tools and equipment JEA considers suitable. Such replacement shall be entirely at the Company's expense, and no change to time prescribed by the Contract will be allowed.

The Company is responsible for furnishing and the security of any and all tools and equipment required to perform the Work.

2.13.31. CARE OF JEA CUSTOMERS

The Company agrees to provide excellent customer service throughout the execution of the Work during both scheduled Work hours and Overtime in the manner, as a minimum, as set forth below:

Customer Service Plan:
The Company shall submit a Customer Service Plan prior to mobilization and designate an individual to assume the duties of the Company's Customer Service Representative (CSR) as described herein.

The Company shall provide an after-hours emergency phone number to JEA.

The Company shall provide contact numbers for those individuals assigned to concerns arising during non-business hours and in the event of emergencies. The designated person(s) shall provide a cellular phone number as the main contact number, and one alternate number. The designated person(s) shall respond to JEA with proposed resolution within two hours of receiving a call from a JEA representative or customer. If the Company fails to respond within the designated time and it is thereby necessary for JEA to provide assistance, the Company shall be responsible for all costs incurred by JEA as a result of resolving the concern.

Upon JEA approval, the Company shall deliver fliers and/or door hangers provided by Project Outreach to all customers in an affected work area at least three days prior to each construction activity including, but not limited to, locates, TV/cleaning, soil borings, mobilization, etc. Upon JEA's request, the contractor will install JEA provided signage at a location chosen by the JEA project team. These signs will be removed by the contractor at the end of the project.

The Company shall notify affected customers prior to any planned water/electric outages, line flushing, valve simulations and driveway/curb construction, paving and road closures. The notification will be produced by the Company (unless notifications are provided by JEA) and approved by JEA Project Outreach.

Customer Concerns:
The CSR shall contact the JEA customer who has a concern by the end of the business day of when the concern was received from JEA Project Outreach. The Company shall contact Project Outreach within two business days to confirm that they have contacted the customer and assessed the concern.

The CSR shall provide JEA Project Outreach with concern evaluations, resolutions, and actions taken all within five business days of when the concern was received.

The CSR shall notify Project Outreach immediately after a concern has been resolved with specific resolution actions or an update of the resolution. Project Outreach will contact the customer following notification of resolution to confirm the resolution before Project Outreach closes the concern and prior to notifying the Company, the CSR, JEA Representatives and inspectors of resolution of the concern.

Within one business day of receiving a concern from a JEA customer, the Company shall notify JEA Project Outreach in writing of each customer concern reported directly to the Company's personnel by any JEA customer. Such notification shall include, as a minimum: the Company's name, date and time the concern was communicated to the Company, the name, address and phone numbers for the customer, the nature of their concern and any action that was taken or any action currently underway to resolve the concern. The CSR shall follow the customer concern procedures stated above.

If the Company fails to meet the problem resolution deadlines stated in this document in a manner that meets acceptable quality standards, JEA may make repairs or take other necessary actions to resolve the issue, which shall be at the Company's sole expense.

Duties of the Customer Service Representative (CSR)

The Company shall provide a Customer Service Representative for the Term of the Contract. The CSR's primary responsibilities shall include, but are not limited to the following:

Communication: Serve as the primary point of contact for customer concerns and information requests; report customer concerns to the JEA Project Manager and Project Outreach or other internal JEA resources and assist in resolution of issues; and meet with customers on site as needed to assess their concerns.

Planning: Conduct biweekly progress meetings with JEA Project Manager; conduct progress meetings with Project Outreach regularly and as needed to review any outstanding complaints and provide a timeframe/action plan for resolving them; review customer satisfaction targets and goals, measurements, documentation and project definition and assist with making improvements; conduct periodic customer service reviews during the course of the Work to assess and identify any items considered to be at risk or vulnerable in relationship to meeting JEA goals and objectives; and notify Project Outreach, in a timely manner, of change in scope or schedule.

Process Improvement: Work with JEA to identify process improvement opportunities that increase customer service and satisfaction; make recommendations to JEA to enhance and assist with JEA goals and objectives for customer service; and conduct a customer service review at the completion of the construction phase of a project, but prior to the restoration, or "punch list" phase, to assess customers' satisfaction with the handling of concerns and customers' overall response to the project.

Disruption of Utility Services: If the Company disrupts any utility services (water, sewer or electric, etc.) during performance of the Work, the Company shall return them to operation as soon as possible. No disruption to any utility service disruption shall exceed the end of the Company's normal work shift. No disruption to the customer's utility services shall exceed any 12-hour period. Should any of the customer's utility services be disrupted, for a period longer than 12 hours, the Company shall provide alternative arrangements for the customer, as determined by JEA, with no additional cost to JEA for these arrangements unless otherwise specified in the documents. The CSR shall immediately notify JEA Project Outreach (telephone 665-7500) of any service disruptions.

Restoration:
The Company shall restore, for no additional compensation, the landscaping of any properties affected by the Company's actions, directly or indirectly, (in the right-of-way not related to ongoing Work, or isolated Work in the

right-of-way that would leave unrestored areas for undue periods of time subject to criticism) to its original state, within five calendar days from the time the area was disrupted. All other restoration required within the right-of-way shall be scheduled in the customary method for such construction and in accordance with any permit conditions.

The Company shall, at its own expense (unless otherwise specified in the documents), repair any irrigation systems damaged by the Company's Work within one day from the time the irrigation system was damaged. If this is not possible, the Company shall inform the customer of the damage and provide an estimated time for repair. In addition, the Company shall make adequate provisions for the customer to water and maintain his or her lawn.

The Company shall repair, at its own expense, any asphalt and concrete damaged by Company (in the right-of-way not related to ongoing Work, or isolated Work within the right-of-way that would leave unrestored areas for undue periods of time subject to residents/customer criticism) within five calendar days from the time the damage occurred. All other restoration required within the right-of-way shall be scheduled in the customary method for such construction and in accordance with any permit conditions.

Customer Concern Ratios:
Project Outreach's goal for customer concerns is to completely resolve all complaints within 10 business days of receiving a complaint. A formal customer concern shall be defined as a documented concern to JEA Project Outreach. The concern may be of a real or perceived problem that the customer has against the Company.

The JEA Project Manager or designee will notify the Company on a monthly basis of how many concerns were received by JEA's Project Outreach and the number of concerns yet to be resolved. JEA will immediately notify the Company when a concern has been opened and has not been a response to it within five business days. The Company shall contact Project Outreach and provide a written correction plan within five calendar days of receipt of the notice. If at any time the Company allows unresolved concerns to exceed the five business days without prior notification to Project Outreach and the customer concern ratio reaches 3.0 percent, the Company shall be required to appear in front of the Company Performance Review Board to explain the circumstances leading to the unresolved concern. The Company Performance Review Board will notify the Chief Procurement Officer of the board's decision and any recommended actions, which may include, but are not limited to, additional remedial action, termination of the Contract and/or suspension from JEA's Responsible Bidder's List in all categories for a period not to exceed one year.

If the Company fails to adhere to the customer service requirements stated herein, the Company's performance shall result in a required hearing before the Company Performance Review Board. The Company Performance Review Board will consist of three JEA directors. The hearing will evaluate the Company's remedial action plan and determine whether such plan will be effective. The Company Performance Review Board will present its recommendation to the Chief Procurement Officer and recommended actions that may include additional remedial actions, termination of the Contract and/or suspension from JEA's Responsible Bidder's List in all categories for a period not to exceed one year.

2.13.32. VIDEO/DIGITAL RECORDS

Prior to any alterations to the Work Location, the Company shall video record the entire Work Location. The Company shall provide original video recording to the Contract Administrator no later than 15 days after the date of the Notice to Proceed.

When required by the technical specifications, the Company shall provide a monthly video record (on DVD) of construction progress to the JEA Project Manager. If construction is being conducted in different localities, then video shall be taken at each Work Location. The JEA Project Manager reserves the right to select the views to be

video recorded. DVD(s) shall be labeled with record of date taken, JEA's assigned project tracking number, and a brief description of times and activity covered in the video.

The Company shall take the progress video(s) between the 20th and 25th day of each month and submit the video(s) to the JEA Project Manager before the end of the 27th day of each month. If Company fails to submit the video(s) to the JEA Project Manager before the 28th day of each month, JEA reserves the right to have the video tape(s) taken by an independent Recording Company at the Company's expense.
In addition, the Company shall provide unedited video(s) with superimposed timer and vocal commentary of the preconstruction and post construction conditions. Video(s) shall be DVD format and include both sides of the right-of-way and record close attention to paved and unpaved driveways and walkways; conditions of lawns, shrubs, flowers, flower beds, and trees; conditions of pavement, fences, signs, planters and any other item within the area of the Work or adjacent right-of-way. The video(s) shall become a part of the Contract Administrator's and JEA Project Manager's permanent job records. The video(s) shall be indexed using the timer for locations by stationing and by street intersections.

The video(s) shall include each waterway crossing. An upstream and downstream view of each bank at the point of crossing shall be taken recording the inertial zone and/or mean high water level. Also, a view of the line route shall be taken from each bank of the crossing and elsewhere as the JEA Project Manager may direct. Construction shall not begin until video recordings are approved by the JEA Project Manager. The video(s) shall depict wet conditions of the Work Location and surrounding areas whenever possible.

2.13.33. WEATHER PROTECTION

The Company shall provide proper facilities, take all necessary precautions and assume the entire cost for protecting the Work against weather conditions and for handling all storm, flood and ground water, sewage, or other seepage, that may be encountered during the performance of the Contract. The Company shall provide for such contingencies and for carrying on the Work in freezing weather by methods that meet with the approval of the JEA Engineer. If the Company fails to provide such protection, or in the event of an emergency, JEA may provide such protection at the Company's expense.

2.13.34. WORK INFORMATION

In the event the Company requires additional information regarding the scope, technical specifications, Work Locations, personnel requirements, or other information pertinent to the Work or Contract, the Company shall request such information or clarifications from the Contract Administrator in writing. Within the bounds of the JEA Representative's authority, JEA Representatives may provide requested information to the Company.

2.13.35. WORK LOCATION CLEANLINESS

The Company shall, at all times, keep the Work Location free from an accumulation of waste materials or rubbish caused by its operations. At the completion of the Work, the Company shall remove all waste materials and any rubbish from and about the project, as well as any tools, construction equipment, machinery and surplus materials. If the Company fails to clean up at the completion of the Work, JEA may do so and charge the cost thereof to the Company.

2.13.36. WORKMANSHIP

The Company shall perform all Work in a safe and professional manner, so as to render a neat and uniform appearance. The Company shall handle all material in such a way as to preserve its finish and protective coatings from damage. General arrangement shall be in accordance with JEA Distribution Construction Standards and shall be satisfactory to the Contract Administrator.

2.13.37. COMPETENT PERFORMANCE OF THE WORK

The Company represents that it will conduct the Work in a manner and with sufficient labor, materials and equipment necessary to affect a diligent pursuance of the Work through Final Completion. If, in the sole opinion of JEA, the Company fails to perform the Work as represented, JEA may, at its sole discretion, take charge of the Work and furnish and provide the labor, materials, and equipment necessary to complete the Work as planned within the required time if JEA deems the organization of the Company or its management, or the manner in which Company is performing the Work, to be manifestly incompetent or inadequate to complete the Work as specified. The Company shall pay JEA for the cost of all such Work completed by JEA.

2.13.38. COMPLIANCE WITH REFERENCED SPECIFICATIONS

All Work, materials, systems or operations specified by reference to standard trade specifications or to manufacturer's published specifications shall comply with the requirements of the referenced specifications, except as modified by the requirements of the Contract Documents. The referenced specification used shall be the latest published edition that is in effect on the effective date of this Contract unless a particular edition is specified. In case of a conflict, the specifications that contain the more stringent requirements will govern.

2.13.39. COMPANY'S KNOWLEDGE OF THE WORK

The Company represents that its total Bid Price and the detailed schedule for the execution of the Work are based on its own knowledge and judgment of the conditions and hazards involved, and not upon any representation of JEA. JEA assumes no responsibility for any understanding or representation made by any of its representatives during or prior to execution of the Contract unless such understandings or representations are expressly stated in the Contract and the Contract expressly provides that JEA assumes the responsibility.

2.13.40. CONTRACTOR'S PLANS AND SPECIFICATIONS

All plans and specifications that the Contractor provides for any building, structure, system or equipment where required by federal, state, local laws and regulation as part of the Work shall bear the seal of a professional engineer duly registered in the State of Florida at no cost to JEA.

2.14. STANDARD REQUIREMENTS FOR CONSTRUCTION

2.14.1. PROTECTION OF THE ENVIRONMENT

The Company and its Subcontractors shall comply with all applicable laws, rules and regulations including, but not limited to, all Environmental Regulations.

A. Asbestos, Lead, or Toxic Mold Notification:
Asbestos, Lead, or Toxic Mold may be present at the Work Location. The Company shall notify the Contract Administrator immediately upon discovery of asbestos, lead, toxic mold. The Company shall not disturb or remove known or discovered asbestos, lead, or toxic mold unless directed by the JEA Representative.

B. Hazardous Materials:
The Company shall bear full responsibility including, but not limited to, payment and liability for the transportation, use, recycling, and disposal of any Hazardous Materials under the Company's control during the performance of the Work. Disposal or recycling of Hazardous Materials shall only be performed at JEA approved facilities. The Company shall provide JEA with appropriate documentation showing proper disposal or recycling of its Hazardous Materials.

The Company shall notify the Contract Administrator in writing of the type, quantity and disposal or recycling method of any hazardous material used during the performance of the Work. The Company shall be solely

responsible for the use and disposal or recycling of any such materials. The Company shall submit cleanup procedures to the JEA Representative for review and written approval prior to the use of the hazardous material. In the event that a hazardous material escapes into the environment, the Company shall immediately notify the Contract Administrator in writing of the occurrence and the actions taken. In the event that the Company encounters hazardous materials in the course of construction, the Company shall immediately notify the Contract Administrator verbally, with a written notification to follow. The Contract Administrator shall arrange for disposal by JEA.

JEA has identified and labeled equipment known to contain PCBs. JEA will remove and transport any equipment so identified. The Company shall not remove or transport any equipment containing PCBs. The Company shall immediately notify the JEA Representative of any questionable or unmarked equipment, and the JEA Representative will arrange for testing and identification.

C. Waste Management:
The Company will be solely responsible for the proper management of all waste material, including but not limited to, paints, lubricants, fuels, solvents, drilling mud and materials, construction and demolition debris, used oil and oily waste, land clearing debris, universal waste (mercury containing lamps and devices, batteries, etc.) and other chemicals and hazardous materials used in connection with or generated during the Work, except as specified above. The Company will provide proper containers for waste materials and comply with all applicable laws, rules and regulations in their disposal or recycling. The Company will dispose of or recycle all empty containers off-site as soon as possible.

D. Wetlands:
The Company understands and agrees that the Work Location may include wetlands or other environmentally sensitive areas. The Company shall not enter these areas during the performance of its Work, unless specifically authorized by the Contract Administrator and appropriate state and federal permits have been obtained.

E. Wildlife:
The Company and/or Subcontractor's employees shall not endanger wildlife species or domestic animals of any kind.

F. Violation of Environmental Laws and Permits:
The Company shall immediately cease any activity that causes or results in a violation of JEA's or Company's environmental permits or federal, state and local laws and regulations. Such violation shall immediately be reported to the Contract Administrator verbally, with written notification to follow. All additional costs due to the Company's noncompliance with the applicable environmental permits or Environmental Regulations shall be paid by the Company.

2.14.2. NPDES PERMIT CONFORMANCE

The Company shall obtain all other applicable local, state, and federal permits. It is unlawful to have any discharges that are not composed entirely of stormwater (except discharges pursuant to a NPDES permit) to the municipal separate stormwater system (MS4). Only non-contaminated water/non-turbid water shall be transported through the MS4. Groundwater discharge (approved by JEA) from dewatering activities may be routed into the stormwater system providing that erosion, and transportation of suspended solids to the system is prevented. If contaminated soil or contaminated groundwater is encountered, the dewatering activity shall cease immediately, and the Company shall contact the Florida Department of Environmental Protection and notify the appropriate department of the incident immediately.

2.14.3. NPDES PERMIT CONFORMANCE - DEWATERING

If Company encounters groundwater, the Company shall be responsible for obtaining; a *Generic Permit for Discharge of Produced Ground Water From any Non-Contaminated Site Activity* from the Florida Department of Environmental Protection (FDEP), and a *Noticed General Permit for Short-term Construction Dewatering* from the St. Johns River Water Management District (SJRWMD) before any dewatering activities can begin.

Company shall also be responsible for developing and utilizing a dewatering system(s) to remove water from the excavations. Prior to beginning any dewatering, the Company shall submit a dewatering plan to JEA for review. The Company shall comply with all sampling requirements listed in FDEP regulation (62-621.300(2) F.A.C.) before any dewatering can begin. The Company shall submit to JEA the sampling analysis results. In the event the sample analysis fails to meet FDEP water quality standards as established in applicable rule, the Company shall not proceed with further permitting or dewatering activities, shall notify JEA of any failure to meet applicable standards, requirements, or rules, and shall await instruction from JEA.

The dewatering plan developed by the Company shall further consider the dewatering volume as estimated using traditional and customary methods. The dewatering plan shall comply with the requirements of 40C-2 and 40C-22, F.A.C., and additional requirements as may be mandated or amended by SJRWMD. In the event the dewatering plan does not comply with those requirements applicable to the *Noticed General Permit for Short-term Construction Dewatering* the Company shall not proceed with further permitting or dewatering activities, shall notify JEA of any failure to meet applicable standards, requirements, or rules, and shall await instruction from JEA.

If the above requirements are not followed, the Company shall be held liable for any fines and/or violations incurred by JEA.

2.14.4. NPDES PERMIT CONFORMANCE - STORMWATER POLLUTION PREVENTION

The Company shall obtain as necessary a *Generic Permit for Stormwater Discharge from Large and Small Construction Activities (CGP),* and shall develop a Stormwater Pollution Prevention Plan (SWPPP) compliant with local, state, and federal rules, laws, and ordinances. Company shall be responsible for implementing the SWPPP, installing and maintaining in a functional manner structural and nonstructural best management practices as described therein, evaluating the effectiveness of the best management practices, and employing additional performance based best management practices as may be deemed necessary by JEA. The Company, at its own expense, shall revise, or include as addendum to the SWPPP measures as maybe required by a local, state, or federal authority to remain compliant with local, state, and federal rules, laws, and ordinances.

No additional payments shall be made to Company for revisions or addendums to the SWPPP,

Or for the actual implementation of those revisions on the Work site, including those made so as to achieve functional performance based best management practices.

The Company shall obtain all other applicable local, state, and federal permits subsequent to notification of JEA of the need for such authorization(s). It is unlawful to have any discharges that are not composed entirely of stormwater (except discharges pursuant to a NPDES permit) to the Municipal Separate Stormwater System (MS4). Only non-contaminated water/non-turbid water shall be transported through the MS4. Groundwater discharge (approved by the FDEP pursuant to 62-621.300(2)) from dewatering activities may be routed into the stormwater system, drainage ditch, creek, river or wetland providing that erosion, and transportation of suspended solids to the system is prevented. If contaminated soil or contaminated groundwater is encountered, the dewatering activity shall cease immediately, and the Company shall contact JEAs Environmental Coordinator, Andrew Sears at (904) 665-7719.

All contractors conducting land disturbing activities shall have at least one corporate representative that is certified for the Florida Department of Environmental Protection Erosion and Sediment Control Inspector Training Manual.

For projects with greater than one acre of disturbed land, a person certified pursuant to the Florida Department of Environmental Protections Erosion and Sediment Control Inspector Training Manual or trained by a certified person shall make the routine inspections shall be maintained and kept on the construction site and made available for inspection during land-disturbing activities. Such inspection shall be made no led that daily and alog of such inspections shall be maintained and kept on the construction site and made available for inspection by City and JEA inspectors throughout the duration of land-disturbing activities. If the inspector is trained by a certified person but not certified themselves, accurate training records must be kept and evidence of annual refresher trainer shall be maintained.

Any required erosion and sediment control plans submitted to the City of Jacksonville must conform to the requirements in the FDEPs Florida Department of Environmental Protections Erosion and Sediment Control Inspector Training Manual or the provisions contained in the Land Development Procedures Manual, whichever

Upon approval to proceed to do so by the Owner, the Company shall complete a *Notice of Termination (NOT)* (DEP Doc. No. 62-621.300(6), F.A.C.), to terminate the CGP coverage within one (1) week of final site stabilization.

If the above requirements are not followed, the Company shall be held liable for any fines and/or violations incurred by JEA.

2.14.5. PREVENTION, CONTROL AND ABATEMENT OF EROSION AND SILTATION

The Company shall take steps and make suitable provisions to minimize siltation and erosion of waterways that may result from its operation during the course of construction.

The Company shall make suitable arrangements, which may require the temporary construction of flumes, boxes, or some other device(s), at the Work Location for the drainage and disposal of water. The Company shall be responsible for protecting adjacent property to the Work Location from damage by water resulting from its operations. The Work Location shall be returned to its original condition to the satisfaction of JEA.

The Company is cautioned that execution or maintenance that creates turbidity and that directly or indirectly affects the water quality of any waterway into which storm water is discharged in such a manner as to exceed the limitations prescribed in the Florida Administrative Code, is a violation of the water quality standards of the State of Florida.

Turbidity shall not exceed 29 NTU's, above background level within 100' of the construction activity. Costs incurred by the Company for compliance to the restrictions outlined above shall be included in the cost of the items for which the turbidity control is required, unless a separate line item is included in the Bid Document for turbidity control. Silt barriers shall be used at all waterway crossings or at any time during construction that siltation or erosion may occur. The Company shall submit to the JEA Engineer, for written approval prior to construction, the method to be used to control the turbidity. The JEA Engineer's approval of the method to be used in no way relieves the Company of the liability in case of a citation against JEA.

2.14.6. SILT FENCE ASSEMBLY

The Company shall furnish and install silt fence assembly (including fabric, stakes, etc.) in accordance with the details shown on the Erosion Control Drawings and as required by the Storm Water Pollution Prevention Plan (SWPPP). Company will be responsible for all costs associated with silt fence assembly. There will not be a separate line item for silt fence assembly on the Bid Form.

2.14.7. DRAINAGE ALONG RIGHTS-OF-WAY

The Company shall so conduct its operations and maintain the Work in such condition that adequate drainage shall be in effect at all times. The Company shall not obstruct existing gutters, ditches and other runoff facilities.

2.14.8. FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP) CERTIFICATION OF COMPLETION

Following satisfactory bacteriological clearance, installation and testing of the piping systems or mains installed under the Contract, the Company shall submit to the Contract Administrator Company-certified, as-built drawings of sufficient detail and accuracy to allow application to FDEP in accordance with the provisions set herein for Certification of Completion. This Certification of Completion must be obtained prior to making final tie-ins and/or service transfers or connections. The Company shall schedule its Work to allow sufficient time for processing the Certificate of Completion. The submittal of as-built drawings in order to obtain the FDEP Certificate of Completion does not relieve the Company of the requirement to submit final as-built drawings as specified in the Contract Documents.

2.14.9. HAND DIGGING AROUND TREES, TREE TRIMMING, ARBORIST SERVICES AND TREE REMOVAL

No separate measurement and payment shall be made for hand digging around trees, tree trimming, and provision of arborist services, but all cost shall be included in the associated item of work in the bid form. Hand digging, tree trimming, and arborist services shall include but not be limited to all labor, equipment and supervision required to successfully hand dig or trim tree branches where tree roots or branches may be destroyed or injured due to the Work. Item shall include services of a certified arborist as required by the City landscape architect to ensure minimal or no damage to tree canopy or root system. If the tree canopy or root system is damaged, the Company, at its own expense, shall repair, restore, or replace the tree at the direction of the arborist. The Company shall review the drawings and visit the Work area prior to the bid to satisfy itself as to the amount of tree removal and disposal to be performed to complete the Work, and the extent of tree trimming required to perform the work. All tree mitigation costs shall be borne by the City of Jacksonville. Trees identified on the drawings for removal shall not be paid for separately, but all associated cost for removal and disposal and subsequent compacted soil backfill replacement shall be included in the associated item of the work.

2.14.10. APPLICABLE WATER AND SEWER STANDARDS, DETAILS AND MATERIALS

All Work shall be done in accordance with the latest version JEA Water and Sewer Standards, Details and Materials. The JEA Water and Sewer Standards, Details and Materials manual may be obtained from jea.com.

2.14.11. INTERRUPTION OF SERVICE

The Company shall not operate any valves, nor otherwise interrupt water and/or sewer service, without first obtaining permission from the JEA Engineer. The JEA Representative shall be present during any interruption of service.

If the Company must shut down a main or portion of a main, thereby causing an interruption of water service, the Company shall provide the JEA Engineer with the following information, in writing, a minimum of four days in advance of any anticipated interruption of service:

- Date and time of outage.
- Purpose of the outage.
- Map of the area to be affected by the outage.
- Letter stating all offices, businesses, and residents have been or will be notified by Company at least four days in advance of the outage (unless JEA chooses to issue such notification).

The Company is not authorized to proceed with requested Work without prior written notice from JEA Engineer that such actions are approved.
In the event of a major emergency that endangers life or property, the Company may take immediate action before notifying JEA. In all cases, however, JEA shall be notified in writing at the earliest opportunity after addressing the emergency.

2.14.12. MAILBOXES

The Company shall carefully remove and relocate mailboxes affected by construction operations to allow for uninterrupted mail service. All temporarily relocated mailboxes shall be reinstalled permanently as soon as construction operations allow. The condition of the reinstalled mailboxes shall be at least equal to the original facility, as directed by JEA. Company shall be responsible for removal, relocation or reinstallation of mailboxes. There will not be a separate line item for Mailbox removal, relocation or reinstallation on the Bid Form.

2.14.13. METERS

The Company shall pay all fees and charges required for connections to utilities, concurrency management, parking meter rental/removal and any other assessments imposed on the Work or initial occupancy of the Contract, except those specifically listed herein as provided by JEA.

2.14.14. SEWAGE SPILLS

The Company shall minimize the amount of sewage released into excavations by notifying affected parties of the service interruption, predraining affected lines, insuring pump station (non-)operating status, etc. The Company shall notify JEA immediately verbally, with written notification to follow.

The Company shall take precautions to prevent sewage from contacting the ground. If sewage contacts the ground, the Company shall take appropriate measures to disinfect the area of the sewage release. If pooling sewage is observed, the Company shall vacuum remove the sewage, or remove the sewage by other means acceptable to the JEA Representative, and dispose of the sewage in accordance with environmental and public health regulations. The Company shall clear any sanitary systems found plugged due to this type of pumping activity at its own expense.

2.14.15. SUBSURFACE INVESTIGATION

A geotechnical exploration of existing conditions including soft digs where necessary in the general area of the proposed Work has been performed and a report of the findings and recommendations are attached

2.14.16. SURVEYING

Unless specifically stated in the Contract Documents as being provided by JEA, the Company shall be responsible for all surveying necessary to commence and perform this Work. The Company shall employ a land surveyor registered in the State of Florida to reference and restore all property corners and/or monuments that may have been disturbed and to ensure accurate horizontal and vertical control during the construction of this project and for staking locations for new structures. Height and spacing of stakes to be as specified elsewhere herein or as directed by JEA Engineer.

All Work shall be done to the lines, grades and elevations shown on the drawings. Any Work improperly located may be ordered removed and replaced at the Company's expense. The Company shall be responsible for making its own determination of water table variations and shall not assume that any water levels shown by the aforesaid boring data will necessarily be maintained at the level indicated. The Company shall investigate the conditions above or below the surface of the ground as it may deem necessary for the proper and timely performance of its Work including, but not limited to, the making of borings.

2.14.17. TEMPORARY ROADWAYS

If the Company's operations render any street or private way unsafe, the Company shall make such repairs or provide such temporary ways and guards necessary for the protection and safety of JEA's and the Company's employees and subcontractors, and the public, and for the orderly maintenance of traffic.

The Company shall always provide and maintain a hard-surfaced roadway for traffic. Where temporary detours of lanes are required, they shall be asphalt-paved by the Company. The Company may construct paving section(s) appropriate to support traffic, provided the surface is smooth and the profile reasonable, and as a minimum, consists of 1 inch of bituminous structural course over a 6-inch limerock base that was inspected and approved by the JEA Engineer. Should any temporary pavement fail, the Company shall be responsible for repairing it, at its own cost, before close of Work on the day notification is given. Should the Company be unable to make such repair by close of Work, the Company shall notify the Contract Administrator and provide an estimated time when repairs can be made. No repair timeframes shall exceed 48 hours. Any damages, either direct or indirect, resulting from such temporary pavement failures shall be the sole liability of the Company.

All limerock base material used for temporary pavement and constructed in proposed grassed areas shall be completely removed and disposed of by the Company prior to final restorative grassing operations. The area shall be backfilled with material stockpiled on the Work Location that is conducive to growth of the plant material. All costs associated with this work shall be included in the cost for the associated item of work.

2.14.18. BYPASS PUMPING

The Company shall provide all necessary labor, materials and equipment to maintain the uninterrupted sewer service of laterals, mains, trunks, force mains and pump stations at all times. The manner in which this is accomplished shall be left to the discretion of the Company, subject to the requirements of the Contract and the prior approval of the JEA Engineer. The JEA Engineer's approval in no way relieves the Company of any liabilities resulting from the bypass method chosen.

The Company shall not allow any sewage, at any time, to be pumped into any drainage structure or to spill, puddle, or run upon any street, construction trench, public or private property.

The responsibility for coordinating the need, length of time, method, and suction and discharge locations for bypass pumping shall be the responsibility of the Company subject to approval by the JEA Engineer.

2.14.19. TRAFFIC SIGNAGE

Costs incurred by the Company to provide new signage and pavement markers, or remove and replace existing signage as necessary to accomplish the work shall not be paid for separately but shall be merged with the cost of the associated item of work. Damaged signage shall be replaced with new signage. All signage and pavement markers in accordance with the drawings and City Traffic Engineer's requirements.

2.14.20. TREE PROTECTION

The Company shall protect all trees, in accordance with applicable city and county laws, from damage by vehicles, equipment and machinery, except those trees designated for removal on the construction drawings and for which the Company shall be responsible for obtaining all required approvals and permits. Removal of any tree not so designated nor permitted, shall be only upon specific approval by the JEA Engineer.

Excavated dirt shall not be piled around the base of any tree not designated for removal. The Company shall not bury or burn any refuse around or near the trees. The Company shall proceed with caution when excavating in the vicinity of root structure of any tree. Excavation shall be by hand if necessary.
Roots up to 2" in diameter when severed do not require any pruning paint. Roots from 2" to 4" in diameter must be severed with a pruning saw and painted. Roots over 4" shall not be severed except as directed by the JEA Engineer.

An ax or similar tool is not acceptable for pruning. The wood shall be treated with asphalt-type pruning paint as soon as possible after pruning.

Prior to any site disturbance, barriers shall be put up around each tree to be protected. These barriers shall be constructed of 2 x 4's or any other practical materials that will discourage disturbance near the tree. To conform to applicable city and county laws and codes, these barriers should be at least 6' away from the trunk of the tree and protect an area that is at least 50% of the unpaved area covered by the crown spread of the tree. When conditions permit, barriers are to be placed in such a manner as to provide the largest undisturbed area possible.

Cutting tree roots shall be kept to a minimum and only allowed when absolutely necessary. In such instances the Company shall ensure that all cuts are made clean with a saw, free of all loose soil, and sealed with pruning paint or shellac. At no time shall roots be pulled, ripped or cut with a blade, backhoe or other mechanical device. Additional fill under the crown spread of trees shall be kept to a minimum. If additional fill is unavoidable, all fill material shall consist of clean, coarse sand or gravel, free of silt and clay to allow for free movement of air and water. Lowering the grade under the crown spread of trees will not be permitted.

Should branches require pruning to provide for roadway or other necessary clearance, they shall be cut back to a main stem or crotch of the tree. All cuts shall be made at the bench collar to allow the natural healing process of the tree to occur. To further promote the natural healing process, no pruning paint or other material shall be applied to pruning cuts.

If a tree is wounded during construction, all bark surrounding the wound shall be cut away and carefully removed. Care shall be taken to leave as much cambium as possible.

Any tree whose root system has been disturbed or damaged must be properly fertilized to aid in its recovery. The hole or punch-bar method shall be used for applying fertilizer. The holes should be approximately 12" to 18" deep, 1" to 2" in diameter, 2' apart, and extend 2' past the drip line of the tree. The Company shall not apply fertilizer within 1 foot of the trunk of a small tree (up to 6" in diameter) or within 3' of the trunk of a large tree (over 6" in diameter). Injury to the root collar and trunk base may result. The type of fertilizer to be used shall be 25% organic 8-8-8 with minor elements included. Chemical analysis as follows: Total Nitrogen, not less than 8.00%, available Phosphoric Acid, not less than 8.00%, water soluble potash, not less than 8.00%. Fertilizer shall be applied at the following rates and shall be evenly distributed among the holes:

Hardwoods up to 6" Dia. 2 lb. per inch of Dia.
Hardwoods over 6" Dia. 4 lb. per inch of Dia.
Evergreens up to 6" Dia. 1 lb. per inch of Dia.
Evergreens over 6" Dia. 2 lb. per inch of Dia.

2.14.21. CONSTRUCTION PARKING

No Company employee vehicular parking will be allowed within the construction footprint. All parking will be offsite. Company shall be responsible for ferrying its employees to and from the Work Location. This will reduce the number of complaints associated with number of vehicles clogging roadways and ruts associated with offstreet parking, as well as provide additional ingress/egress corridor for required construction vehicles.

2.15. VENDOR PERFORMANCE EVALUATION

2.15.1. VENDOR PERFORMANCE EVALUATION

Use of Vendor Performance Evaluation Scorecards

JEA may evaluate the Company's performance using the evaluation criteria shown on the vendor scorecard available online at JEA.com.

Scores for all metrics shown on the evaluation range from a low of 1, meaning significantly deficient performance, to a high of 5, meaning exceptionally good performance. The Company's performance shall be classified as Top Performance, Acceptable Performance, or Unacceptable Performance, as defined herein. The evaluator will be a designated JEA employee. The evaluator's supervisor and the Chief Purchasing Officer will review deficient performance letters and Unacceptable Performance scorecards, as described below, prior to issuance. When evaluating the Company's performance, JEA will consider the performance of the Company's Subcontractors and suppliers, as part of the Company's performance.

Frequency of Evaluations

JEA may conduct performance evaluations and prepare scorecards in accordance with the procedures described herein at any time during performance of the Work or soon after the completion of the Work. JEA may conduct one or more evaluations determined solely at the discretion of JEA.

Unacceptable Performance

- If at any time, JEA determines, using the criteria described on the scorecard, that the performance of the Company is Unacceptable, the Contract Administrator and Chief Procurement Officer or his designated alternate will notify the Company of such in a letter. The Company shall have 10 days to respond to the Contract Administrator. Such response shall include, and preferably be delivered in-person by an officer of the Company, the specific actions that the Company will take to bring the Company's performance up to at least Acceptable Performance.
- Within 30 days from date of the first Unacceptable Performance letter, the Contract Administrator and Chief Purchasing Officer or his designated alternate will notify the Company by letter as to whether its performance, as determined solely by JEA, is meeting expectations, or is continuing to be Unacceptable. If the Company's performance is described in the letter as meeting expectations, no further remedial action is required by the Company, as long as Company's performance continues to be Acceptable.
- If the Company's performance as described in the letter continues to be Unacceptable, or is inconsistently Acceptable, then the Company shall have 15 days from date of second letter to demonstrate solely through its performance of the Work, that it has achieved Acceptable Performance. At the end of the 15-day period, JEA will prepare a scorecard documenting the Company's performance from the start of Work, or date of most recent scorecard, whichever is latest, and giving due consideration to improvements the Company has made in its performance, or has failed to make. If the scorecard shows Company's performance is Acceptable, then no further remedial action is required by Company as long as Company's performance remains Acceptable. If the scorecard shows the Company's performance is Unacceptable, JEA will take such actions as it deems appropriate including, but not limited to, terminating the Contract for breach, suspending the Company from bidding on any JEA related solicitations, and other remedies available in the JEA Purchasing Code and in law. Such action does not relieve the Company of its obligations under the Contract, nor does it preclude an earlier termination.
- In the event that the Contract Term or the remaining Term of the Contract does not allow for the completion of the deficient performance notification cycles described above for those in danger of

receiving an Unacceptable Performance scorecard, JEA may choose to accelerate these cycles at its sole discretion.

- If the Company receives five or more letters of deficiency within any 12 month period, then JEA will prepare a scorecard describing the deficiencies and the Company's performance will be scored as Unacceptable.

Acceptable Performance

JEA expects the Company's performance to be at a minimum Acceptable.

Disputes

In the event that the Company wants to dispute the results of its scorecard performance evaluation, the Company must submit a letter to the Chief Procurement Officer supplying supplemental information that it believes JEA failed to take into account when preparing the scorecard. Such letter, along with supplemental information, must be submitted no later than 10 days following the Company's receipt of the scorecard. If the Chief Procurement Officer decides to change the scorecard, the Company will be notified and a revised scorecard will be prepared, with a copy issued to the Company. If the Chief Procurement Officer decides that no change is warranted, the decision of the Chief Procurement Officer is final. If the Company is to be suspended from consideration for future Award of any contracts, the Company may appeal to the Procurement Appeals Board as per JEA Procurement Code.

Public Records

There can be no expectation of confidentiality of performance-related data in that all performance-related data is subject to disclosure pursuant to Florida Public Records Laws. All scorecards are the property of JEA.

2.16. JEA RESPONSIBILITIES

2.16.1. DENSITY TEST ALLOWANCE

JEA will provide funds as specified on the bid sheet to reimburse Company at cost for hiring one or more testing laboratory(ies) to perform all sampling, field testing and laboratory testing as specified herein, or as directed by the JEA Engineer. All testing is to be performed under the direct supervision of a registered geotechnical engineer paid for with the allowance. The testing allowance is to be used for first tests only. Any retesting due to failed first tests shall be at Company's expense. Company shall clearly mark on its invoices costs associated with testing services identifying the cost to Company of the testing service. Company agrees to invoice JEA for testing services at its cost with no markup.

2.16.2. ACCESS TO THE WORK LOCATIONS

JEA will provide, as indicated in the Contract Documents, and no later than the date when needed by the Company, access to the Work Location, including rights-of-way or access thereto, and such other lands that are designated for the Company's use. JEA will secure easements for permanent structures or permanent changes in existing facilities, unless otherwise specified in the Contract Documents.

2.17. CHANGES IN THE WORK, CONTRACT TIME OR PRICE

2.17.1. AMENDMENTS

This Contract may not be altered or amended except in writing, signed by JEA Chief Procurement Officer, or designee, and the Company Representative, or each of their duly authorized representatives.

2.17.2. FORCE MAJEURE

No party shall be liable for any default or delay in the performance of its obligations under this Contract due to an act of God or other event to the extent that: (a) the non-performing party is without fault in causing such default or delay; (b) such default or delay could not have been prevented by reasonable precautions; and (c) such default or delay could not have been reasonably circumvented by the non-performing party through the use of alternate sources, work-around plans or other means. Such causes include, but are not limited to: act of civil or military authority (including but not limited to courts or administrative agencies); acts of God; war; terrorist attacks; riot; insurrection; inability of JEA to secure approval, validation or sale of bonds; inability of JEA or the Company to obtain any required permits, licenses or zoning; blockades; embargoes; sabotage; epidemics; fires; hurricanes, tornados, floods; or strikes.

In the event of any delay resulting from such causes, the time for performance of each of the parties hereunder (including the payment of monies if such event actually prevents payment) shall be extended for a period of time reasonably necessary to overcome the effect of such delay, except as provided for elsewhere in the Contract Documents.

In the event of any delay or nonperformance resulting from such causes, the party affected shall promptly notify the other in writing of the nature, cause, date of commencement and the anticipated impact of such delay or nonperformance. Such written notice, including Change Orders, shall indicate the extent, if any, to which it is anticipated that any delivery or completion dates will be thereby affected within seven (7) calendar days.

2.17.3. EFFECTIVENESS OF CHANGE ORDER

Any change in the Contract resulting from the RFI will be incorporated into the Contract through the use of a Change Order, Supplemental Work Authorization or Purchase Order. Whether requested by the Company, claimed by the Company, or contemplated by JEA, no change shall be authorized and effective unless made through an approved Supplemental Work Authorization (SWA) or on a JEA Change Order signed by the Contract Administrator or through a formal written amendment to this Contract. All Work defined on Change Orders shall be subject to the conditions of the Contract, unless specifically noted on the Change Order.

2.17.4. INITIATION OF A CHANGE BY COMPANY

To request any change in the Work including, but not limited to, changes in scope, quantities, price, or schedule, the Company shall submit a written request in the form of a Request for Information ("RFI") to the JEA Representative within ten (10) working days of the date that the event that prompted the change was discovered or should have been discovered. The RFI shall contain sufficient information regarding the nature of the requested change, including an itemized estimate of cost, either positive or negative, in relation to the change, and any effect on contract time which is related to the changed condition, and work descriptions and other information necessary to evaluate the merits of the change. The JEA Representative may reject RFI's which do not provide sufficient supporting information. Upon receipt of the Company's RFI, the JEA Representative will provide written direction as to the procedures that will be used to address the request. JEA shall have the right to approve or disapprove any RFI, request or claim for change as it deems necessary and in its best interests consistent with the other Contract requirements. Where JEA and the Company are unable to reach a mutually acceptable resolution for the RFI, JEA will make a commercially reasonable determination, made in accordance with JEA's Procurement Code, which shall be final.

2.17.5. INITIATION OF A CHANGE BY JEA

When it is in JEA's best interest, the JEA Representative may request that the Company provide pricing information to accommodate a requested change in the Work, including a change to the scope of Work, quantity, schedule or completion date. Upon the written request by JEA, the Company shall submit a cost estimate, including all pricing elements requested by JEA. The Company shall not proceed with any changes to the Work until such change is authorized in writing.

2.17.6. NO DAMAGE FOR DELAY

Damage, loss, expense or delay incurred or experienced by the Company in the prosecution of the Work by reason of unforeseen circumstances, unanticipated difficulties and obstructions, bad weather, or other mischances that are generally considered to be a part of the usual hazards associated with Work, shall be borne entirely by the Company and shall not be the subject of any claim for additional compensation or change in Approved Schedule.

The Company agrees that its sole remedy for any claims, damages or losses related to any delay, disruption or hindrance alleged to be caused by JEA or any of JEA's agents or other contractors, shall be an extension of the Contract completion date.

Any demand for equitable time adjustment must be served in writing to JEA within five days of the event giving rise to the delay, disruption or hindrance. Any request for an equitable time adjustment shall be accompanied by a logical time impact analysis, demonstrating the nature and magnitude of the event to the critical path.

Failure to strictly comply with these requirements shall be deemed a waiver of any right to seek equitable time adjustment.

In the event the "no damage for delay" clause is inapplicable, there shall be no recovery for home office overhead and any damages claimed shall be proven by discreet accounting of direct project costs and no theoretical formula or industry estimating reference manuals shall be permissible.

2.17.7. QUANTITIES

Where the total Bid Price was based on estimated quantities, prior to making final payment, JEA will determine actual quantities using sampling, surveying and other industry recognized means and prepare a Change Order adjusting the Contract Price to reflect actual volumes.

The Company shall immediately notify the JEA Contract Administrator in writing of any unauthorized change in the scope of the Work or significant change in the quantities of the Work that may increase the Contract Price, require an extension of Work schedule, or negatively impact permitting or other regulatory requirements

2.17.8. USE OF THE SUPPLEMENTAL WORK AUTHORIZATION (SWA)

The JEA Representative will issue a written SWA to incorporate cost or schedule changes into the Contract. Issuance of an SWA is solely at the discretion of the JEA Representative. The SWA shall be used for increases or decreases in the Contract price, within the SWA amount set forth in the Bid, or to make changes in schedule for performance of the Work. An SWA shall authorize the Company to perform changes in the Work. The Company shall not start on SWA work until the Company receives a fully authorized, written SWA form, signed by the appropriate JEA personnel - the Company shall not consider verbal statements as authorization to proceed with the changes. The Company should not expect that any SWAs will be issued. JEA shall have no obligation to pay for SWA work unless the same is performed pursuant to a written SWA form signed before the SWA work is commenced.

2.17.9. WHEN SWA EFFECTIVE

The Company shall not start on SWA work until the Company receives a fully authorized, written SWA form, signed by the appropriate JEA personnel. The Company shall not consider verbal statements as authorization to proceed with the changes. An SWA shall authorize the Company to perform changes in the Work. JEA shall have no obligation to pay for SWA work unless the same is performed pursuant to a written SWA form signed before the SWA work is commenced.

In determining costs for Work associated with any Change Order or an SWA, the following methods may be used:

1. Agreed Upon Lump Sum Method

a. The Company and the JEA Representative shall mutually agree to the pricing of a change order or an SWA. Any negotiated increase or decrease in the Contract Price shall be based on the Company's costs for labor, materials and supplies directly applicable to the increase or decrease plus 10% thereof for Company's supervision, overhead, bonds and profit. For any negotiated increase or decrease, the Company will provide a complete detailed breakdown for all labor, material, and equipment, etc. associated with the change. The detailed breakdown shall include applicable labor rates for all trades used, equipment rates, labor and equipment hours. A lump sum figure submitted with no breakdown will be returned to the Company without review.

b. Where the work is covered by established Unit Prices contained in the Contract, and JEA agrees that the Unit Price in the Contract is a fair and reasonable price, the Unit Price will be applied to the quantity of work. In the event that JEA does not agree that the Unit Price in the Contract is a fair and reasonable price, a negotiated price will be applied to the quantity of work at the discretion of the JEA.

2. Cost Reimbursable (Time and Materials) Method

a. Whenever the Company and the JEA are unable to agree on costs for an increase in the Work, JEA or JEA Representative shall order the Company to proceed with the Work on a cost reimbursable (time and material) basis. JEA will pay the Company for the SWA work in the manner hereinafter described, and the compensation thus provided shall constitute full payment for said work. JEA shall issue the SWA for the Company to perform the specific work with payment determined as follows:

b. For materials purchased by the Company and used in the work, the Company shall be paid the actual cost of such materials, including sales taxes if required, and freight and delivery charges as shown by original receipted bills. A mark-up amount equal to 10% of the sum thereof shall be added to this cost. JEA reserves the right to select and approve, or to reject the materials to be used and the sources of supply of any materials furnished by the Company.

c. The Company will be paid the cost of wages for all labor that is engaged in the Work, plus the actual cost chargeable to the Work for workers compensation insurance, social security taxes, unemployment compensation insurance and such additional amounts as are paid by the Company. A total mark-up shall be added equal to 10% of wages and other cost listed above. In evidence of the costs of labor the Company shall provide a certified statement of wages actually paid, together with copies of supporting payrolls. Wage rates used in determining the amount of the payment will be the actual wage rates paid by the Company for Work under this Contract, except that no rate used shall exceed the rate of comparable labor currently employed on the project.

d. Payment for the services of foremen in direct charge of the specific operation will be made. Payment for the service of superintendents, timekeepers or other overhead personnel will not be made nor will payment for the services of watchmen be made unless required specifically by the SWA Work. The actual function performed by an employee rather than its payroll title will be the criterion used in determining the eligibility of an employee's services for payment under this provision.

e. The types and amounts of equipment and machinery used by the Company in carrying out its work under the SWA shall be made in keeping with normal practice for work of similar nature. JEA may, at its discretion, limit by specific instruction the types and amounts of equipment and machinery to be used. For all equipment and machinery used in the SWA work, JEA will pay the lowest of the following options to which no mark-up percentages will be added (note that these options apply to rented or contractor owned equipment):
80% of the rental value as set forth in the Blue Book value, or

Actual cost, or

Current local equipment rental company quote as produced by JEA.

In computing the hourly rental of such equipment, the following applies:

The lowest calculated hourly equipment rental rate shall be used based on the duration that the equipment is at the site and/or the actual cost the Company is paying. For example, if the equipment used has been on the project for more than one month, then the hourly rate used shall be derived/calculated from the monthly equipment rate.

Less than 30 minutes shall be considered 1/2 hour except when the minimum rental time to be paid is one hour.

Rental time will not be allowed while equipment is inoperative due to breakdowns. The rental time of equipment to be paid for shall be the time the equipment is in operation on the SWA work being performed. The Company shall be reimbursed for the time required to move the equipment to the Work, and return it to its original location, only if the Company is charged this cost by the renting agency. Excess rental time of equipment due to inefficient work practices will not be reimbursed. Actual costs must be supported by invoices or other similar documentation provided by the Company.

f. No payment will be allowed for the use of small tools and minor items of equipment, which, as used herein, are defined as individual tools or pieces of equipment having a replacement value of $500.00 or less.

g. The Company and JEA Representative shall compare records of the Work performed on a Cost Reimbursable basis at the end of each day. These records shall be prepared by the Company and shall be signed by both JEA and the Company Representative. A copy of these records shall be submitted to JEA with the invoice for the work.

h. Payment for cost reimbursable SWA work will be included in monthly progress payments.

i. The Company's Subcontractors will be allowed a 10% mark-up on Work performed by their own forces. The Company will be allowed a 5% mark-up on the Subcontractor's costs (i.e. labor and materials) only, no mark-up on the Subcontractor's profit.

j. Subcontractor's costs in excess of fifty thousand dollars ($50,000) shall be justified for competitiveness through the submission of at least 3 bids or proposals for the work, or other cost justification satisfactory to JEA

2.17.10. CHANGES IN THE WORK

Changes in the Work, including changes to scope, quantities, price, schedule or completion date, may be authorized through Supplemental Work Authorizations or through a Change Order.

2.17.11. CHANGES TO WORK SCHEDULE OR TIME

The Work schedule and/or contract time may be changed by a Change Order, Purchase Order or SWA. The Company's request or claim for a Work schedule and/or contract time adjustment shall be in writing delivered to the Contract Administrator within ten (10) working days following the discovery of the event that prompted the claim or the date when the event should have been discovered. Where accepted by JEA, changes to Work schedule will only adjust for critical path impacts. Failure to include the necessary critical path analysis with the request shall be grounds for rejecting the claim. The critical path as used in this Section means the series of interdependent Work events that must be sequentially performed and that require a longer total time to perform than any other such series. Upon receipt of the Company's request for a change in the Work schedule, the Contract Administrator will provide any additional directions in writing detailing the procedures that will be used to resolve the request, including

provision of time impact or manpower and equipment loading schedules. Where JEA and the Company are unable to reach a mutually acceptable resolution of request, JEA will make a commercially reasonable determination, made in accordance with JEA's Procurement Code, which shall be final

2.18. MISCELLANEOUS PROVISIONS

2.18.1. AMBIGUOUS CONTRACT PROVISIONS

The parties agree that this Contract has been the subject of meaningful analysis and/or discussions of the specifications, terms and conditions contained in this Contract. Therefore, doubtful or ambiguous provisions, if any, contained in this Contract will not be construed against the party who physically prepared this Contract.

2.18.2. APPLICABLE STATE LAW; VENUE; SEVERABILITY

The rights, obligations and remedies of the parties as specified under the Contract will be interpreted and governed in all respects exclusively by the laws of the State of Florida without giving effect to the principles of conflicts of laws thereof. Should any provision of the Contract be determined by the courts to be illegal or in conflict with any law of the State of Florida, the validity of the remaining provisions will not be impaired. Litigation involving this Contract or any provision thereof shall take place in the State or Federal Courts located exclusively in Jacksonville, Duval County, Florida.

2.18.3. CUMULATIVE REMEDIES

Except as otherwise expressly provided in this Contract, all remedies provided for in this Contract shall be cumulative and in addition to and not in lieu of any other remedies available to either party at law, in equity or otherwise.

2.18.4. ENTIRE AGREEMENT

This Contract constitutes the entire agreement between the parties. No statement, representation, writing, understanding, or agreement made by either party, or any representative of either party, which are not expressed herein shall be binding. All changes to, additions to, modifications of, or amendment to this Contract, or any of the terms, provisions and conditions hereof, shall be binding only when in writing and signed by the authorized officer, agent or representative of each of the parties hereto.

2.18.5. EXPANDED DEFINITIONS

Unless otherwise specified, words importing the singular include the plural and vice versa and words importing gender include all genders. The term "including" means "including without limitation", and the terms "include", "includes" and "included" have similar meanings. Any reference in this Contract to any other agreement is deemed to include a reference to that other agreement, as amended, supplemented or restated from time to time. Any reference in the Contract to "all applicable laws, rules and regulations" means all federal, state and local laws, rules, regulations, ordinances, statutes, codes and practices.

2.18.6. HEADINGS

Headings appearing herein are inserted for convenience or reference only and shall in no way be construed to be interpretations of text.

2.18.7. INDEPENDENT CONTRACTOR

Company is performing this Contract as an independent contractor and nothing in this Contract will be deemed to constitute a partnership, joint venture, agency, or fiduciary relationship between JEA and Company. Neither Company nor JEA will be or become liable or bound by any representation, act, or omission of the other.

2.18.8. LANGUAGE AND MEASUREMENTS

All communication between the Company and JEA, including all documents, notes on drawings, and submissions required under the Contract, will be in the English language. Unless otherwise specified in the Contract, the US System of Measurements shall be used for quantity measurement. All instrumentation and equipment will be calibrated in US System of Measures.

2.18.9. MEETINGS AND PUBLIC HEARINGS

The Company will, upon request by JEA, attend all meetings and public hearings as required, in any capacity, as directed by JEA.

2.18.10. NEGOTIATED CONTRACT

Except as otherwise expressly provided, all provisions of this Contract shall be binding upon and shall inure to the benefit of the parties, their legal representatives, successors and assigns. The parties agree that they have had meaningful discussion and negotiation of the provisions, terms and conditions contained in this Contract. Therefore, doubtful or ambiguous provisions, if any, contained in the Contract shall not be construed against the party who physically prepared this Contract.

2.18.11. NONEXCLUSIVE

Notwithstanding anything contained herein that may appear to be the contrary, this Contract is "non-exclusive" and JEA reserves the right, in its sole discretion, to retain other companies to perform the Work, and/or JEA may self-perform the Work itself.

2.18.12. NONWAIVER

Failure by either party to insist upon strict performance of any of the provisions of the Contract will not release either party from any of its obligations under the Contract.

2.18.13. REFERENCES

Unless otherwise specified, each reference to a statute, ordinance, law, policy, procedure, process, document, drawing, or other informational material is deemed to be a reference to that item, as amended or supplemented from time to time. All referenced items shall have the enforcement ability as if they are fully incorporated herein.

2.18.14. SEVERABILITY

In the event that any provision of this Contract is found to be unenforceable under applicable law, the parties agree to replace such provision with a substitute provision that most nearly reflects the original intentions of the parties and is enforceable under applicable law, and the remainder of this Contract shall continue in full force and effect. With regard to any provision in this agreement pertaining to damages, equitable or otherwise, it is the intent of the Parties that under no circumstances shall there be recovery for home office overhead. Any damages claimed shall be proven by discreet accounting of direct project costs and no theoretical formula or industry estimating reference manuals shall be permissible.

2.18.15. SUBCONTRACTING OR ASSIGNING OF CONTRACT

Each party agrees that it shall not subcontract, assign, delegate, or otherwise dispose of the Contract, the duties to be performed under the Contract, or the monies to become due under the Contract without the other party's prior written consent.

The assignment of the Contract will not relieve either of the parties of any of its obligations until such obligations have been assumed in writing by the assignee. If the Contract is assigned by either of the parties, it will be binding

upon and will inure to the benefit of the permitted assignee. The Company shall be liable for all acts and omissions of its assignee or its Subcontractor.

In the event the Company obtains JEA approval to use Subcontractors, the Company is obligated to provide Subcontractors possessing the skills, certifications, registrations, licenses, training, tools, demeanor, motivation and attitude to successfully perform the work for which they are subcontracted. The Company is obligated to remove Subcontractors from performing Work under this Contract when the Company recognizes that a Subcontractor is failing to work in a manner consistent with the requirements of this Contract, or when JEA notifies the Company that JEA has determined a Subcontractor is failing to work in a manner consistent with the requirements of this Contract.

2.18.16. SURVIVAL

The obligations of JEA and the Company under this Contract that are not, by the express terms of this Contract, to be performed fully during the Term, shall survive the termination of this Contract.

2.18.17. TIME AND DATE

Unless otherwise specified, references to time of day or date mean the local time or date in Jacksonville, FL. If under this Contract any payment or calculation is to be made, or any other action is to be taken, on or as of a day that is not a regular business day for JEA, that payment or calculation is to be made, and that other action is to be taken, as applicable, on or as of the next day that is a regular business day. Where reference is made to day or days, it means calendar days. Where reference is made to workday, workdays, business day, or business days, it means regular working days for JEA Procurement.

2.18.18. TIME OF ESSENCE

For every material requirement of this Contract, time is of the essence.

2.18.19. TITLE TO MATERIALS FOUND

JEA shall retain the title to water, mineral matter, timber and any other materials that the Company, or its Subcontractors, encounters during the excavation or other operations of the Work. The Company shall use or dispose of this material in accordance with the Contract or written instructions from the Contract Administrator. Any materials found in the excavation, or other operations of the Company, that are of archaeological or historical value shall be left in place. The Company shall immediately notify JEA of the find and shall take no further action until directed by JEA.

2.18.20. USE OF JEA CONTRACTS BY THE CITY OF JACKSONVILLE

Where the City of Jacksonville's or its other independent agencies' or political subdivisions' procurement codes all use of JEA contracts, the Company agrees to extend any pricing and other contractual terms to such entities.

2.18.21. WAIVER OF CLAIMS

A delay or omission by JEA to exercise any right or power under this Contract shall not be construed to be a waiver thereof. A waiver by JEA under this Contract shall not be effective unless it is in writing and signed by the party granting the waiver. A waiver by a party of a right under or breach of, this Contract shall not be construed to operate as a waiver of any other or successive rights under, or breaches of, this Contract.

The Company's obligations to perform and complete the Work in accordance with the Contract shall be absolute. None of the following will constitute a waiver of any of JEA's rights under the Contract: approval of payments, including final payment; Certificate of Contract Completion; any use of the Work by JEA; nor any correction of faulty or defective work by JEA.

2.18.22. JEA PROJECT SECURITY PROGRAM

The JEA Project Security Program establishes a coordinated security program and assigns specific security responsibilities for which the Company and/or its Subcontractors shall be responsible at while performing services at existing JEA facilities and upon the substantial completion of new facilities. The programs objectives are 1) to direct all project security activities toward a single goal--no breaches, thefts or vandalism, and 2) to ensure effective coordination and communication of all project security activities with JEA Security.

In general, the Company shall provide on-site JEA security personnel at any time a JEA facility's perimeter is unsecured, including but not limited to, alarms disabled, fences or gates down, traffic flows that require gates to be opened repeatedly and/or for more than one hour of the work day. The Company shall schedule security personnel through JEA Security. Where existing lighting is disabled or otherwise impacted by the Work, the Company shall provide temporary lighting equal to or exceeding that which exists.

Further, the Company shall be responsible for complying with all applicable provisions of Chapter 12 "Security Program" of the JEA Contractor Safety Management Process Safety Requirements, a copy of which may be obtained upon request.

3. TECHNICAL SPECIFICATIONS/DETAILED SCOPE OF WORK

3.1. TECHNICAL SPECIFICATIONS/DETAILED SCOPE OF WORK (APPENDIX A)

Technical Specifications and a Detailed Scope of Work are located in Appendix A of this document.

4. FORMS

4.1. ADDITIONAL FORMS

- Appendix B Bid Form
- Appendix B List of Subcontractors Form
- Construction Drawings

OTTER RUN (WTP) RENEWAL AND REPLACEMENT

TECHNICAL SPECIFICATIONS

100% DOCUMENTS

APRIL 2017

Prepared By:

CPH, Inc.
5200 Belfort Road, Suite 220
Jacksonville, Florida 32256
Phone: 904-332-0999
CPH Project No. J6602

Roberto M. Gonzalez, FL PE #56875

Stephen E. Bailey PE #42461

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OTTER RUN WATER TREATMENT PLANT (WTP) UPGRADES
JEA Project No.
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April 2017

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

Summary of work, other contracts, work sequence, operation of existing facilities, use of premises, Owner furnished products and coordination.

1.02 SUMMARY OF WORK

A. The work to be performed under this Contact consists of the construction of the Otter Run WTP Renewal and Replacement project, which generally includes the following:

- Construct 0.1 million gallon prestressed concrete ground storage tank with aerator
- Construct three new high service pumps with variable frequency drives (provide spare 300gpm pump)
- Construct two new flowmeters, and associated conductivity meters and pressure transmitters at two existing wells.
- Construct high service pump building that includes four rooms (high service pump room, restroom, electrical room and NaOCl Pump Room)
- Construct new Sodium Hypochlorite Storage and Feed System
- New Diesel Engine Generator and Fuel Tank
- Construct new yard piping and valves
- Construct new above grade flow meter
- Demolition of existing 36,000 gallon and 30,000 gal steel ground storage tanks and aerator
- Demolition of the existing high service pumps and steel enclosure
- Demolition of the existing sodium hypochlorite system

- Demolition of the existing well valves associated piping
- All site preparation, clearing, grubbing, grading, site compaction, surveying, excavation, fill, dewatering, sodding, concrete sidewalks/drives, and restoration as necessary to complete the project.
- All other materials and appurtenances necessary for a complete and working system.

B. Furnish all materials, equipment, tools, and labor which is reasonably and properly inferable and necessary for the proper completion of the Work, whether specifically indicated in the Contract Documents or not.

C. All fees and permits for the permanent construction, which are required by controlling agencies or authorities, including fees for the review of Contract Documents prior to construction, will be procured by the OWNER. Other licenses or permits for construction facilities of a temporary nature which are necessary for the prosecution of the work shall be secured and paid for by the CONTRACTOR.

D. Repair, replace, or otherwise settle with the OWNER, if damage to property or existing facilities occurs, including damage to pavements, utilities, lawns, structures, etc.

E. Construct the Project under a Lump Sum Price Contract.

F. Contract Time: Contractor shall have no more than 240 calendar days to reach substantial completion including DEP clearance, as required, of the new pump building, reservoir and other WTP components. Upon acceptance of substantial completion of the WTP by Owner and Engineer, the Contractor shall have 60 days of additional calendar days to reach final completion. Final completion shall be within 300 days of Notice to Proceed.

1.03 WORK UNDER OTHER CONTRACTS – NOT USED

1.04 WORK SEQUENCE AND WORKING HOURS

The CONTRACTOR's sequence of work may be of his choosing and shall be coordinated with the OWNER and ENGINEER. Normal working hours for the project

shall be an eight (8) hour period between the hours of 8:00 a.m. – 7:00 p.m., Monday through Friday. Should the Contractor request of JEA to approve work periods greater than 8 hours a day, he shall make such requests in writing a minimum of 24 hours prior to such work periods.

The Contractor may be required to perform certain work at select locations along the route of construction at times of the day or night when vehicular traffic and pedestrian traffic is at diminished levels and at times appropriate to other activities which are occurring in the area of the project. The Contractor shall comply with requirements to alter his schedule of work as requested or required by JEA without change to the contract price or time.

1.05 OPERATION OF EXISTING FACILITIES

The project area will be closed to the public during construction. The CONTRACTOR shall coordinate all construction activities with the OWNER.

1.06 CONTRACTOR USE OF PREMISES

Confine operations at the site to areas permitted by applicable laws, ordinances, permits, and by the Contract Documents. Do not unreasonably encumber the site with materials or equipment. Do not load structures with weight that will endanger the structure. The CONTRACTOR shall assume full responsibility for protection and safekeeping of products stored on the job site.

1.07 OWNER FURNISHED PRODUCTS – NOT USED

1.08 COORDINATION

A. The CONTRACTOR shall be fully responsible for the coordination of his work and the work of his employees, subcontractors, and suppliers and to assure compliance with schedules.

B. The coordination requirements of this Section are in addition to the requirements in JEA's Solicitation Documents.

C. It is the CONTRACTOR's responsibility to coordinate with all the utilities regarding locates, protection of existing facilities, testing, or relocations.

1.09 DRAWINGS AND PROJECT MANUAL

A. The Work shall be performed in accordance with the Drawings and Specifications prepared by CPH, Inc.

B. In all cases where notes, specifications, sketches, diagrams, details or schedules in the Specifications or in the Drawings, or between the Specifications and the Drawings conflict, the higher cost requirement shall be furnished by the Contractor, unless otherwise directed by Engineer.

C. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the Engineer, and shall notify same, in writing, of all errors, omissions, conflicts and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting therefrom, nor from rectifying such conditions at his own expense.

D. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under this Contract.

E. Intent

1. All work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their implied intent, or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

2. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. Such items shall be provided by the Contractor in accordance with the specification on the Drawings.

3. The apparent silence of the Specifications to any detail, or the apparent omission from them of a detailed description concerning any Work to be

done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

4. Order of Precedence: Refer to JEA's Solicitation Documents for this project.

1.10 WEATHER

During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the Engineer as to suspensions shall be final and binding. During suspension of the Work from any cause, the Work shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise; and, if the Engineer will so direct, the rubbish and surplus materials shall be removed. Also, refer to additional requirements in the Solicitation Documents.

1.11 PROTECTION AND RESTORATION

The Contractor shall be responsible for the preservation of all public and private Property, and shall use every means of protection necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in other manner acceptable to the Engineer. Also, refer to additional requirements in the Solicitation Documents.

1.12 DELIVERY AND STORAGE

A. General

1. The Contractor shall be responsible for all material, equipment and supplies sold and delivered to the Owner under this Contract until final inspection of the Work and acceptance thereof by the Owner.

2. All materials and equipment to be incorporated in the Work shall be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any

injury, theft or damage or any kind whatsoever to the material or equipment.

3. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the Work, and the Contractor shall receive no compensation for the damaged material or its removal.

4. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.

5. Refer to additional requirements in the Solicitation Documents.

B. Delivery – The Contractor shall

1. Deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted time.

2. Coordinate deliveries in order to avoid delay in or impediment of the progress of the Work of any related Contractor.

3. Schedule deliveries to the site not more than one month prior to scheduled installation without written authorization from the Engineer.

4. Arrange deliveries of products in accordance with construction schedules coordinated to avoid conflict with work and conditions at the site.

5. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

6. Immediately on delivery, inspect shipments with the Owner's field representative to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

7. Provide equipment and personnel to handle products by methods recommended by the manufacturer to prevent soiling or damage to products or packaging.

8. Submit operation and maintenance data to the Engineer for review prior to shipment of equipment.

C. Storage

1. The Contractor shall be responsible for securing a location for on-site storage of all material and equipment necessary for completion of this project.
2. All material delivered to the job site shall be protected from dirt, dust, dampness, water and any other condition detrimental to the life of the material from the date of delivery to the time of installation of the material and acceptance by the Owner.
3. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
4. When required or recommended by the manufacturer, the Contractor shall furnish a covered, weather protected storage structure providing a clean, dry, non-corrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this project.
5. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
6. The Contractor shall carefully study manufacturer's storage instructions. These instructions shall be carefully followed and a written record of this kept by the Contractor.
7. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding".
8. Mechanical equipment to be used in the Work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed and lubricated prior to testing and start-up, at no extra cost to the Owner.

D. Specific Material Storage Requirements

1. Loose Granular Materials: Store in a well-drained area on solid surfaces to prevent mixing with foreign matter.
2. Cement, Sand and Lime: Stored under a roof and off the ground and kept completely dry at all times.

3. Brick, Block and Similar Masonry Products: Handle and store in a manner to reduce breakage, chipping, cracking and spilling to a minimum.

4. All structural, miscellaneous steel, and reinforcing steel: Store off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting.

   Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections form the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, and engineering and any other costs associated with making the necessary corrections. In any event, equipment and materials not properly stored will not be included in a payment estimate.

1.13 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. Comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to all parties involved in the installation, including two copies for the Engineer's use. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with the manufacturer's instructions, consult with the Engineer for further instructions. Do not proceed with Work without clear instructions.

C. Perform Work in strict accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

D. The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the installation of the Work and to handle all emergencies normally encountered in Work of this character.

E. Equipment shall be installed in a neat and workmanlike manner on the foundations

at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer during installation.

F. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

G. The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the Engineer and made of ample size and strength for the purposes intended. The manufacturer shall furnish substantial templates and working drawings for installation.

1.14 CONSTRUCTION FIELD ENGINEERING

A. Registered Land Surveyor: The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida for the following specific services as applicable to the Work:

   a. Identify existing rights-of-ways and property lines along or adjacent to the Work;

   b. Locate existing utilities and structures as may be affected by the Work;

   c. Locate control points prior to starting the Work;

   d. Replace control points or reference points which may be lost or destroyed.

   e. Prepare a certified survey of the actually constructed facilities based on information concurrent with the construction progress.

B. Contractor shall protect control points prior to starting the Work and shall preserve all permanent reference points during construction. The Contractor shall bear the cost of re-establishing project control points, and bear the entire expense of rectifying Work improperly installed due to not maintaining or protecting or to removing, without authorization, such established points, stakes, and marks.

C. Submittals

   a. Certificate signed by a Registered Surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.

b. Certified drawings showing locations of all structures, piping conduits and other improvements, including electronic files. These drawings are referenced as the Project Record Drawings and shall be included with the Project Record Documents.

c. Documentation to verify accuracy of field engineering work when requested by the Engineer.

1.15 UTILITIES

A. Utility Construction

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto, whether owned or controlled by governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage or water. Other public or private property which may be affected by the Work shall be deemed included hereunder.

2. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.

3. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Owner. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Owner may require special construction procedures. As a minimum, the Contractor shall conform to the following restoration procedures:

a. Interim Restoration: All excavations shall be backfilled and compacted as specified by the end of each working day.

All pipe and fittings shall be neatly stored in a location which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.

b. Final Restoration: After completing all utility installations, and after testing of the pipe, final restoration shall be performed. In no event shall final restoration begin after substantial completion. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction.

The Contractor's Progress Schedule shall reflect the above restoration requirements.

B. Existing Utilities

1. The locations of all existing underground piping, structures and utilities have been taken from information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered.

2. The Contractor shall, at all times in performance of the Work, employ approved methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of existing public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services; and shall cooperate fully with the owners thereof to that end.

3. Pipelines shall be located substantially as indicated on the Drawings, but the Owner reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. When the location of piping is dimensioned on the Drawings, it shall be installed in that location; when the location of piping is shown on a scaled drawing, without dimensions, the piping shall be installed in the scaled location unless the Owner approves an alternate location for the piping. Where fittings are noted on the Drawings, such

notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required. The Engineer may require detailed pipe laying drawings and schedules for project control.

4. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with the completed Work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the Owner. Any existing facilities which require operation to facilitate repairs shall be performed only by the owner of the respective utility.

5. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the proximity of excavation, be temporarily stayed and/or shored in position while Work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.

C. Notices

1. All governmental utility departments and other owners of public utilities which may be affected by the Work will be informed in writing by the Contractor within two weeks after the execution of the Contract or Contracts covering the Work. Such notice will be sent out in general, and directed to the attention of the governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the Work.

2. The Contractor shall also comply with Florida Statute 553.851 regarding notification of existing gas and oil pipeline company owners. Evidence of such notice shall be furnished to the Owner within two weeks after the execution of the Contract.

3. It shall be the Contractor's responsibility to contact utility companies at least 48 hours in advance of breaking ground in any area or on any unit of the Work so maintenance personnel can locate and protect facilities, if

required by the utility company.

4. The Contractor shall, prior to interrupting a utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the utility owner and make arrangements for the interruption which will be satisfactory to the utility owner.

D. Exploratory Excavations

Exploratory excavations shall be conducted by the Contractor for the purpose of locating underground pipelines or structures in advance of the construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48 hours or 1000 feet in advance of Work. If there is a potential conflict, the Contractor is to notify the Engineer immediately. Information on the obstruction to be furnished by the Contractor shall include: Location, Elevation, Utility Type, Material and Size. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

E. Utility Crossings

It is intended that whatever existing utilities must be crossed, deflection of the pipe within specified limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the Owner this procedure is not feasible, he may direct the use of fittings for a utility crossing or conflict transition as detailed on the Drawings.

F. Relocations

1. Relocations shown on the Drawings – Public utility installations or structures, including but not limited to light poles, signs, fences, piping, conduits and drains that interfere with the positioning of the Work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.

2. Relocation not shown on the Drawings

a. Where public utility installations or structures are encountered during the course of the Work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Owner, removal, relocation, replacement or rebuilding is necessary to complete the Work under this contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the Owner, for the Contractor to accomplish.

b. If such Work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such Work is accomplished by the Contractor, it will be paid for as a Change Order.

3. All existing utility castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished Work.

4. All existing utility systems which conflict with the construction of the Work herein which can be temporarily removed and replaced shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

G. Lines and Grades

1. All Work under this Contract shall be constructed in accordance with the line and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

2. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the project control points set by the Owner, and shall be solely responsible for the accuracy

thereof.

3. Reclaimed water main shall have a minimum of 36-inches of cover over the top of the pipe. Cover shall vary to provide long uniform gradient or slope to pipe to minimize air pockets.

4. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:

   a. Gravity Lines: continuous control, using laser beam technology.

   b. Pressure Lines: control stakes set at 50 ft intervals using surveyors level instrument.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 14 00

CONSTRUCTION SEQUENCE

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Project consists of work on property owned by JEA. The Otter Run WTP will be off-line during construction. All coordination shall be in presence of OWNER and ENGINEER and shall be confirmed in writing by OWNER in order to be valid.

B. Performed work in a manner to minimize disruption to the operation and staff of the Lofton Oaks System. Modifications that affect or may affect the operation of the system shall not be made without written permission from OWNER.

C. Construction progress schedule required under Section 01 33 00 shall reflect the conditions presented in this section.

D. Special precautions are necessary to ensure that no damage occurs to the facilities that are to remain in operation and are not to be modified or replaced. Any temporary facilities, materials, equipment, and labor required to ensure that no damage occurs shall be provided by CONTRACTOR as part of the Work and at no additional cost to OWNER.

E. OWNER reserves the right to postpone connections to existing utilities due to operational and/or weather related concerns.

1.02 NOTIFICATION REQUIREMENTS

A. CONTRACTOR shall give a minimum of 5 working days advance written notice to OWNER and ENGINEER of each component proposed for shutdown, tie-in, or disruption, all of which shall be subject to OWNER's approval and limitations. Shutdowns, tie-ins, or disruptions specifically mentioned in the Section must conform to this requirement and any others requested by OWNER or ENGINEER.

1.03 SUBMITTAL REQUIREMENTS

A. CONTRACTOR shall submit shop drawings and working drawings in accordance with Section 01 33 00 to show schedules and details of all temporary services, bypasses, shutdowns, tie-ins and connections to existing systems.

1.04 SITE CONDITIONS

A. CONTRACTOR shall coordinate the activities to allow for orderly and timely completion of all the work.

B. When access through construction areas must be disrupted, CONTRACTOR shall provide alternate acceptable access for the plant operators.

C. CONTRACTOR shall coordinate activities in the common areas with plant operators. CONTRACTOR shall submit to OWNER and ENGINEER a description and schedule as to how the common areas will be used, recognizing

the required coordination with the plant operators. Access to existing process equipment must be provided to the Plant Operating Personnel at all times.

D. Various interconnections within the plant may depend on the closure of various valves. CONTRACTOR shall coordinate with the Plant Operation Personnel prior to attempting any such closure and provide any corrective measure of temporary facilities necessary to attain the shut-off needed to perform the work without interrupting the plant operation.

E. Some interconnections within the plant may require temporary partial power shutdown. CONTRACTOR shall make every effort necessary to minimize the shutdown time and coordinate with the Plant Operating Personnel and/or utility authorities prior to attempting any such power shutdown. Furthermore, CONTRACTOR shall provide any corrective measure or temporary facilities necessary to perform the work without interrupting the plant operation.

F. During all Start-Up and Performance testing activities, CONTRACTOR shall make available manpower, equipment, and manufacturer's representatives required to make any necessary adjustments and training. CONTRACTOR shall provide all disinfection chemicals of suitable quantity to test operation of new facilities.

G. Lofton Oaks System Otter Run WTP plant will be off-line during the entire construction period. CONTRACTOR shall conduct operations so as to cause the least possible interference and/or inconvenience with the normal operations of the system.

H. Dust tight and noise dampening partitions or other methods approved by ENGINEER to contain dust, debris, rain, noise, etc., from construction areas shall be provided. Protective covers for equipment and furnishings shall be provided by CONTRACTOR in areas of work within new buildings and structures.

1.05 CONSTRUCTION CONSTRAINTS

A. CONTRACTOR shall meet the constraints below and shall consider these constraints when developing the overall plan of construction. The list is not intended to release CONTRACTOR from responsibility to coordinate Work in any manner which will ensure project completion within the time allowed. The following areas are not necessarily listed in their required sequence of construction. A suggested sequence within each area, where necessary, is included. However the overall general sequence outlining the critical items is outlined below. Should CONTRACTOR wish to deviate from this overall sequence they shall obtain permission and approval prior to proceeding. Any facility that is required to be in service to operate the plant shall either remain in service or be temporarily relocated and reinstalled until the new system is approved and on-line.

1. CONTRACTOR shall have JEA actuate valves to isolate existing Otter Run WTP and place off-line from the Lofton Oaks Potable Water System.

2. Demolish site and provide temporary debris control containment and security fencing.

3. Coordinate with Geotech for final geotechnical exploration to confirm construction recommendations prior to construction of new Ground

Storage Reservoir.

4. Install yard piping under new GSR location to isolation valve connections.
5. Construct new GSR.
6. Fill new GSR from Lofton Oaks System with metered water. And let set for 30 days.
7. Install remaining underground piping, electrical, instrumentation/control conduits and utilities.
8. After 30 days of settlement connect yard piping to new GSR.
9. Construction new High Service Pump Room Building.
10. Pour new pavements, roadways and sidewalks.
11. Install new security fence.
12. Install new High Service Pumps, liquid chlorine chemical feed system, electrical components, Instrumentation & Controls.

B. Sitework

1. Since work will be occurring around active existing pipes, the CONTRACTOR shall prepare working drawings of existing and proposed new work to scale and submitted to the ENGINEER in advance of excavation. This will require additional pot-holing and excavations to locate and determine pipe elevations. The ENGINEER has provided all known existing information as a starting point to the CONTRACTOR.
2. All site and underground pipe and structures installation work shall be organized and scheduled to accomplish the following:
    a. OWNER access to facilities shall be maintained at all times.
    b. All underground work shall be performed concurrently to avoid subsequent trenching through the same areas to a reasonable extent.
    c. Yard electrical work and piping work shall be shown on the same working drawings and fully coordinated horizontally and vertically.
    d. Existing systems shall remain fully operational except for pre-planned, scheduled, and organized temporary outages.
3. New slabs or pavement shall not be installed until all piping, cables, conduits, and duct banks under the paved area have been installed. Roads shall be stabilized with crushed stone until that time. Any weak areas in base course or existing pavement shall be removed and replaced prior to the final surface course installation.
4. All connections to existing facilities shall be scheduled through OWNER and ENGINEER to minimize the impact on plant operations and construction progress.

C. Electrical

1. There shall be no demolition work or shutdowns of the electrical system without approval by the ENGINEER and OWNER. The CONTRACTOR shall plan in advance for modifications required to the on-site wells.

2. CONTRACTOR shall coordinate the location of any new conduits and hand dig areas to avoid other utilities in the area. Detailed locations of new underground electrical shall be coordinated by the CONTRACTOR and included in the CONTRACTOR's yard piping working drawings which also show other existing utilities, conduits, ductbanks and yard structures.

D. Final Piping Connections and Pressure Testing

1. Final connections will be required to existing pipes on the site. All connections shall be coordinated with the plant operating staff and scheduled a minimum of five days in advance with OWNER. CONTRACTOR shall pressure test all piping prior to making connections. CONTRACTOR shall coordinate with the OWNER to complete all bacteriological testing on all new facilities.

2. Once the new WTP is ready for operation, the CONTRACTOR shall make all connections to the existing distribution system. The CONTRACTOR shall schedule connections at least 5 working days prior with the ENGINEER and OWNER. All connections to the existing system will remain in-tact until the system is performance tested and approved for final use.

E. Electrical and High Service Pump Building Testing

1. Submit a plan for testing operation of the building including all HVAC, pumps, VFDs, MCC, and all controls.

2. Test the pumps with water from the new GSR and certify that that the pumps met the operating conditions outlined in Section 43 21 10.

3. After the connections are made, operate the system in automatic mode for five consecutive days without any interruption and conduct performance testing.

F. Testing

1. All facilities and systems shall be tested as a condition precedent to substantial completion. See Section 01 78 25 and equipment specifications for additional requirements. Start-up plans for the facility and equipment shall be submitted, reviewed, and approved by the ENGINEER.

1.06 PERMITS

A. Arrange for all required inspections and shall close out all Nassau County permits at the end of the Contract.

B. Provide the ENGINEER the required documentation to close out the FDEP permit.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 20 00

MEASUREMENT AND PAYMENT - LUMP SUM CONTRACTS

PART 1 GENERAL

1.01 SECTION INCLUDES

Measurement and payment provisions and schedule of values

1.02 GENERAL MEASUREMENT AND PAYMENT PROVISIONS

A. Payment for all work done in compliance with the Contract Documents, inclusive of furnishing all manpower, equipment, materials, and performance of all operations relative to construction of this project, will be made as a lump sum which will be complete payment for all work called for or reasonably inferable from the Contract Documents and other work will be considered incidental to the Contract and no additional compensation will be allowed.

B. The Owner reserves the right to alter the Drawings, modify incidental work as may be necessary, and increase or decrease the work to be performed to accord with such changes, including deductions or additions to the scope of work outlined in the Contract Documents. Changes in the work shall not be considered as a waiver of any conditions of the Contract nor invalidate any provisions thereof. Changes resulting in changes in the scope or quantities of Work or time or other conditions of work will be basis for consideration of a Change Order which is to be negotiated and executed before proceeding with the work. A supplemental agreement between the Contractor and the Owner will be required when such changes meet the conditions described in the Supplementary Conditions. Work which has not been authorized by a written Change Order will not be subsequently considered for additional payment.

C. The Contractor shall take no advantage of any apparent error or omission in the Drawings or Specifications, and the Engineer shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.

D. If the Contractor makes a claim for an extra or additional cost and requests a Change Order be issued prior to performing the work, and the ENGINEER and/or OWNER renders a decision denying such request, the CONTRACTOR must notify the Engineer in writing within 3 days of the time that the CONTRACTOR is informed of the Engineer's decision. Otherwise the Owner will not consider any such difference as a claim for a Change Order or additional payment or time. Any, such written notice received by the Engineer from the Contractor within the 3 day period shall be just reason for the Engineer to re-evaluate his previous decision.

E. Failure on the part of the Contractor to construct any item to plan or authorized dimensions within the specification tolerances shall result in: reconstruction to acceptable tolerances at no additional cost to the Owner; acceptance at no pay; or, acceptance at reduced price, all at the discretion of the Engineer.

F. Work shall not be considered complete until all testing has been satisfactorily completed and the item of work has demonstrated compliance with plans and specifications.

G. A preliminary monthly application for payment shall be submitted to the Owner/Engineer for review five (5) days prior to the submittal for approval of the Contractor's monthly payment request.

1.03 PAYMENT METHOD – SCHEDULE OF VALUES

A. The Company shall submit to JEA a monthly Application for Payment that details the Work completed during that month. The Company shall request payment in accordance with the amounts/percentages set forth on the Schedule of Values that the Company submitted prior to the start of the Work. The Schedule of Values is defined as an itemized list that establishes the value of each part of the Work for a stipulated price and for major lump sum items in a unit price contract. JEA will determine, either by measurement or approximation, the final quantities incorporated into the Work under items for which Unit Prices are established in the Contract Documents. JEA's determination as to the quantity of the Work successfully completed shall be final.

B. Refer to Section 01 37 00 for Schedule of Value requirements.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere

A. Work under this Section includes:

1. Preconstruction meeting.
2. Progress meetings.

1.02 REQUIREMENTS INCLUDED

A. The ENGINEER shall schedule and administer a preconstruction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work.

1. Prepare agenda for meetings.
2. Make physical arrangements for meetings.
3. Preside at meetings.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The CONTRACTOR shall attend meeting to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.03 PRECONSTRUCTION MEETING

A. The ENGINEER will schedule a preconstruction meeting prior to beginning the work. This meeting shall be attended by the ENGINEER, the CONTRACTOR, and the OWNER. The purpose of the meeting shall be to review shop drawing procedures, construction methods, and to establish a construction schedule.

B. Location: A central site, convenient for all parties designated by the ENGINEER.

C. Attendance:

1. OWNER's Representative.
2. ENGINEER and his professional consultants.
3. Resident Project Representative.
4. CONTRACTOR's Superintendent.
5. Major Subcontractors.
6. Major Suppliers.
7. Utilities.
8. Others as appropriate.

D. Suggested Agenda:

1. Distribution and discussion of:
    a. List of major subcontractors and suppliers.
    b. Projected construction schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities.
4. Project Coordination.
5. Designation of responsible personnel.
6. Procedures and processing of:
    a. Field decisions.
    b. Proposal requests.
    c. Submittals.

d. Change Orders.

e. Applications for payment.

7. Adequacy of distribution of Contract Documents.

8. Procedures for maintaining record documents.

9. Use of Premises:

a. Office, work and storage areas.

b. OWNER's requirements.

10. Construction facilities, controls and construction aids.

11. Temporary utilities.

12. Housekeeping procedures.

13. Check of required Bond and Insurance certifications.

14. Liquidated Damages.

15. Request for a weekly job meeting for all involved.

16. Introduction of the plant superintendent and discussion of the need for continued levels of wastewater treatment through the construction period, accommodations for plant employees, and partial OWNER occupancy.

17. Equal Opportunity Requirements.

18. Laboratory testing of material requirements.

19. Inventory of material stored on-site provisions.

20. Posting of Government funding sign.

1.04 PROGRESS MEETINGS

A. Schedule regular periodic meetings. The progress meetings will be held at a frequency determined by JEA.

B. Hold called meetings as required by progress of the work.

C. Location of the meetings: Project field office of CONTRACTOR or ENGINEER.

D. Attendance:

1. ENGINEER, and his professional consultants as needed.
2. Subcontractors as appropriate to agenda.
3. Suppliers as appropriate to the agenda.
4. Others as appropriate.

E. Suggested Agenda:

1. Review, approval of minutes of previous meeting.
2. Review of work progress since previous meeting.
3. Field observations, problems, conflicts.
4. Problems which impede construction schedule.
5. Review of off-site fabrication, delivery schedules.
6. Corrective measures and procedures to regain projected schedule.
7. Revisions to construction schedule.
8. Progress, schedule during succeeding work period.
9. Coordination of schedules.
10. Review submittal schedules; expedite as required.
11. Maintenance of quality standards.
12. Pending changes and substitutions.
13. Review proposed changes for:
    a. Effect on construction schedule and on completion date.
    b. Effect on other contracts of the Project.
14. Other business.
15. Construction schedule.
16. Critical/long lead times.

F. The CONTRACTOR is to attend progress meetings and is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the work, etc.

G. The CONTRACTOR is to provide a current submittal log at each progress meeting in accordance with Section 01 33 00.

END OF SECTION

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SECTION 01 32 34

PRECONSTRUCTION VIDEO

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide all material, equipment, transportation, labor and incidentals to prepare a continuous, color audiovisual recording of the proposed project to serve as a record of pre-construction conditions.

B. All recordings and written records shall become the property of Owner.

C. Recordings shall be submitted in DVD format.

D. Provide video recording no later than 15 days after Notice to Proceed.

1.02 SCHEDULING

A. Make recordings within 30 days prior to commencement of construction. No construction shall begin prior to review by the OWNER'S REPRESENTATIVE of the recording covering the construction area.

B. The OWNER'S REPRESENTATIVE shall have the authority to reject all or any portion of a recording not conforming to specifications and order that it be redone at no additional charge. The Contractor shall reschedule unacceptable coverage within five (5) days after being notified.

1.03 PROFESSIONAL SERVICES

A. Engage the services of a professional known to be skilled and regularly engaged in the business of constructing color, audio-video documentation. The professional shall be prepared to serve as a consultant or witness for the Owner in any litigation, public hearing or other legal or administrative proceeding involving the project.

B. Include the names and addresses of two references that the professional has performed color audio-video recording on projects of a similar nature, including one within the last six (6) months.

C. Furnish to the OWNER'S REPRESENTATIVE a list of all equipment to be used for the recording, i.e., manufacturer's name, model number, specification and other

pertinent information.

1.04 SUBMITTALS

A. Submit videos in accordance with JEA's Solicitation Documents.

B. Qualifications and references of the professional.

PART 2 PRODUCTS

2.01 GENERAL

A. The total recording system and the procedures employed in its use shall be such as to produce a finished product that will be admissible as evidence in a legal or administrative proceeding involving the project. The video portion of the recording shall produce bright, sharp, clear pictures with accurate colors and shall be free from distortion or any other form of picture imperfection. The audio portion of the recording shall clearly produce the commentary of the camera operator and be free of distortion.

B. All video recordings shall, by electronic means, display on the screen the time of day, the month, day and year of the recording and the horizontal location of the recording in relation to the project stationing (when applicable). This time and date information must be continuously and simultaneously generated with the actual recording.

PART 3 - EXECUTION

3.01 COVERAGE

A. The recordings shall contain coverage of all surface features within the construction zone of influence. These features shall include, but not be limited to, all roadways, pavement, retention ponds, driveways, sidewalks, culverts, headwalls, retaining walls, landscaping, trees, poles, signs, overhead projections and fences. Of particular concern shall be the existence or non-existence of any faults, fractures or defects. Significant detail of any pre-existing damages to physical features and improvements shall be provided.

B. Panning, zoom-in and zoom-out rates shall be controlled to maintain a clear view of the object. The following features and improvements shall be clear and visible:

a. Cracks in wall.

b. Condition of fencing.

c. Condition of planted areas and type of vegetation.

d. Condition of sodded areas.

e. Conditions of sprinkler systems and associated controls and wiring.

f. Condition of signs.

g. Conditions of lighting and associated wires.

3.02 AUDIO CONTENT

A. Accompanying the video recording of each DVD shall be a corresponding and simultaneously recorded audio recording. This audio recording, exclusively containing the commentary of the camera operator, shall assist in viewer orientation and in the identification, or objective description of the features being shown in the video portion of the recording.

B. The audio recording shall be free from any conversation between the camera operator and any other production technicians that is not pertinent to the project.

3.03 DVD INDEXING

A. DVD shall be permanently labeled and shall be properly identified by number and project title.

B. Each DVD shall have a written log of that DVD's contents. The log shall describe the various segments of coverage contained on that VDV in terms of the names of the streets or easements, coverage beginning and end, directions of coverage, DVD unit counter numbers when possible, and the date of the recording.

3.04 CONDITIONS OF RECORDING

A. All recording shall be performed during times of good visibility. No recording shall be done during periods of significant precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects and to produce sharp, bright recordings of those subjects.

3.05 CONTINUITY OF COVERAGE

A. The recording shall be a single, continuous, unedited recording which begins at one end of a particular construction area.

B. However, where coverage is required in areas not accessible by conventional wheeled vehicles and smooth transport of the recording system is not possible, such coverage shall consist of an organized interrelated sequence of recordings at various positions along that proposed construction area, i.e., wooded easement area. Such coverage shall be obtained by walking or by a special conveyance.

3.06 COVERAGE RATES

A. The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and significance of the surface features within that construction areas' zone of influence.

3.07 CAMERA OPERATION

A. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed 10 feet. The camera shall be mounted such that transport of the camera during the recording process will not cause an unsteady picture.

B. Control camera functional controls, such as camera pan, tilt, zoom-in and zoom-out rates, such that recorded objects shall be clearly viewed during playback. In addition, all other camera and recording system controls, such as lens focus and aperture, video level, pedestal, chroma, white balance and electrical focus shall be controlled or adjusted to maximize picture quality.

C. Maintain viewer orientation of the physical location of the audio and video portions of the recording. To this end, overall views of all visible house and business addresses shall be utilized.

D. In areas where the proposed construction location will not be readily apparent to the video viewer, highly visible yellow flags shall be placed, by the Contractor, in such a fashion as to clearly indicate the proposed center line of construction.

E. The horizontal location of the recording shall be documented by linear measurement, utilizing a "fifth wheel" measuring device, relating the recording to project stationing (when applicable).

3.08 TESTS

A. Submit the completed recordings to the OWNER'S REPRESENTATIVE for review.

B. If any recording or parts of any recording are illegible or inaudible, they shall be re-recorded and edited into the sequence prior to commencement of construction.

END OF SECTION

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SECTION 01 33 00

SUBMITTALS

PART 1 GENERAL REQUIREMENTS

1.01 Description

A. This Section includes but is not limited to requirements for the following:

1. Construction Schedules.
2. Shop Drawings, Product Data, and Samples.
3. Operation and Maintenance Manuals.
4. As-Built/Record Documents.

PART 2 SCHEDULES AND REPORTS

2.01 Schedule of Operations

Submit a schedule of operations to the ENGINEER for approval prior to any construction operations. The construction operations shall be sequenced to provide a minimum of interruption to operation of the existing facilities. Inform the ENGINEER of any changes in the schedule and allow ample time for the OWNER to alter operations as required by the construction of the various components of the work. Approval of traffic control and schedules shall be obtained from the governmental entity having jurisdiction over the area of work.

PART 3 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

3.01 Shop Drawings

A. Shop Drawings are original drawings, prepared by the CONTRACTOR, a subcontractor, or distributor, which illustrate some portion of the work; showing fabrication, layout setting, or erection details.

B. Shop drawings shall be prepared by a qualified detailer and shall be identified by reference to sheet and detail numbers on the Contract Documents. Reproductions for submittal shall be full size opaque diazo prints or other print acceptable to the ENGINEER. Reduced size prints will not be reviewed or approved.

3.02 Product Data

A. Product data are manufacturer's standard schematic drawings and manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data.

B. Standard drawings shall be modified to delete information which is not applicable to the project and supplemented to provide additional information applicable to the project.

C. Catalog sheets, brochures, etc., shall be clearly marked to identify pertinent materials, products, or models.

3.03 Samples

Samples are physical examples to illustrate materials, equipment, or workmanship and to establish standards by which work is to be evaluated.

3.04 CONTRACTOR's Responsibilities

A. Prior to submission, the CONTRACTOR shall thoroughly check shop drawings, product data, and samples for completeness and for compliance with the Contract Documents and shall verify all dimensions and field conditions and shall coordinate the shop drawings with the requirements for other related work.

B. The CONTRACTOR's responsibility for errors and omissions in submittals is not relieved by the ENGINEER's review of submittals.

C. The CONTRACTOR shall notify the ENGINEER, in writing, at the time of submission, of deviations in submittals from the requirements of the Contract Documents and is not relieved by the ENGINEER's review of submittals, unless the ENGINEER gives written acceptance of specific deviations.

D. Begin no work which requires submittals until return of submittals with ENGINEER stamp and initials or signature indicating the submittal has been reviewed.

3.05 Submission Requirements and ENGINEER Review

A. Submit four (4) prints of each shop drawing plus additional number of copies that contractor requires. Submit at least four (4) copies of product data. Submit the number of samples indicated in the individual Specifications Section.

B. Shop drawings, product data, samples and certifications shall be submitted by the CONTRACTOR to the ENGINEER. Submittals should be properly identified with the name of the project, dated, and each lot submitted shall be accompanied by a letter of transmittal referring to the name of the project and to the specification page number and/or Drawing number for identification of each item. Submittals for each type of work shall be numbered consecutively, and the numbering system shall be retained throughout all revisions.

C. Submittals shall bear the CONTRACTOR's stamp of approval certifying that they have been checked. Submittals without the CONTRACTOR's initialed or signed certification stamp and submittals which, in the ENGINEER's opinion, are incomplete, contain numerous errors or have not been properly checked, will be returned unchecked by the EGNINEER for resubmission. The CONTRACTOR shall mark his corrections in Green ink and the ENGINEER's comments shall be noted in Red.

D. The CONTRACTOR shall allow a minimum of 14 days for review of shop drawings. The ENGINEER will review submittals with reasonable promptness. The ENGINEER’s review of submittals shall not be construed as a complete check and shall not relieve the CONTRACTOR from responsibility for complete compliance with the Contract requirements. No corrections, changes or deviations indicated on submittals reviewed by the ENGINEER shall be considered as a change order.

E. If submittal is acceptable, the ENGINEER will return 1 print to the CONTRACTOR. If the submittal is not satisfactory, one set of prints will be retained by the ENGINEER and the remaining prints returned to the CONTRACTOR for appropriate action.

F. In the event a third submittal of shop drawings is required, due to previous submittals of incomplete or incorrect shop drawings not in accordance with the Drawings and Specifications, the CONTRACTOR will be charged one-half the cost incurred by the ENGINEER for the review of the third submittal. The CONTRACTOR shall bear the total cost incurred by the ENGINEER for all subsequent reviews. The ENGINEER costs charged to the CONTRACTOR will be at the cost plus rate generally charged by the ENGINEER and will be deducted by the OWNER from payments due the CONTRACTOR.

G. Distribution of copies of acceptable submittals will be as mutually determined by the CONTRACTOR, OWNER and ENGINEER on an individual item basis during or following the preconstruction conference.

PART 4 OPERATION AND MAINTENANCE MANUALS

4.01 Submittal Requirements

A. The CONTRACTOR shall be responsible for obtaining installation, operation, and maintenance manuals from the manufacturers and suppliers. Submit one (1) electronic pdf copy and four (4) hard copies of manuals (plus additional copies to be returned to the Contractor) to the ENGINEER within 30 days after approval of shop drawings, product data, and samples, and not later than the date of shipment of each item of equipment to the project site. All operation and maintenance manuals shall be submitted prior to the completion of 35% of the construction.

B. Manuals shall be provided for each piece of equipment including individual components and subsystems of complete assemblies. The section of the manual on operation shall describe the function of each component and its relationship to the system of which it is a part. Where several models, options, or styles are described, the manual shall identify the items actually provided.

C. The manual shall contain the following:

1. Table of contents/index
2. Specific description of each system and components

3. Manufacturer's identification, including order number, model, and serial number

4. Name, address, telephone number(s) and e-mail address(es) of vendor(s) and local service representative(s)

5. Specific on-site operating instructions (including starting and stopping procedures)

6. Safety considerations

7. Project specific operational procedures

8. Project specific maintenance procedures

9. MANUFACTURER's operating and maintenance instructions – specific to the project

10. Copy of each wiring diagram

11. Copy of CONTRACTOR's approved shop drawings

12. List of spare parts and recommended quantities

13. Product Data: Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Delete inapplicable information.

14. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams

15. Provide logical sequence of instructions for each procedure, incorporating MANUFACTURER's instructions specified.

16. Equipment attributes sheet for submittal of name plate data.

17. Warranties and Bonds.

D. Each manual shall be bound in a binder and labeled to identify the contents, specification section, and project to which it applies.

E. Operation and maintenance manuals specified herein are in addition to any operation, maintenance, or installation instructions by the CONTRACTOR to install, test, and start up equipment.

F. Manuals for Equipment and Systems - In addition to the requirements listed above, for each System, provide the following:

1. Overview of system and description of unit or system and component parts. 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. Procedures and guides for trouble-shooting; disassembly, repair, and reassembly instructions
    b. Alignment, adjusting, balancing and checking instructions
    c. Servicing and lubrication schedule and list of recommended lubricants
    d. MANUFACTURER's printed operation and maintenance instructions
    e. Sequence of operation by instrumentation and controls manufacturer
    f. Original MANUFACTURER's parts list, illustrations, assembly drawings and diagrams required for maintenance
5. Control diagrams by controls manufacturer as installed (as-built)
6. CONTRACTOR's coordination drawings, with color coded piping diagrams, as installed (as- built)

7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams. Include equipment and instrument tag numbers on diagrams.
8. List of original MANUFACTURER's spare parts and recommended quantities to be maintained in storage
9. Test and balancing reports, as required
10. Additional Requirements as specified in individual product specification
11. Design data for systems engineered by the CONTRACTOR or its Suppliers
12. Equipment attribute Information

    Equipment Attribute Worksheets as presented at the end of this Section shall be provided for all equipment meeting the asset definition as follows:

    Asset Definition

    - Maintenance is recommended
    - Assets have a value greater than $1,000
    - Assets are complete and usable, and perform a distinct function independently (i.e., they pump waste, remove solids, etc.)

    a. This asset definition is intended to give a general indication of which equipment must be included in the Equipment Attribute Worksheets. The ENGINEER will provide the specific list of equipment that the CONTRACTOR must provide information for.

    b. The information requirements are shown in detail in the table. The data requirements include nameplate data, manufacturer and supplier information, information specific to the type of equipment, and recommended preventative maintenance activities.

c. An electronic copy of the Equipment Attribute Worksheets must be delivered in Excel format and submitted to the ENGINEER on CD-ROM and submitted with the O&M manuals. It is not necessary to submit printed copies of the Equipment Attribute Worksheets.

G. Manual for Materials and Finishes – In addition to the requirements listed above, for each material or finish, provide the following:

1. 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.

2. Instructions for Care and Maintenance: Include MANUFACTURER's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.

3. 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.

H. Quick Reference Sheets for Equipment

1. For each item of equipment provide the following:

a. A minimum of one 8 ½ x 11-inch laminated quick reference sheet. Sheets shall be three hole punched and may be double sided.

b. Each quick reference sheet shall include the following minimum information:

1) Safety Procedures:

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

c. Provide three copies of quick reference sheets for review by the ENGINEER.

d. After quick reference sheets have been approved, provide four copies of laminated quick reference sheets to the ENGINEER in one commercial coiled three-ring binder with durable and cleanable plastic cover.

PART 5 RECORD DOCUMENTS

5.01 General

A. Provide and maintain on the jobsite one complete set of prints of all drawings which form a part of the contract. Immediately after each portion of the work is installed, indicate all deviations from the original design shown in the drawings either by additional sketches or ink thereon.

B. Maintain the field as-built drawings in as great detail (or better) than that shown in the Construction Drawings (i.e., related fittings where called out, show dimensions as frequently shown on drawings, etc.). Refer to **Table 01 33 00-1** for Contractor's field responsibilities with regard to maintaining records during construction.

C. Contractor shall employ a professional land surveyor licensed in the state of Florida to obtain the As-Built survey data required in **Table 01 33 00-1**.

D. Upon completion of the work, Contractor shall deliver three (3) full-size sets of approved, certified as-builts to the Engineer plus a CD with an electronic file of the as-built drawings in the latest version of AUTOCAD format. Each completed set of "As-Built" drawings shall include on its face, a certified statement by the Contractor's Professional

Land Surveyor that the set of "As-Built" drawings accurately depicts the actual work as constructed. The final As-Builts provided by the Contractor to the Engineer shall provide the level of detail as listed in **Table 01 33 00-1** and in 3.05 E and F below.

E. The as-built documents shall also show limits of road restoration, power pole replacement, driveways, new drain lines, new inlets.

F. Mark on the Specifications the manufacturer, trade name, catalog, and supplier of each product actually installed, and mark changes made by change order or field order.

G. At the completion of the Work, deliver the as-built documents to the Engineer, in good condition and free from any extraneous notations.

TABLE 01 33 00 -1: WATER MAIN AS-BUILT INFORMATION

Water System Feature	**Contractor's Field Responsibilites** *(Provide Red Line marks on field set of the approved plans)*	**Contractor's Survey Responsibility by a Licensed Surveyor** *(Survey information to be included in Contractor's ACAD As-Built Drawings)*	**Contractor's ACAD As-Built Drawing Responsibilities** *(Include final ACAD deliverable of As-Built Drawings. Clearly identify on the As-Built Drawings (e.g. clouding) all changes from design drawings, which were marked on the field set of drawings.*
Pipes and Fittings	1) Material, class, size, joint type, fittings. 2) Measure distance between fittings (center of tees, crosses, bends). 3) Depth of pipes during installation at every fitting and appurtenance. 4) Limits of pipe	1) Horizontal and vertical location of main (top of pipe): Measurements/ offset ties shall be referenced to permanent surface improvements at the point of connection, all changes in direction or elevation but not to exceed intervals of 50 feet or less along straight runs and at the pipe terminus. 2) Top and bottom of crossings (drainage, sewer, telephone, cable, TV, electric, etc.) for location and	1) Redraw pipe if location differs from approved plans. 2) Draw existing pipe locations on As-Built Drawings 3) Detail any connection to existing utilities and any horizontal and vertical pipe alignment change.

	restraint. 5) Location and elevation of pipes at utility crossings.	verification of pipe separation requirements.	
Valves: Gate Valves (GV); Butterfly Valves (BV); Air Release Valves (ARV); Blow Off Valves (BO)	Type and size	1) Horizontal locations of valve: Valve shall be referenced for future recovery from three permanent surface improvements. 2) Vertical locations of valve: Valve shall be measured to the center of the operating nut.	1) Redraw on drawings if location differs from approved plan. 3) Indicate new information on plans.

EQUIPMENT ATTRIBUTE SHEETS

In order to facilitate the creation of asset records and their corresponding preventive maintenance schedules and activities in the Computerized Maintenance Management System (CMMS), information should be completed using the Excel template provided. Examples are provided in the Equipment Attribute Sheets template to help convey how the information should be completed. In addition, each worksheet in the Excel template is described below. The ENGINEER will provide the CONTRACTOR a copy of the Excel spreadsheet for use in distributing to vendors/manufacturers for completion. The spreadsheet will be pre-populated with the list of assets for which information is required and the specific attributes that need to be completed.

VENDOR-MANUFACTURER WORKSHEET

Information for the equipment Vendors and Manufacturers should be provided on the Vendor-Manufacturer worksheet. The information that is required is listed below.

Vendor ID / Manufacturer ID	A unique identifier for the Vendor or Manufacturer. If this is unknown enter an abbreviation for the Vendor / Manufacturer name.

Vendor/Manufacturer Name	The name of the Vendor or Manufacturer
Address	Company address
City	
State or Country	
ZIP Code	
Phone	Company phone number
Fax	Company fax number
Contact Name	Best contact person
Contact Phone	Contact information associated with the person identified in the Contact Name field
Contact Fax	
Contact email	

LOCAL REPRESENTATIVE WORKSHEET

Information for the local representative should be provided on the Local Representative worksheet. The information that is required is listed below.

Company Name	The company name of the Local Representative
Address	Company address
City	
State	
ZIP Code	
Contact Name	Best contact person
Contact Phone	Contact information associated with the person identified in the Contact Name field
Contact Fax	
Contact email	

ASSETS WORKSHEET

The following Asset information should be provided for all equipment. The equipment that should be included will be pre-populated.

Asset ID	Will be pre-populated
Asset Description	Will be pre-populated
Tag Number	Identifier from the P&ID
Model Number	Equipment Model Number
Serial Number	Serial Number that is specific to the piece of equipment
Vendor ID	Identifier for the Vendor associated with the piece of equipment. The Vendor ID should be defined on the Vendor-Manufacturer worksheet.
Manufacturer ID	Identifier for the Manufacturer associated with the piece of equipment. The Manufacturer ID should be defined on the Vendor-Manufacturer worksheet.
Cost	The installed cost of the equipment.
Warranty Duration	The length of the warranty on the equipment
Anticipated Warranty Start Date	The estimated date of substantial completion. Will help define when the warranty will expire.

In addition to the information above, additional asset-specific attributes must be completed. The additional fields that need to be completed will be defined for you on the Assets Worksheet for each different type of asset. See the Equipment Attribute Sheets template for examples.

SPARE PARTS WORKSHEET

Spare parts or kits that are to be used in the performance of recommended preventive maintenance activities should be listed on the Spare Parts worksheet. This will enable JEA to keep an inventory of the items and enable preventive maintenance work orders to reference the spare part requirements.

Spare Part or Kit ID	A unique identifier for the Spare Part of Kit
Spare Part / Kit Description	A useful description to help users of the CMMS and/or maintenance crews identify what is needed to perform the preventive maintenance task.

Vendor/Manufacturer ID	The unique identifier for Vendor or Manufacturer of the item. The identifier should reference the Vendor-Manufacturer worksheet.
Kit Contents	If the item is actually a kit that contains multiple items, the quantity and a brief description of each item in the kit should be listed individually.
Asset ID(s)	The list of Assets that the spare parts are applicable to. The Asset IDs are defined in the Assets worksheet.

PREVENTIVE MAINTENANCE WORKSHEET

All recommended preventive maintenance (PM) activities for the equipment provided must be compiled on the Preventive Maintenance worksheet. This will facilitate the creation of the necessary preventive maintenance schedules for the equipment in the CMMS. It will also help JEA identify the specific tasks and materials that are involved in completing future PM work orders. The Preventive Maintenance worksheet contains two sections. The general list of preventive maintenance activities and their frequencies should be entered in the Preventive Maintenance Header. The tasks that a maintenance worker would execute as part of each PM should be entered into the Preventive Maintenance Tasks.

Preventive Maintenance Header

PM ID	Please specify a unique number for each recommended preventive maintenance (PM) activity. The first PM should have an ID of 1, and you should increment from there. The individual tasks that comprise the activity will be listed separately below and will reference this identifier.
PM Description	A useful description of the PM activity. It should also contain the frequency that the activity should be performed.
Frequency - Calendar	If the frequency is calendar based (every week, 2 weeks, month, etc) please enter the frequency.
Frequency - Runtime	If the PM should be scheduled based on equipment run-time, please enter the runtime interval at which the PM should be performed.

Applicable Asset ID(s)	In order to create the PM schedules in the CMMS, a list of the applicable Asset IDs are needed. If a PM is applicable to several assets that you are supplying, please list all those Asset IDs and create rows as necessary in Excel.

Preventive Maintenance Tasks

PM ID	This is the identifier from the Preventive Maintenance Header (above).
Task Number	A numeric identifier for each task listed under a scheduled PM. The first task should be "10" and each successive task should be incremented by 10.
Task Description	A useful description of the task. It is not necessary or desirable for this to be overly detailed. It is meant to be a checklist that a person could use in performing the recommended PM activities. The examples provided are an indicator of the desired level of detail.
Spare Part / Kit ID	If the task likely will require spare parts, the spare parts should be listed here. The ID that should be entered here should come from the Spare Parts worksheet.
Spare Part / Kit Quantify	The quantity of the specified parts that are likely to be necessary to complete the PM task
Special Tools / Equipment Description	If any special or unusual tools or equipment are necessary to perform the maintenance task, a description should be entered here.

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SECTION 01 35 43

STORMWATER POLLUTION PREVENTION / NPDES REQUIREMENTS

PART 1 GENERAL

1.01 Section Includes

Stormwater Pollution Prevention Plan requirements and recommendations under the NPDES program for construction projects located in Florida.

1.02 Purpose

The purpose of this section is to outline minimum requirements for stormwater pollution prevention as required under the NPDES program. There may be more stringent local government or Owner requirements for Erosion and Sediment Control, which would be located in the Specifications or on the Drawings. The more stringent requirement governs.

1.03 Abbreviations

A. NPDES - National Pollution Discharge Elimination System

B. SWPPP - Stormwater Pollution Prevention Plan

C. NOI - Notice of Intent

D. NOT - Notice of Termination

1.04 Definitions

The term “NPDES Generic Permit” means the State of Florida Department of Environmental Protection (FDEP) Generic Permit For Stormwater Discharge from Large and Small Construction Activities.

1.05 Construction Projects Requiring Compliance with NPDES Generic Permit

A. All projects 1 or more acres in size that discharge to offsite areas.

B. Smaller projects that are in the same construction corridor as larger construction projects where the larger project is 1 or more acre in size and is required to comply with the NPDES Generic Permit. In this case, even if the smaller project

is less than 1 acre in size, the smaller project must comply with the NPDES Generic Permit.

1.06 General Requirements

A. Construction of this project is required to comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) Generic Permit for Stormwater Discharge from Small and Large Construction Activities.

B. In order to meet NPDES requirements, the Contractor is responsible for preparing a Stormwater Pollution Prevention Plan (SWPPP), implementing, inspecting, maintaining, and reporting on all elements of the SWPPP, completing and submitting the required Notice of Intent (NOI) and Notice of Termination (NOT) forms as the Operator, and paying all associated fees. Copies of the NPDES Generic Permit, NOI, and NOT forms, and permit application fee information are available for download at dep.state.fl.us/water/stormwater/npdes/

C. The Contractor must include in the SWPPP the names and addresses of all subcontractors working on this project who will be involved with the major construction activities that disturb site soil or who implement a pollutant control measure. These subcontractors, in addition to the Contractor, shall comply with the requirements of the NPDES Generic Permit and any local governing agency having jurisdiction concerning erosion and sedimentation control, and shall sign a copy of the certification statement in the SWPPP.

D. The SWPPP shall describe and ensure the implementation of best management practices which will be used to reduce the pollutants in stormwater discharge associated with construction activity and to assure compliance with the terms and conditions of the NPDES Generic Permit. The erosion and sediment control measures shown on these Drawings are the minimum required and are to be installed prior to construction. The Contractor is responsible for complying with all applicable rules, regulations and water quality standards and may need to install additional controls to meet these requirements.

1.07 SWPPP Implementation and Submittal Requirements

A. The SWPPP shall be completed prior to submittal of the NOI and shall include the elements necessary to comply with the NPDES Generic Permit for construction activities administered by the FDEP and shall also include all local

governing agency and Owner requirements. There may be more stringent local government or Owner requirements for Erosion and Sediment Control, which would be located in the Specifications or elsewhere on these Drawings.

B. The Contractor must file the NOI with FDEP and the Owner at least two (2) business days prior to the start of construction. The Contractor shall also submit a copy of the NOI to the MS4 operator for all projects that discharge stormwater associated with construction activity to a municipal separate stormwater system (MS4). A copy of the NOI and a description of the project must be posted in a prominent place for public viewing at the construction site.

C. The SWPPP must be implemented at the start of construction. A complete copy of the SWPPP, including copies of all inspection reports, plan revisions, etc., must be retained at the project site at all times during working hours and kept in the permanent project records for at least three years following submission of the NOT.

D. Final Stabilization means that all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover (evenly distributed, without large bare areas) with a density of at least 70% for all unpaved areas and areas not covered by permanent structures has been established or equivalent permanent stabilization measures (such as geotextiles) have been employed. Once construction is completed and final stabilization has been achieved, the Contractor must file the NOT to FDEP, the Owner, and the MS4 operator within 14 days.

1.08 Inspections

A. It is the responsibility of the Contractor to assure the adequacy of site pollutant discharge controls. Between the time the SWPPP is implemented and final site stabilization is achieved, all disturbed areas and pollutant controls must be inspected at least once every seven calendar days and within 24 hours following a rainfall of 0.5 inches or greater. The inspections are to be conducted by the Contractor's qualified designated representative.

B. All inspections shall be documented in an inspection report that summarizes the scope of the inspection, the names and qualifications of personnel making the inspection; the date of the inspection; rainfall data; major observations relating to

the implementation of the SWPPP, and actions taken in order to ensure compliance with NPDES requirements and the SWPPP. Such reports shall identify any incidents of non-compliance and actions taken to bring the project into compliance. Where a report does not identify any incidents of non-compliance, the report shall contain a certification that the facility is in compliance with the NPDES requirements and the SWPPP. Each inspection report shall be signed and certified by each inspector.

1.09 Updating and Modifying the SWPPP

A. Based on inspection results, any modifications necessary to increase effectiveness of the SWPPP to an acceptable level must be made within seven calendar days of the inspection.

B. The SWPPP must be updated each time there are significant modifications to the pollutant prevention system or a change of contractors working on the project who disturbs site soil. For construction activities where the operator changes, the new operator shall file an NOI for coverage under this permit at least two (2) days before assuming control of the project and the previous operator shall file an NOT to terminate permit coverage in accordance with the NPDES Generic Permit. Amendments to the plan shall be prepared, signed, dated, and kept as attachments to the original SWPPP.

1.10 Minimum SWPPP Provisions

A. Each SWPPP shall provide a description of pollutant sources and other information including a description of the nature of the construction activity; the intended sequence of major activities which disturb soils for major portions of the site; estimates of the total area of the site and the total area of the site that is expected to be disturbed by excavation, grading, or other construction activities; existing data describing the soil or the quality of any discharge from the site and an estimate of the size of the drainage area for each discharge point; a site map indicating drainage patterns and approximate slopes anticipated after major grading activities, areas of soil disturbance, an outline of areas which may not be disturbed, the location of major structural and nonstructural controls identified in the plan, the location of areas where stabilization practices are expected to occur, surface waters, wetlands, and locations where stormwater is discharged to

a surface water or MS4; and the latitude and longitude of each discharge point and the name of the receiving water(s) for each discharge point.

1.11 Minimum Erosion and Sediment Control Construction Requirements

A. Stabilize all construction site exits with coarse aggregate or other approved materials, in accordance with details on the Drawings. Other minimum construction requirements that need to be implemented in order to comply with the NPDES Generic permit include installation of sediment barriers down slope from construction activities that disturb site soil; constructing rock surface temporary parking areas; installation of sediment barriers down slope prior to clearing and grubbing; installation of sediment barriers on the down slope side of utility construction and soil stockpiles; and the installation of sediment barriers on the down slope side of grading activities.

B. Stabilization measures shall be initiated as soon as practicable, but in no case more than 7 days, in portions of the site where construction activities have temporarily or permanently ceased.

C. The Owner has the authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, trenching, borrow and embankment operations. The Owner also has authority to direct Contractor to provide immediate permanent or temporary erosion and sediment control measures.

D. The Contractor shall respond to erosion and sediment control maintenance requirements or implement additional measures to control erosion ordered by Owner or governing authorities within 48 hours or sooner if required at no additional cost to the Owner.

E. The Contractor shall incorporate permanent erosion control features into project at earliest practical time to minimize need for temporary controls.

F. For drainage basins with 10 or more disturbed acres at one time, a temporary (or permanent) sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent control measures, shall be provided where attainable until final stabilization of the site. The 3,600 cubic feet of storage area per acre drained does not apply to flows from offsite areas and flows from onsite areas that are either undisturbed or have undergone final stabilization where such flows

are diverted around both the disturbed area and the sediment basin. For drainage basins with 10 or more disturbed acres at one time and where a temporary sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent controls is not attainable, a combination of smaller sediment basins and/or sediment traps and other BMPs should be used. At a minimum, silt fences, or equivalent sediment controls are required for all sideslope and downslope boundaries of the construction area.

G. Water trucks shall be used as needed during construction to reduce dust generated on the site. Dust control must be provided by the Contractor and shall be in compliance with applicable local and state dust control regulations.

1.12 Maintenance Requirements

A. Maintain all erosion and sediment control measures throughout construction. Repair or replace all damaged sediment barriers. Remove accumulated sediment along all silt fences where the height of the sediment exceeds one-third of the height of the silt fence. Inspect all temporary and permanent grassing areas and re-grass where there are bare spots, washouts, or unhealthy growth.

B. At the completion of construction, once final stabilization has been achieved, clean all accumulated sediment from all storm structures, pipelines, and stormwater ponds. Remove all temporary sediment controls upon receipt of authorization to remove has been received from the Owner or Engineer. Note that this may not occur for some time after construction activities have been completed, in order to ensure their removal has not occurred until final stabilization has been achieved to the satisfaction of the Owner and Engineer.

1.13 Stormwater Discharge Provisions

A. Non-stormwater components of site discharge must be clean water. Water used for construction, which discharges from the site, must originate from a public water supply or private well approved by the governing local agency. Water used for construction that does not originate from an approved public supply must not discharge from the site. Allowable non-stormwater discharges include discharges from fire fighting activities; Fire hydrant flushing; Water used to wash vehicles or control dust; Water flowing from potable sources and water line flushing; Irrigation drainage; and runoff from pavement wash down where spills

or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents have not been used.

B. Solid materials, including building materials, are not allowed to be discharged from the site with stormwater. All solid waste, including disposable materials incidental to the major construction activities, must be collected and placed in containers. The containers shall be emptied periodically by a contract trash disposal service and hauled away from the site.

C. Substances that have the potential for polluting surface and/or groundwater must be controlled by whatever means necessary in order to ensure that they do not discharge from the site. As an example, special care must be exercised during equipment fueling and servicing operations. If a spill occurs, it must be contained and disposed so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil in accordance with local and state regulations.

D. All personnel involved with construction activities must comply with state and local sanitary or septic system regulations. Temporary sanitary facilities shall be provided at the site throughout the construction phase for use by all construction personnel and shall be serviced by a commercial operator at least once a week.

E. Discharges resulting from groundwater dewatering activities at construction sites are permitted provided the groundwater is free of sediments, is not contaminated, and dewatering occurs in accordance with state and local governing agency regulations.

F. Chemicals, paints, solvents, fertilizers, and other toxic material must be stored in waterproof containers. Except during application, the contents must be kept in trucks or within storage facilities. Runoff containing such material must be collected, removed from the site, treated, and disposed at an approved solid waste or chemical disposal facility.

G. The discharge of hazardous substances or oil in the stormwater discharge(s) from a facility or activity shall be prevented. This does not relieve the operator of the reporting requirements of 40 CFR part 117 and 40 CFR part 302. The operator shall submit within 14 calendar days of knowledge of the release a written description of: the release (including the type and estimate of the amount

of material released), the date that such release occurred, the circumstances leading to the release, and remedial steps to be taken. The SWPPP must be modified within 14 calendar days of knowledge of the release to: provide a description of the release, the circumstances leading to the release, and the date of the release. In addition, the plan must be reviewed to identify measures to prevent the reoccurrence of such releases and to respond to such releases, and the plan must be modified where appropriate.

END OF SECTION

SECTION 01 37 00

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 PRELIMINARY SCHEDULE OF VALUES

A. Schedule Items

The apparent low bidder will prepare a preliminary schedule of values within the time frame referenced in the instructions to bidders. Each item in the schedule includes the complete structure; piping and valves (including pipe in the yard within 5 feet of the structure); equipment and local control panels furnished by equipment manufacturers. All electrical work will be included in the electrical item unless noted otherwise. All field instruments will be included in the instrumentation item. The preliminary schedule of values will include, but not limited to, the lump sums for the following items:

1. Mobilization

2. Demolition: This item includes all work related to demolition, removal, and abandonment of existing equipment, structures, yard piping and valves. Major items include the demolition of the existing 36,000 Gal GSR No. 1 steel tank, concrete slab for GSR No. 1, 30,000 Gal GSR No. 2 with aerator, concrete slab for GSR No. 2, existing HSP room and HSP's (including electrical components). Also includes demolition of the existing NaOCl tank, pumps and fiberglass housings and chlorine analyzer. Also includes demolition of the hydropneumatic tank.

3. Ground Storage Reservoir with aerator: This item includes all work related to the construction of a new 0.1 MG prestressed reinforced concrete storage tank with a dome roof, cascade tray aeration, influent and effluent piping, instruments, drain and overflow piping, interior ladder, exterior stairs, valves, sampler stations, hatch, coatings, and all appurtenances shown on the drawings and described in the specifications.

4. High Service Pump Building: This item includes a new CMU building with four (4) rooms, doors, concrete slab and foundation, coatings, HVAC, ventilation, monorail, and hollow core concrete roofing.

5. High Service Pumping: This item includes all work related to the installation of the new high service pumps, VFDs for new high service pumps, providing a spare pump, concrete slabs, and associated piping, valves and appurtenances.

6. Well Pump and Motors: This item includes all work related to the installation of the new flow meters, pressure transmitters, level transducers. Well pumps and motors will be installed by JEA

7. Sodium Hypochlorite Storage and Feed: This item includes all work related to the installation of the new storage chemical storage tank, new aluminum roof, concrete slabs, ramp, fill station, eyewash station, chemical feed pumps and skids, chemical piping, valves, injection wells and all appurtenances shown on the drawings and described in the specifications.

8. Emergency Power Generator and Fuel Tank: This item includes all work related to the construction of a new concrete generator pad and installation of a new stand-by generator, fuel tanks, fuel piping and valves, electrical gear, controls, and other appurtenances complete as shown in the drawings and specified herein.

9. Electrical: This item includes all the electrical work on the project including all motor control centers, conduit and wire, lighting, emergency power generation systems and fiber optic communication systems.

10. Instrumentation: This item includes all field instruments, PLC control panels and the complete Supervisory Control System including all control stations.

11. Yard Piping: This item includes all yard piping, valves and backflow preventers, metering stations, all other in-ground facilities and above ground piping facilities not specifically included with any of the other items included in the schedule.

12. Site Work: This item includes demolition, mobilization, demobilization, concrete, start-up, asset management, grading, paving, drainage, sidewalks, driveways,

storm water drainage structures, gravel filling retention pond, building, O&M Manuals, As-builts and site restoration.

13. Asset Management: This item includes contractor submission of completed Asset Management tables in accordance with JEA requirements.

14. Start-up: This item includes all testing and start up services.

15. O&M Manuals: This item includes submission of O&M Manuals, in compliance with the this technical specifications manual.

16. Asbuilts: This item includes submission of as-builts in ACAD 2012 format.

17. Demobilization

B. Bid Breakdown

1. Submit to the OWNER'S REPRESENTATIVE a breakdown of all lump-sum bid items into the major and minor portions of work and include material and equipment costs. The breakdown shall be by Process area and specification division within each Process area. The breakdown shall be done in accordance with a form established by the Contractor and acceptable to the Owner.

2. This breakdown shall be the basis of all progress payments. Fill in amounts or quantities where unit quantities are shown, i.e., L.F., C.Y., S.F. The Contractor may submit an alternate form, providing it is at least as detailed as the enclosed form.

3. Form:

				CONTRACT			THIS MONTH		TO DATE	
Activity No.	PROCESS NO.	SPEC DIV	DESCRIPTION	QTY	NIT PRICE	TOTAL COST OF ITEM	QTY	AMOUNT THIS MONTH	QTY	TOTAL COST OF ITEM

1.02 FORM & CONTENT OF SCHEDULE OF ASSET VALUES

A. A spreadsheet will be provided that includes the assets to be accounted for in the Schedule of Asset Values.

B. For each asset listed, provide a constructed cost which will include an allocation of construction activities including, but not limited to, demolition, sitework, specialties, materials, labor, general conditions, and overhead and profit associated with the construction of the asset.

C. The combined value of the assets will equal the bid price for the project, and will require adjustments as necessary due to change orders. The schedule of asset values will be updated on a monthly basis and will be included in the monthly pay request application for approval.

D. The OWNER reserves the right to edit this list prior to the first pay request application, and may add up to 10 percent more items than have been identified on the attached list.

END OF SECTION

SECTION 01 41 26

PERMITS AND FEES

1.01 GENERAL

A. Obtain and pay for all permits and licenses as provided for in the General Conditions, except as otherwise provided herein.

B. Schedule all inspections and obtain all written approvals of the agencies required by the permits and licenses.

C. Comply with all conditions specified in each of the permits and licenses.

D. A copy of the permits obtained by the Owner will be furnished to the Contractor.

2.01 PERMITS BY OWNER

A. The Owner will obtain and pay for the following permits:

1. Florida Department of Environmental Protection (FDEP) Application for a specific permit to construct PWS components.

2. St. Johns River Water Management District (SJRWMD) Environmental Resource Permit (ERP) letter modification.

3. Nassau County:

a. Nassau County Building Department Permit – The Owner will make the preliminary submittal for review and comments. The contractor will be responsible for obtaining, coordinating, and paying for the final permit.

b. Nassau County variance for sidewalk

c. Nassau County Site Engineering Plan Approval

B. Permits by Contractor

1. The Contractor will coordinate and JEA will pay the utility fees for a new JEA water meter, new and modified FPL electric services and/or power distribution lines.

2. The Contractor will obtain, coordinate, and pay for all other permits including Florida Department of Environmental Protection (FDEP) Stormwater Notice of Intent, site dewatering, Nassau County Building permit including demo, mechanical, electrical and other trade permits, Nassau County site work, right-of-way, and driveway permits.

3. If dewatering is required, the Contractor shall coordinate with the St. Johns River Water Management District regarding the applicable rules and regulations. If a dewatering permit is required, the Contractor shall prepare an application to the District and pay any fee.

END OF SECTION

SECTION 01 45 00

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Contractor will contract with, provide and pay for the services of an independent testing laboratory to perform certain specific testing as required by the Contract Documents, specified in the Specifications; or as specified here-in. This testing will include:

1. Field Density Tests, Concrete Test Cylinders, Grout Prisms, Mortar Cubes, Limerock Bearing Ratios, Grain Size Analysis, and Moisture-Density Relationships (Proctor).
2. JEA will provide the water for leakage testing of the new 100,000 gallon Ground Storage Reservoir.

This testing does not include tests required to prove satisfactory operation of equipment or materials, pressure leakage and infiltration/exfiltration tests, bacteriological tests, or any tests specified to be made by the Contractor. Testing of pipe material and pipe, proof of design tests, pressure tests and bacteriological testing are specified in other sections of the Specifications and are the responsibility of the Contractor. Any and all tests which have to be repeated because of the failure of the tested material to meet Specifications shall be paid for by the Contractor and the costs of any such retests shall be deducted from payments due the Contractor. JEA will be responsible for taking and analyzing water samples for bacteriological clearance. The Contractor shall be responsible for cleaning and chlorinating all components and providing a means for JEA to take water samples as required.

The results of all the testing reports shall be copied to the Contractor and the Owner.

1.02 LABORATORY DUTIES: LIMITATIONS OF OWNER

A. The laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the work.

1.03 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall:

1. Cooperate with laboratory personnel, and provide access to the Project.

2. Secure and deliver to the laboratory adequate quantities of samples of materials that are representative of the whole of the material proposed to be used and which require testing.

3. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes that require control by the testing laboratory.

4. Furnish incidental labor and facilities:

   a. To provide access to Project to be tested.

   b. To obtain and handle samples at the Project site or at the source of the product to be tested.

   c. To facilitate inspections and tests.

   d. For storage and curing of test samples.

B. The Contractor shall notify in writing the Owner and the Testing Laboratory in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. When tests or inspection cannot be performed after such notice, the Contractor shall reimburse the Owner for laboratory personnel and travel expenses incurred due to Contractor's failure to adequately provide such notice.

C. The Contractor shall employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience.

D. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefore, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval.

E. CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with OWNER's or ENGINEER's acceptance of a Supplier of materials or equipment proposed to be incorporated in the

Work, or of materials or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work.

F. All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to OWNER and CONTRACTOR.

G. If any Work (including the work of others) that is to be inspected, tested or approved is covered without written concurrence of Owner's Representative, it must, if requested by ENGINEER, be uncovered for observation. Such uncovering shall be at CONTRACTOR's expense unless CONTRACTOR has given Owner's Representative timely notice of CONTRACTOR's intention to cover the same and Owner's Representative has not acted with reasonable promptness in response to such notice.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 45 10

QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

Quality control, quality assurance

1.02 QUALITY CONTROL

A. It is the Contractor's responsibility to perform all work to a degree and in a manner that satisfies and complies with the Project requirements. In order to fulfill this responsibility, the Contractor is required to have an approved Quality Control Program, including testing, as part of his Contract work in accordance with the Contract Documents and to submit details of his Program to the Engineer for review and approval prior to commencing any construction operations. The submittal shall include detailed information on locations and number of all tests, etc., that will be necessary for the Contractor to make his own determination that the work is being performed in compliance with the Project requirements.

B. As part of the Contractor’s Quality Control Program included as part of his work, the Contractor shall employ and pay for an independent, approved soils testing laboratory to perform testing services outlined in these Contract Documents.

C. The Contractor's Quality Control Program shall include, but not be limited to, the following in addition to the type and frequency of tests as required by the technical specifications:

1. Piping and structural excavation, bedding and backfill materials and density quality control testing.

2. Determination of compactive effort needed for compliance with the density requirements.

3. Portland cement concrete and asphalt paving quality control testing including design mix review, materials, field slump and air content, and field and lab cured strength samples and testing.

D. In addition to Quality Control Testing, the Contractor shall be responsible for required testing or approvals for any work (or any part thereof) if laws or regulations of any public body having jurisdiction specifically require testing, inspections or approval. The Contractor shall pay all costs in connection therewith and shall furnish the Engineer the required certificates of inspection, testing or approval. The Contractor shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with Owner or Engineer acceptance of a supplier of materials or equipment proposed to be incorporated into the work.

E. Any design or testing laboratory utilized by the CONTRACTOR shall be an independent laboratory acceptable to the OWNER and the ENGINEER, approved in writing, and complying with the latest edition of the "Recommended Requirements for Independent Laboratory Qualification", published by the American Council of Independent Laboratories.

F. Testing laboratories, whether provided by the OWNER or the CONTRACTOR, shall promptly notify the ENGINEER and the CONTRACTOR of irregularities or deficiencies of work, which are observed during performance of services. Laboratories shall submit two (2) copies of all reports directly to the ENGINEER and two (2) copies to the CONTRACTOR.

1.03 QUALITY ASSURANCE

A. In addition to the services provided by the laboratory paid for by the Contractor as a part of his work, the Owner, at his sole discretion, may employ an additional independent soils laboratory as part of Owner's Quality Assurance Program to verify that the work meets the requirements of the Contract Documents. The Owner furnished Quality Assurance testing may include the type and frequency of tests as required by the technical specifications. The Owner reserves the right to have additional tests made beyond those specified in the Contract Documents. The Contractor shall cooperate with the Owner and make the work and samples available for Owner testing at no additional cost in case the Owner chooses to have additional Owner furnished testing performed. It is the sole responsibility of the Contractor to see that his work meets all provisions of the Contract Documents.

B. The CONTRACTOR shall cooperate with the soils laboratory personnel and provide access to the work to be tested. The CONTRACTOR shall notify the Engineer and Owner's testing laboratory sufficiently in advance of operations to allow scheduling of tests. The CONTRACTOR shall furnish casual labor and facilities to obtain and handle samples at the site and to store and cure test samples as required.

1.04 TESTING OF MATERIALS

A. Unless otherwise specified, all materials shall be sampled and tested in accordance with the latest published standard methods of ASTM in effect at the time bids are received. If no ASTM Standards apply, applicable standard methods of the Federal Government or of other recognized agencies shall be used.

B. Test of materials shall be made by a representative of the Contractor, unless otherwise provided. Testing of equipment shall be the responsibility of the CONTRACTOR or an authorized manufacturer's representative. All test results shall be furnished to the ENGINEER in writing. The CONTRACTOR shall provide facilities required to collect and forward samples. The CONTRACTOR shall furnish the required samples without charge.

C. The CONTRACTOR shall not make use of or incorporate in the work, the materials represented by the sample until tests have been made and the material found to be in accordance with the requirements of the Specifications.

D. Materials to be tested and the applicable test procedure shall be as outlined in the individual sections of these Specifications.

1.05 SOURCE AND QUALITY OF MATERIALS AND EQUIPMENT

A. The source of materials to be used shall be in accordance with the Contract Documents and as approved by the ENGINEER before delivery. The approval of the source of any material shall continue as long as the material conforms to the Specifications.

B. All material not conforming to the requirements of the Specifications shall be considered as defective and shall be removed from the work. If in place, faulty materials shall be removed by the CONTRACTOR at his expense and replaced

with acceptable material unless permitted otherwise by the OWNER. No defective materials which have been subsequently corrected shall be reused until approval has been given.

C. Upon failure of the CONTRACTOR to comply immediately with any order of the ENGINEER to remove and replace defective material, the OWNER shall have authority to remove and replace defective materials, and to deduct the cost of removal and replacement from any monies due or to become due to the CONTRACTOR. Failure to reject any defective materials or work at the time of installation shall in no way prevent later rejection when such defects are discovered, nor obligate the OWNER to final acceptance.

1.06 ADDITIONAL TESTING

A. In addition to soils laboratory and materials testing, the Contractor shall perform other testing called for in the Contract Documents including but not limited to piping, pressure, leakage, infiltration and exfiltration, as appropriate. Bacteriological samples will be taken and tested by JEA, however the Contractor is required to clean and chlorinate and provide sample points.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 51 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

Construction facilities, controls, temporary utilities, project identification signs, field office and storage sheds, storage of materials and equipment

1.02 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

A. Responsibility

All construction facilities and temporary controls remain the property of the CONTRACTOR establishing them and shall be maintained in a safe and useful condition until removed from the construction site.

B. Temporary Electric Service: CONTRACTOR shall coordinate with the power company for temporary power at no cost to JEA.

C. Temporary Heating (NOT USED)

D. Temporary Ventilation (NOT USED)

E. Temporary Telephone

1. The CONTRACTOR shall provide the site superintendent with a mobile phone or radio so that he can be reached at all times.

F. Temporary Water

1. There is potable water facilities in the immediate area of proposed construction and the Contractor will coordinate with JEA to obtain a meter for any potable water needs during the project.

2. As may be necessary, the Contractor shall provide a water truck for all necessary water during construction.

G. Temporary Sanitary Facilities

Provide temporary toilet facilities as required. Maintain these during the entire period of construction under this Contract for the use of all construction

personnel on the job. Enough chemical toilets shall be provided to conveniently serve the needs of all personnel. Chemical toilets and their maintenance shall meet the requirements of State and local health regulations and ordinances.

H. Temporary Pumping and Site Drainage

The CONTRACTOR shall keep the site free from water at all times to permit continuous access and to prevent damage to the work.

I. Material Hoists and Cranes

1. Provide material hoists required for normal use by all trades and employ skilled hoist operators. Provide all necessary guards, signals, safety devices, etc., required for safe hoist operation. The construction and operation of material hoists shall be in accordance with the applicable ANSI Standards, the "Manual Code of Accident Prevention in Construction" of the Associated General Contractors of America, OSHA, and of other Federal, State, and municipal codes or ordinances. The CONTRACTOR shall prohibit the use of hoists for transporting personnel. Hoists shall be located to avoid risk of damage to completed work.

2. Special rigging and hoisting facilities shall be provided by each trade requiring their use.

J. Temporary Runways, Scaffolding, and Ladders (NOT USED)

K. Temporary Chutes (NOT USED)

L. Security

Full time watchmen will not be specifically required as a part of the Contract, but the CONTRACTOR shall provide inspection of work area daily and shall take whatever measures are necessary to protect the safety of the public, workmen, and materials, and provide for the security of the site, both day and night.

M. Access Roads and Parking Areas

The CONTRACTOR shall maintain all access roads and parking areas. The contractor shall ensure all accesses to existing homes, drives, and streets are unobstructed throughout construction.

N. Dust and Mud Control

Take all necessary precautions to control dust and mud associated with the work of this Contract, subject to the approval of the ENGINEER. In dry weather, spray dusty areas daily with water or weekly with oil in order to control dust. Take necessary steps to prevent the tracking of mud onto adjacent streets and highways.

O. Traffic Regulation (NOT USED)

P. Project Identification Signs

1. As soon as practicable after award of contract, furnish and erect two signs for the project, placed at locations determined by OWNER. Signs shall be erected when the work is started and shall be suitably supported, braced, and maintained, and shall be removed upon completion of the project or when directed by the OWNER.

2. The signs shall be identical and shall state the title of the project and the names of the OWNER, ENGINEER and the CONTRACTOR. Submit to the OWNER for approval the proposed sign lettering (fonts, size) and text prior to fabricating the signs.

3. The sign shall be 1" exterior grade plywood. All surfaces shall be painted with three coats of white exterior grade paint and neatly painted black letters.

4. No other signs will be permitted.

Q. CONTRACTOR's Field Office and Storage Sheds

The CONTRACTOR shall provide field office and storage sheds as required for the performance of the Work and protection of materials and equipment.

R. OWNER / ENGINEER Field Office (NOT USED)

S. Removal of Temporary Construction

Remove the various temporary facilities, services, and controls and legally dispose of them as soon as the ENGINEER deems permissible. Portions of the site used for temporary facilities shall be properly reconditioned and restored to a condition acceptable to the ENGINEER.

1.03 MATERIALS AND EQUIPMENT

A. Transportation and Handling

1. Manufactured materials and products shall be delivered to the project site as needed for installation, undamaged, in original packages, containers, or bundles, as packaged by the manufacturer with manufacturer's name, brand, seals, and labels intact.

2. Materials other than those designated within the Specifications or approved by the ENGINEER shall not be delivered to the project site.

B. Storage and Protection

The CONTRACTOR shall be responsible for protection and preservation of all materials until final acceptance of the Project. Any damage to work prior to acceptance shall be remedied by the CONTRACTOR at no additional cost to the OWNER.

C. Protection of Completed Work

Provide temporary weather-tight enclosures to protect work from damage by the elements, and protect finished surfaces to prevent any damage resulting from the work of any trade.

1.04 SUBMITTALS

A. Prior to installation of construction facilities and temporary controls, submit the following items for review and approval:

1. Project identification sign - provide proposed text, layout, and sizing of all required signs.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 74 23

CLEANING UP

PART 1 GENERAL

1.01 SUMMARY

A. Execute cleaning during progress of Work and at completion of Work.

B. Refer to specification sections for specific cleaning for Products or Work.

1.02 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with local codes, ordinances, regulations, and anti-pollution laws. Do not burn or bury rubbish or waste materials on Project site. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to property and persons or damage surfaces of material to be cleaned.

B. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

PART 3 EXECUTION

3.01 CLEANING DURING CONSTRUCTION

A. At all times maintain areas covered by the contract and adjacent properties and public access roads free from accumulations of waste, debris, and rubbish caused by construction operations.

B. During execution of work, clean site, adjacent properties, and public access roads and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish. Unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

C. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

D. Cover or wet excavated material leaving and arriving at the site to prevent blowing dust. Clean the public access roads to the site of any material falling from the haul trucks.

E. Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipes structures, work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the work, and the ditches, channels, drains, pipes, structures, and work, etc., shall, upon completion of the work, be left in a clean and neat condition.

F. On or before the completion of the work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

G. Provide on-site containers for collection and removal of waste materials, debris, and rubbish in accordance with applicable regulations.

3.02 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

g. Sweep concrete floors broom clean in unoccupied spaces.

h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.

j. Remove labels that are not permanent.

k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.

p. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in JEA's Solicitation Documents.

D. Electrical Contractor shall touch-up paint or repaint damaged finishes on electrical items delivered to Project with finish coat of paint. Owner's Representative will make final determination of items to be repainted or touched-up.

E. Prior to substantial completion or Owner occupancy, Contractor with Owner's Representative and Owner**,** shall conduct inspection of sight-exposed interior and exterior surfaces and work areas to verify Work and site is clean.

3.03 CLEANING AND DISINFECTION OF CONCRETE TANKS

A. Clean thoroughly, using water under pressure, before disinfecting.

1. Isolate reservoir from system to avoid possibility of contaminating materials entering distribution system.

2. Cleaning shall:

a. Remove deposits of foreign nature.

b. Remove growths.

c. Broom walls, floor, and ceiling.

d. Avoid damage to structure.

e. Avoid contamination by workers and equipment.

3. Water used in cleaning reservoir shall be wasted before adding chlorinating agent to reservoir.

3.04 CLEANING OF WASTEWATER TANKS

A. Wet wells, tanks, and basins shall be washed down and swept before wastewater or process wastes are allowed to enter.

END OF SECTION

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SECTION 01 78 00

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

Substantial completion requirements, clean-up, final completion requirements, closeout submittals

1.02 CLEAN-UP OPERATIONS

A. The entire project site shall be thoroughly cleaned at the completion of the work.

B. The CONTRACTOR shall be responsible for the removal of excess dust and mud created by the construction project from all sidewalks, streets, and highways as directed by the OWNER. Equipment to clean these surfaces shall be subject to approval by the OWNER.

1.03 SUBSTANTIAL COMPLETION REQUIREMENTS

A. Complete the following before requesting the inspection for certification of substantial completion.

1. Submit as-built drawings.

2. Deliver tools, spare parts, extra stocks of material and similar physical items to the Owner.

3. Complete required cleaning and testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the project site, along with construction tools and facilities, mock-ups, and similar elements.

4. Complete final cleaning up requirements, including touch-up painting of marred surfaces.

5. Touch-up and otherwise repair and restore marred exposed finishes.

B. Work is not substantially complete until regulatory agency letters of clearance for placing systems into service are received by the Owner.

1.04 CLOSEOUT SUBMITTALS

A. Upon completion of the project, or portions thereof, the CONTRACTOR shall transfer to the OWNER all applicable items accumulated throughout construction. These include but are not limited to the following items:

1. Service manuals, installation instructions, special tools, and specialties.
2. Spare parts ordered as part of this Contract.
3. Submittal of the Material and Workmanship Bond.
4. Submittal of manufacturers' guarantees, bonds, and letters of coverage extending beyond the time limitations of the CONTRACTORS' guarantee.
5. Delivery of any salvaged or borrowed materials or equipment to the OWNER.
6. Record documents of completed facilities.
7. All keys to all doors, gates, and equipment.
8. Checklist indicating satisfactory completion of all unfinished items from the final inspection.
9. Waivers of lien.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 78 25

PLANT TESTING, STARTUP AND COMMISSIONING

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide planning, and functional completion testing, as indicated and specified. Section includes:

1. Plant Checkout Plan

2. Functional Completion Testing including coordination with the Vendors for them to provide their services as contracted by the Owner.

B. It is intended that the Owner will perform its own startup and commissioning of the final improvements at the Otter Run WTP after the control panels (provided by the Contractor) are completed and installed by JEA, however the Contractor shall be responsible for testing the functionality of each new component being furnished and installed by the Contractor. Contractor shall assist JEA with the overall plant startup once the control panels are completed.

1.02 DEFINITIONS

A. The Plant Checkout Plan (the Plan) incorporates all aspects of functional completion testing, startup, commissioning, performance testing, training, and reliability tests to ensure the facility operates properly and meets design intent and performance.

B. Functional Completion Testing is testing of the equipment and unit process systems to confirm that construction and installation has been completed in anticipation of initial startup of the equipment and unit process systems. Functional Completion Testing includes:

1. Physical Checkout shall be defined as the process of physically inspecting products after they have been installed in the Work to determine if the Products have been properly and completely installed, and are ready for Field and/or Functional Testing. The requirements for Physical Checkout are contained in the pertinent technical specification(s) (if applicable).

2. Field Testing shall be defined as testing that is performed by the Contractor, with Supplier assistance, on Products after they have been installed in the Work, and after the performance of physical checkout, for the purpose of proving that the tested Products meet the requirements of the pertinent technical specifications. Administrative and minimum technical requirements for field testing are specified in Paragraph herein, while additional technical requirements are contained throughout the technical specifications. The test criteria are specified herein.

C. For the purposes of this specification, Startup shall be defined as the operation of equipment or unit process systems using clean water, air, or other fluids and gases as necessary to demonstrate the operation of the equipment or unit process systems with other equipment that is a part of, or a treatment process for the Facility. Administrative and minimum technical requirements for startup are specified herein. It is the Owner's intent to conduct the Start-up of the project, however, this does not release the Contractor from responsibilities to have the equipment totally prepared for the start-up.

D. For the purposes of this specification, Commissioning shall be defined as the operation of equipment or unit process systems using process liquids or process solids, plant support equipment, and plant utilities to demonstrate equipment or unit process systems are capable of processing water at specified flows and conditions for a sustained period of operation as required by this section or equipment or unit process systems specifications. Successful Commissioning shall determine that the equipment or unit process systems are ready to begin Performance Testing. Administrative and minimum technical requirements for Commissioning are specified herein, while additional technical requirements are contained throughout the technical specifications. It is the Owner's intent to conduct the Commissioning of the project; however, this does not release the Contractor from responsibilities to have the equipment totally prepared for the commissioning.

E. Performance Testing is defined as a test to demonstrate the specified throughput of the equipment and unit process systems while maintaining regulatory compliance with Federal, State, and Local government regulations and minimum compliance with the equipment or unit process systems performance requirements and guarantees.

F. The Testing and Checkout Coordinator shall be defined as the person provided by the Contractor to coordinate and oversee the total spectrum of testing and inspection activities required by the Contract Documents. The Testing and Checkout Coordinator

shall have been in responsible charge of two similar Projects in the last four to six years.

1.03 ROLES AND RESPONSIBILITIES

A. The Contractor shall provide all outside services, materials, labor, supplies, test equipment and other items necessary to perform the Plant Testing, Startup and Commissioning as specified herein. In addition, the Contractor shall arrange for and provide the participation or assistance of survey crews, quality control technicians, and required governmental agency representatives.

B. The Owner had contracted for certain Supplier's representative's activities to assist with installation, for vendor training and other services. This information will be provided to the General Contractor. Timing for the performance of these services is to be defined in the Contractors Checkout Plan, specified herein.

C. The Owner will review and comment on the Contractor's deliverables, participate in the physical inspection activities, witness the shop and field testing, witness functional testing, maintain the permanent record of all testing results, and provide verification of conformance to the specifications. The Owner's right to perform inspections, witness tests or monitor or assess the Work and activities does not relieve the Contractor of its obligation to comply with the requirements of the Contract Documents nor does it imply completion of the Work.

1.04 SUBMITTALS

A. Submit the following shop drawings in accordance with Section 01 33 00.

1. Submit a Plant Checkout Plan.

1.05 PLANT CHECKOUT PLAN

A. The Contractor shall be responsible for preparing, coordinating, and executing the Plan.

1. The Contractor shall use the resources of the equipment and unit process systems suppliers in this work, particularly for specific equipment and unit process systems.

2. An initial draft of the Plan shall be submitted as indicated here:

a. The initial draft Plan for the Facility shall be completed and submitted by the Contractor to the Owner for review as defined in Section 01 33 00.

b. The Contractor shall incorporate the Owner's comments into the revised Plan within 30 days of receiving comments, and reissue the Plan to the Owner.

c. The Contractor shall regularly schedule meetings with the Owner to review and coordinate activities required by the Plan.

B. The Plan shall define:

1. The logical and systematic performance of physical inspections, field and functional tests, including:

a. A chronological schedule of all testing and inspection activities.

b. A checklist of all inspection and testing activities broken down by location, discipline, system, and device or item.

c. All blank forms proposed by the Contractor for verification or recording of the functional completion testing**.**

d. An index which cross references the forms to their intended application(s).

e. A list of all supplier certifications, including those required by the applicable technical specifications. Provisions shall also be included for retesting, in the event it is required.

2. A list of participants in functional completion testing, startup, commissioning, and performance testing**.**

3. A list of special test equipment required for functional completion testing, startup, commissioning, and performance testing.

4. Sources of the test media (water, power, air.) for functional completion testing.

5. The proposed method of delivery of the media to the equipment to be tested during functional completion testing.

6. Temporary or interim connections for the sequencing of multiple units during functional completion testing.

7. Ultimate disposal of the test media after functional completion testing,

C. The plan shall be reviewed by the Owner, modified or revised as necessary by the Contractor, then re-reviewed by the Owner. The Contractor shall continue to update the Plan, working in conjunction with the Owner, prior to the start of the scheduled equipment checkout and functional testing activities as specified in Paragraph 1.08 herein. Each specific element of the plan must receive review or comment by the Owner, two weeks prior to the actual commencement of testing as defined herein.

D. The Contractor shall designate, in the Plan, a Testing and Checkout Coordinator, to coordinate and manage the activities defined in the Plan.

1.06 FUNCTIONAL COMPLETION TESTING

A. Functional Completion Testing shall be completed as construction and installation of equipment is completed to demonstrate that the equipment is ready for equipment and unit process systems startup.

1. Functional Completion Testing shall be done in a coordinated manner based on the Plan prepared by the Contractor.

    a. The Owner's operating and maintenance staff shall be allowed to observe and as necessary lead for the purposes of familiarization and training.

    b. Additional witnesses, such as the Engineer, may be present to represent the Owner.

2. Functional Completion Testing procedures and documentation forms shall be developed by the Contractor. The procedures shall include a listing of items inspected for Functional Completion Testing.

3. If any equipment or unit process systems do not meet Functional Completion Testing requirements, it shall be the responsibility of the Contractor and/or equipment suppliers to make the necessary corrections or replacements and repeat the test.

4. The equipment and unit process systems shall not be started up or put into service until the Functional Completion Testing is completed as evidenced by a completed Functional Completion Testing certificate for the equipment or subsystem.

5. Modifications to the equipment and unit process systems required to meet Functional Completion Testing requirements shall be provided, and all retesting shall be performed at no additional cost to the Owner.

6. A Functional Completion Testing Certificate shall be prepared by the Contractor for each piece of equipment or unit process and submitted to the Owner for review.

1.07 STARTUP

A. Startup activities for the Facility shall not be initiated until the requirements of Functional Completion Testing are completed for the equipment or unit process systems and have been documented by the General Contractor.

B. The requirements of this section shall be satisfactorily completed prior to beginning Commissioning for equipment and unit process systems.

1. It is intended that the Owner's operating and maintenance staff shall lead the startup activities and the Contractor's staff shall be available to assist for the purposes of familiarization and training.

2. Additional witnesses, such as the Engineer, may be present to represent the Owner.

C. For equipment or unit process systems that do not meet the specified Startup requirements, it shall be the responsibility of the Contractor and/or equipment or unit process systems suppliers to make the necessary corrections or replacements and repeat Startup at no additional cost to the Owner.

D. Startup Reports for each piece of equipment or unit process shall be completed and submitted by the Contractor to the Owner for review as defined in Section 01 33 00.

E. The Owner and the Contractor shall not begin Commissioning until Startup certificate is completed and is submitted.

1.08 COMMISSIONING

A. Commissioning activities for the Facility shall not be initiated until the requirements of Startup are completed for the equipment or unit process systems.

B. The requirements of this section shall be satisfactorily completed prior to beginning Performance Testing for equipment and unit process systems.

C. Commissioning shall be used by the Owner and equipment or unit process suppliers to adjust, fine tune, modify and prepare the equipment or system for continuous operation and Performance Testing.

1. Equipment shall not be operated without the guidance of qualified personnel having the knowledge and experience necessary to conduct proper operation thereof and obtain valid results.

2. All required adjustments, tests, operation checks, and Startup and Commissioning activities shall be provided by qualified personnel.

3. The Owner/Owner's operating and maintenance staff shall be responsible for coordinating the Startup and Commissioning of the equipment and unit process systems with the assistance of the Contractor and of equipment or unit process systems suppliers with the Owner in accordance with the Plan.

4. Additional witnesses, such as the Engineer, may be present to represent the Owner.

D. For equipment or unit process systems that do not meet Commissioning requirements, it shall be the responsibility of the Contractor and/or equipment or unit process systems suppliers to make the necessary corrections or replacements and repeat Commissioning at no additional cost to the Owner.

E. The equipment or unit process systems shall not be Performance Tested or otherwise placed into service until Commissioning is completed as evidenced by a completed Commissioning certificate for the equipment or unit process systems.

F. Commissioning Certificates for each piece of equipment or unit process shall be completed and submitted by the Contractor to the Engineer and Owner for review as defined in Section 01 33 00, Table 01 33 00-1.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.01 PLANT CHECKOUT PLAN

A. The Plan shall include the following items as a minimum:

1. Cover Sheet with Plant identification, title, date and other information as needed to properly identify the specific information for the Facility.
2. Status and revisions sheet with appropriate dates and signatures spaces to document the development and status of the document.
3. Table of Contents including Appendix.
4. Equipment and systems descriptions with anticipated break down for individual startup activities. This section shall define the individual “packages” for startup activities for the equipment or unit process systems.
5. Schedule of events for startup and other activities covered by the Plan.
    a. The schedule shall define dates for completing activities for equipment and unit process systems.
    b. The schedule shall be the Contractor’s best estimate of time sequence at the time of issuance.
    c. The Contractor shall submit monthly schedule updates to the Plan.
    d. The schedule shall follow the required sequencing as specified herein.
6. Sign-off sheets consisting of certification forms or completion reports required by the specifications shall be included in the Plan. Standard forms shall be developed by the Contactor for this purpose.
7. Reports, test results and other supporting data shall be collected by the Contractor for documentation of the specific details leading to the certification or completion.

B. Following shall be the sequence for completing functional completion testing, and subsequent startup, commissioning and performance testing activities required by the Plan.

1. Sodium Hypochlorite Feed System
2. Controls
3. High Service Pumps
4. Ground Storage Reservoir No. 1

C. Any variation in the startup sequence deemed necessary by the Contractor shall be reviewed by the Owner prior to changing the sequencing.

D. Prior to Functional Completion Testing the Contractor shall have performed the following preliminary matters.

1. Conduct (or have previously conducted, whichever is appropriate) all field inspections as defined in the individual sections of the Specifications, installation checks, hydrostatic tests, performance tests, and perform any corrections required.

2. Demonstrate that individual components of the completed work have been properly installed and operate in accordance with the Contract Documents, and that they are ready to be utilized for their intended purposes.

3. Remove all electrical jumpers, bypasses or other items connected to the equipment that are not intended to remain in the Facility and are not required by the Specifications.

4. Confirm that all electrical circuits are energized in the manual position, that valves and gates are set to their normal position and that flow through the completed work is unobstructed.

5. Install required temporary piping connections/facilities for supplying, circulating, and disposing of test water.

3.02 FUNCTIONAL COMPLETION TESTING

A. Provide 30 days written notice to the Owner for each functional completion test so that the Owner may witness the functional completion tests. The Owner may witness the performance of any or all functional completion testing, at their option.

B. Testing shall be conducted in accordance with the accepted Plan using applicable standard techniques reviewed by the Owner.

1. Local and remote instrumentation may be used to record test data where it is determined the devices have been calibrated and sufficient to obtain necessary data.

C. The Contractor shall develop standard data sheets to document Functional Completion Testing requirements have been met for all equipment and unit process systems included in the Plan.

1. As equipment testing is completed the appropriate data sheet shall be completed and signed by the responsible party and submitted to the Owner for review and acceptance.

2. Data values shall be stated in the engineering units noted in the equipment specifications.

D. A detailed Functional Completion Test plan shall be prepared and submitted to the Owner for review and comment.

1. The plan shall be prepared by the Contractor in conjunction with the equipment or subsystem supplier and shall become a part of the overall Plan.

E. In the event no reference to procedures is made, or no procedures for startup and commissioning are contained in a technical specification for the following test parameters, the following shall be the checkout requirements. Should these requirements conflict with the Supplier's recommendations or in any way be less stringent than the Supplier's requirements, they shall be superseded by the Supplier's requirements for checkout testing.

1. Measurement of wearing ring clearances for all pumps requiring assembly, so equipped:

a. Take two readings taken opposed to each other by 90 degrees.

b. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck rings found to be out of round or out of specified tolerance.

2. Measurement of Impeller Bore for all pumps requiring assembly:

a. Take two readings opposed to each other by 90 degrees.

b. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck impellers found to be out of round or out of specified tolerance.

3. Measurement of shaft runout for all rotating equipment requiring assembly:

a. Remove bearings from the shaft. Support shaft on pedestal rollers or in a lathe.

b. Check each shoulder on the shaft.

c. Take two readings for each shoulder, opposed to each other by 90 degrees.

d. All measured clearances shall be within Supplier's specifications for new installations. Replace and recheck shafts found to be out of round or out of specified tolerance.

4. Vibration Measurements:

a. Provide vibrational signature testing and documentation for each piece of direct drive or close coupled rotating equipment with a motor HP of 100 or above and a rated operating speed in excess of 1999 RPM.

b. Unless specified otherwise, the current edition of the Hydraulic Institute Standard, "Acceptable Field Vibration Limits" shall be the standard for vibrational testing.

c. Take all specified vibrational readings in three directions: vertical, horizontal, and axial.

d. Provide vibrational measurements in the following engineering units:

(1) Displacement in thousandths of an inch (mils), peak to peak.

(2) Velocity in inches per second (ips), peak to peak.

(3) Acceleration in feet per second per second (lg=32.3 ft/sec./sec.) zero to peak.

(4) Spike energy in g-SE.

(5) The vibrational readings shall be less than the device rotating frequency, and within the operating band specified by the Supplier.

(6) Amplitude Allowable Maximums:

RPM	**Amplitude inches peak to peak:**
3,000 and above	0.001
1,500 - 2,999	0.002

RPM	Amplitude inches peak to peak:
1,000 - 1,499	0.0025
999 and below	0.003

5. Belt Drives:

    a. All belts shall ride within the sheave and not slip to the bottom of the groove(s).

    b. Belt tension shall be in accordance with Supplier's recommendations.

    c. Pulley alignment shall be within Supplier's recommendations.

6. Gear Drives and Reducers:

    a. Check gears for lash at no less than three points around the gear.

    b. Rotate gears a full 360 degrees while checking alignment.

7. Coupling/Shaft Alignment:

    a. Perform all final alignments and checks with a dial indicator or a laser device. Feeler gauges and straight edges are not acceptable.

    b. Eliminate soft foot conditions prior to aligning.

    c. When checking for final soft foot, any displacement in excess of 0.002" must be corrected.

    d. When checking for pipe strain, any displacement in excess of 0.002" requires piping realignment.

    e. Alignments will not be regarded as final until the grout is set and all piping has been attached. Demonstrate that alignment is not changed by attachment of piping.

    f. Shim the driving element, never the driven element.

    g. Take bracket sag corrections into account when using a dial indicator. Bracket sag shall be determined on a rigid pipe.

    h. Mount a dial indicator to the driven element so that it can be rotated. Rotate both elements while aligning.

i. When aligning three coupled elements, align gear reduction elements with the driven element first, then align the driver to the gear reduction element.

j. Check all four alignments, i.e., angular alignment in the vertical and horizontal planes, and parallel alignment in the vertical and horizontal planes.

k. The acceptable alignment accuracy for flexible couplings is +0.005 inches, or the Supplier's specifications, whichever is more stringent.

l. The dial indicator must be perpendicular to the alignment surface.

m. Number hold down nuts prior to tightening. Loosen in reverse order. Tighten in ascending order.

n. Use only clean, deburred shims. Clean the machine base and feet from rust or burrs prior to alignment.

8. Measurement of Noise (dB):

a. Eliminate noise sources generated by adjacent construction activity prior to testing.

b. Establish a background noise level prior to testing.

c. Perform noise level testing on each installed device as required by the technical specifications.

d. The maximum noise level exposure is 75 dBA over eight hours continuous for office, shop, and other areas where the Owner's personnel will be performing their assigned duties.

9. Hydrostatic Testing:

a. AWWA C600 standards latest edition are the standards for all hydrostatic testing.

b. Visually inspect all welds prior to testing, for cracks, undercut on surface greater than 1/32-inches deep, lack of fusion on surface, reinforcement greater than Table 127.4.2 located in ANSI B31.1 Power Piping, and incomplete penetration (when accessible). Repair or rework as directed by the Owner’s Representative.

c. At no time during hydrostatic testing shall any part of the piping system be subjected to a stress greater than 90 percent of its yield strength at test temperature.

d. After 10 minutes of full hydrostatic test pressures, make an examination for leakage of all joints, connections, and all regions of high stress, such as around openings and thickness transition sections.

e. Unless otherwise specified, the minimum required hydrostatic test pressure shall be 1.5 times the design pressure as specified and as indicated.

f. Pressure holding time shall be 10 minutes plus the time required to inspect for leakage.

g. Maximum pressure shall not exceed the maximum rated pressure for any component in the system being tested.

10. Electrical Equipment:

a. The testing standards for electrical components are those contained in Division 26 and the pertinent technical specification(s).

F. When contracted, the Owner will furnish an authorized, competent representative of the equipment or unit process supplier to supervise and coordinate the Functional Completion Testing program.

1. Instrument readings and other test data shall be tabulated by the Contractor.

G. It is the intent that as a result of this phase of Section 01 78 25 that the following has been accomplished:

1. All structures and pipelines have been filled.

2. Operational adjustments desired by the Owner have been made.

3. All chemical feed systems are capable of delivering their respective chemicals to their designated feed points, with the dosage rate manually and adjustable via SCADA.

4. All field devices are operational with control, indication, and alarm capability.

5. All electric valves can be operated.

6. Manufacturer's written certifications regarding equipment installation have been provided.

7. Manufacturer's training sessions have been conducted and video tape provided to the OWNER.

8. The system control and monitoring signals are properly received or transmitted from/to the interface terminal blocks as shown on the drawings.

9. Graphical display screens are functioning properly (by others)

10. Adjustments desired by the Owner have been made.

11. All functions of the automatic control system have been demonstrated and are fully operational.

12. Release/approvals have been received from JEA to place the Facility into operation.

H. Documentation Requirements:

1. Certificates are required for all Functional Completion Testing for equipment and unit process systems. Four copies of the completed certificates shall be supplied for review by the Owner. Contents of the certificate shall be at a minimum:

   a. Equipment Suppliers Review Comments and Approval Page. This page shall include Certification by the equipment or unit process systems suppliers that the equipment or unit process systems are properly installed and suitable for startup.

   b. Owner Review Comments and Approval Page.

   c. Test Descriptions/Procedures

      (1) Equipment or unit process systems tested.

      (2) Test dates.

      (3) Electrical Inspection and Tests

      (4) Test results.

      (5) Any repairs or corrections required to obtain acceptable test results.

(6) Calibration sheet for instrumentation or devices used for testing but not part of plant installation.

(7) Copies of calibration records for plant installed instrumentation

d. Certify Mechanics and Installation. Inspection and certification to be conducted by equipment representative. Inspect and certify that each piece of equipment meets the following requirements:

(1) Not damaged in transportation or installation.

(2) Properly installed with no undue force imposed from piping or supports.

(3) Is properly lubricated.

(4) Motor rotation is correct.

(5) Free of overheating.

(6) Free of vibration.

(7) Free of noise.

(8) Functions without overloading.

(9) Piping and other connections are completed.

(10) No leaks at equipment connections (static pressure testing).

e. Inspection and certification to be conducted by Contractor.

f. Instrumentation and Control Inspection and Tests

g. Inspect and certify instrumentation and control circuits for the following:

(1) Loop checks have been completed for all signal and control circuits.

(2) All instruments have been calibrated.

(3) All instrumentation tubing has been pressure tested and any leaks repaired.

(4) Manual modes function as intended.

(5) Protective interlocks function as intended.

(6) Remote modes function as intended.

(7) Automatic modes function as intended.

h. Instrumentation tests include the following:

(1) Complete loop checks for all signals and controls. Control panel operates process properly in automatic mode.

(2) Tests certificates shall be submitted no later than 30 calendar days, after testing ends. The Owner's Representative and Owner shall have no more than 30 calendar days to complete a review and return with any exceptions noted.

3.03 STARTUP & COMMISSIONING:

A. Startup and commissioning shall be led by the Owner.

END OF SECTION

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SECTION 02 01 30

CONNECTIONS TO EXISTING BURIED PIPELINES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials and installation of hot-tap connections to existing buried ductile-iron and steel and PVC (cast-iron outside diameter) pipelines and line stopping (as required) and replacement of existing piping.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions, Section 01 33 00, and the following.

B. Submit manufacturer's catalog data for tapping sleeves. Show coatings.

PART 2 - MATERIALS

2.01 TAPPING SLEEVES

A. Tapping sleeves shall comply with MSS SP-60, MSS SP-111, or AWWA C223, and MSS SP-113.

B. Tapping Sleeves shall be stainless steel, and from the current JEA Approved Materials (AW-203):

a. Cascade, CST-EX

b. Dresser Industries, Inc., 630

c. Ford Meter Box Company, FAST Series, FTSS

d. JCM Industries, Inc. 432, 439, 452 (14-inch and larger)

e. Power Seal, 3490, 3490 MJ

f. Romac Industries, SST

g. Smith Blair, 663 & 665

h. Mueller H304

C. Pressure rating shall be at least 200 psi for piping 12 inches and smaller and at least 150 psi for piping 14 through 24 inches.

2.02 COATING FOR TAPPING SLEEVES

A. Coat with fusion-bonded epoxy per Section 351 of the current JEA standards.

2.03 TAPPING GATE VALVES

A. Refer to Section 40 05 20 for gate valve specification requirements. Tapping valves shall be one of the following manufacturers/model in accordance with JEA's Current Approved Materials listed in AW-302.

   a. American Flow Control

   b. AVK (S/S Stem Only), 25/30081

   c. Clow Valve,F-6114,2638

   d. Kennedy Valve Company, 950-X

   e. M&H Valve, 4751

   f. Mueller, T-2360, T-2361

   g. U.S. Pipe, 5860

   h. Mueller-Aqua Grip, A-2361-76

   i. American – RD

2.04 CONNECTIONS TO EXISTING STEEL PIPES

A. Provide a fabricated steel collar with nozzle. Minimum thickness of collar plate and nozzle shell shall be 3/8 inch. Width of collar from the inside surface of the outlet to the outside edge of the collar shall be one-third to one-half of the diameter of the outlet. Collar may be oval or rectangular with rounded corners. An entire wrapper plate may be substituted for the collar. Steel material shall have a minimum yield stress of 30,000 psi.

PART 3 - EXECUTION

3.01 VERIFICATION OF PIPE OUTSIDE DIAMETER PRIOR TO INSTALLATION

A. Excavate the points of connection prior to submittal of shop drawings. Verify outside diameter prior to ordering materials.

3.02 WRAPPING OR COATING TAPPING SLEEVES

A. After installation, wrap the entire sleeve and tapping valve with polyethylene sheet wrap (blue).

END OF SECTION

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SECTION 02 41 00

EQUIPMENT, PIPING, AND MATERIALS DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION:

A. This section describes demolition and removal, replacement, abandonment, and relocation of existing process and mechanical and electrical equipment and piping.

PART 2 - MATERIALS

A. Refer to other sections of these specifications for material to be used in removing, replacing, and/or abandoning in place equipment.

PART 3 EXECUTION

3.01 GENERAL:

A. Perform removal, replacement, abandonment, relocation, and demolition work specified and indicated in the drawings. Prepare remaining surfaces to receive new scheduled and specified materials and finishes or finish to match adjacent surfaces if no additional work is scheduled or indicated.

B. Removal

1. Remove equipment indicated in the drawings.

C. Replacement

1. Replace equipment indicated in the drawings or listed herein. Unload the removed equipment and store it in the location designated by the Owner. Install the new equipment in locations as indicated in the drawings and as summarized below:

Existing Equipment Description	New Equipment	
	Description	Spec. Section
GSR No. 1 with Aerator	Crom or Precon prestressed concrete tank	33 16 22
HSP's & VFD's No. 1, 2, and 3	Horizontal End Suction Centrifugal Pumps	43 21 10
Sodium Hypochlorite Storage Tank	Double Wall High Density Polymer Tank	43 41 27
Sodium Hypochlorite Skid with Two Metering Pumps	Sodium Hypochlorite Skid with Two Grundfos Mechanical Electronic Pumps	43 21 64 and 43 32 80
Chlorine Analyzer	Depolox 3 Plus	None
Diesel Engine Generator	Caterpillar D.E.G.	23 32 12
Fuel Tank	Above Ground Storage Tank	23 13 23

D. Abandon

1. Abandon in place equipment indicated in the drawing. Piping located beneath structures, driveways, or other obstructions that are not assigned to be demolished can be abandoned in place. Grout fill existing piping that is abandoned in place.

E. Relocate

1. Relocate the existing temperature and rain gauge.

F. Salvage

1. Equipment salvaged from the premises is the property of the Owner, unless specifically noted on the drawing or in this specification. Carefully remove and handle the equipment. Unload the equipment and store it on-site in the location designated by the Owner. Leave the property free of debris and material. The following items are to be turned back over to JEA's Investment Recovery Group:

- Diesel Engine Generator & fuel tank
- 500 Gal hypochlorite tank and containment area
- Hypochlorite pumps and associated skid
- Chlorine analyzer

2. Contractor shall be responsible for salvaging (recycling) the existing steel items to be demolished as listed below:
    - GSR No. 1 and GSR No. 2 (existing) with aerator
    - Buried cast iron piping
    - 5,000 gallon hydropneumatic tank
3. Demolition of Existing 36,000 gallon and 30,000 GSRs: Assume that the tank floors are 12" thick. Assume that the existing exterior paint on this tank contains no lead contaminates.
4. Sodium hypochlorite chemical tanks: Contractor shall transfer the existing sodium hypochlorite chemicals (liquid) from the old storage tank to the new bulk storage tank. JEA will provide additional sodium hypochlorite chemicals, as required.

The Contractor's bid shall reflect the gross salvaged costs of these items.

G. Existing Piping and Electrical Utilities

1. Shut off or disconnect utilities affecting demolition work. Schedule shutdowns with the Owner; notify the Owner three working days in advance of any shutdown that is required to perform the work. The Owner will open/close valves on piping, slide and sluice gates in channels, and electrical disconnects required for the shutdowns.

H. Plugging Abandoned Piping

1. Plug all pipes to be abandoned.
2. Plug and grout fill all pipes to be abandoned under structures.
3. Plug by placing a 3-foot-long concrete plug in the open ends or by pipe plugs.

I. Removal or Relocation of Electrical Materials and Equipment

1. Unless otherwise noted, remove existing electrical materials and equipment from areas indicated for demolition or where equipment is to be relocated. Disconnect circuits at their source. Remove materials no longer used, such as studs, straps, and conduits. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface. Remove existing unused wires.

2. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface.

J. Ballasts

1. Electrical discharge lighting ballasts manufactured before 1974 that will be removed under this contract contain polychlorinated biphenyls (PCBs).

2. Electrical discharge lighting ballasts manufactured after 1973 may contain PCBs.

3. It is the Contractor's responsibility to identify the presence of PCBs and to dispose of them in compliance with all local, state, and federal laws, regulations, and ordinances.

K. Transformers and Other Electrical Apparatus

1. Transformers, switches, capacitors, resistors, and/or other liquid-filled electrical apparatus that will be removed under this contract may contain PCBs. It is the Contractor's responsibility to identify the presence of PCBs and to dispose of them in compliance with all local, state, and federal laws, regulations, and ordinances.

L. Patching

1. Patching shall mean the restoration of a surface or item to a condition as near as practicable to match the existing adjoining surfaces unless otherwise noted, detailed, or specified.

2. When patching involves painting, special coating, vinyl fabric, or other applied finish, refinish the entire surface plane (i.e., wall or ceiling), unless complete refinishing of the entire space is scheduled or specified.

3. Patching includes cleaning of soiled surfaces.

M. Demolition

1. Existing buildings, structures, boxes, pipes, pavements, curbs, and other items are to be removed, altered, salvaged, and disposed of as specified herein or indicated in the drawings. Remove and dispose of all portions of these items that interfere with project construction.

2. Remove and dispose offsite facilities to be demolished in their entirety including below ground footings, foundations, and other associated appurtenances, as shown in the drawings or as specified herein. Backfill and compact all site areas disturbed by demolition work with earth backfill material in accordance with Section .

3. Perform the work in a manner that will not damage parts of the structure not intended to be removed or to be salvaged for the Owner. If, in the opinion of the Owner's Representative, the method of demolition used may endanger or damage parts of the structure or affect the satisfactory operation of the facilities, promptly change the method when so notified by the Owner's Representative. No blasting will be permitted.

4. Equipment, material, and piping, except as specified to be salvaged for the Owner, or removed by others, within the limits of the demolition, excavations, and backfills, will become the property of the Contractor and shall be removed from the project site. The salvage value of this equipment, materials, and piping shall be reflected in the contract price of the demolition work.

5. Do not reuse material salvaged from demolition work on this project, except as specifically shown.

N. Schedule

Certain items cannot be removed, replaced, abandoned, or demolished until certain other work has been accomplished.

END OF SECTION

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SECTION 03 05 10

LEAKAGE TESTING OF HYDRAULIC STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION

This section describes the method of testing concrete hydraulic structures for leakage. Following structures shall be leak tested:

Ground Storage Reservoir

PART 2 MATERIALS

Provide piping, and equipment to test concrete structures for leakage. JEA requires the Contractor to obtain a flow meter from JEA (the inspector assigned to the job) to track water consumption. There will be a charge for this meter, but there will be no charge for the use of water.

PART 3 EXECUTION

3.01 GENERAL

A. Hydrostatically test reinforced concrete structures which will contain water to determine that they conform to “Leakage Test Procedure” herein and are free of detectable leaks. Do not hydrostatically test walls which are to be restrained or laterally supported by slabs until slab concrete has obtained the specified compressive strength.

B. Prior to testing, clean exposed surfaces by thoroughly hosing and removing surface laitance and loose matter from walls and slabs. Remove wash water and debris from the structures by means other than washing through plant piping.

C. No backfilling, floor finish, concrete or mortar fill, wall insulation, gasproofing or protective coatings, or permanent pipe connections shall be applied to or installed in any new water containment structures until they have been subjected to loading for settlement and tested for leakage. Testing shall not

be done until the concrete has reached its 28 day design strength.

3.02 LEAKAGE TEST PROCEDURE

A. Unless additional provisions for leakage testing are provided herein, leakage testing shall be carried out in accordance with ACI 350.1 - Tightness Testing of Environmental Engineering Concrete Structures. The test criterion shall be HST-NML (No measureable loss) for fully lined tanks or secondary containment structures and HST-050 (0.050% per day) for other tanks as defined by ACI 350.1

B. During the test period, the excavation around the structure shall be kept dewatered by the Contractor. The Contractor shall temporarily close all bottom openings and wall openings below maximum water level in the structures; furnish and fill the structures to the design maximum water level with clean water. The Contractor shall make his own arrangements for handling the water for testing and its transfer from one structure to another and its final disposal.

C. Filling rate shall not exceed 8ft of water depth over a 24–hr period with continuous monitoring, except prestressed circular concrete tanks shall be tested in accordance with Section 33 16 22. Filling shall be at a uniform rate.

D. For the Preloading Test the Contractor shall maintain the liquid level in the structures at the design maximum water level for 72-hours. If the characteristics of settlement of the structure so require, the loading shall continue for a longer period to permit the necessary consolidation of the foundation material, in which case the Contractor shall be entitled to no extra compensation, but a commensurate extension of time for completion of the whole work under this contract shall be allowed.

E. During the leakage test period, the Engineer or engineer’s representative shall inspect the structure for leakage. If moist spots become visible, indicating the existence of minor leaks, or if the water level indicates hidden

leakage, the Contractor shall furnish all materials and do all work necessary to locate the leaks and make the structure watertight to the complete satisfaction of the Engineer. This includes the repair of cracks, tie holes, etc. No additional compensation shall be allowed for such work.

F. If, in the opinion of the Engineer, during the course of the test weather conditions are such that it becomes difficult to accurately monitor the water level in the tank, the test shall be stopped, and started over again when weather permits.

G. On conclusion of the test, the Contractor shall pump or drain the water from the structure and dispose of it without injury to structures or surfaces. Coordinate with JEA representative for discharge of test water used for the prestressed concrete tank.

3.03 REPAIR METHODS

Methods for repairing concrete not passing the leakage test shall be as recommended by the prestressed concrete tank manufacturer.

END OF SECTION

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SECTION 03 11 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 REFERENCE:

A. General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this Section.

1. 03 21 00 - Concrete Reinforcement
2. 03 30 00 - Cast-In-Place Concrete

1.02 WORK INCLUDES:

A. All formwork for concrete as described in this section, indicated on the drawings or required by other sections of these specifications. Openings for other affected work. Form accessories and stripping forms.

1.03 QUALITY ASSURANCE:

A. Codes and Standards

1. Formwork shall comply with the provisions of ACI 347 "Recommended Practice for Concrete Formwork".
2. ACI "Formwork for Concrete" and Specifications for Structural Concrete for Buildings.
3. PSI - "Construction and Industrial Plywood".

B. The Contractor is solely responsible for the design, construction and performance of the formwork. The engineers examination of formwork plans and shoring operations shall in no way relieve the contractor of this responsibility.

1.04 SUBMITTALS:

A. Submit to the Engineer shop drawings prepared and designed by an engineer registered in the state of Florida, for record purposes showing layout of shoring, sections and unusual details in accordance with the General Conditions of the Contract for construction. Submit sufficient information for full description of capacity.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Forms

1. Wood

a. For concrete below grade, use standard grade or better boards or planks; or use 3/4" minimum thickness exterior type plywood, Grade B/B, Class I, PS-1.

b. For exposed concrete surfaces use 3/4" minimum thickness exterior type plywood, Grade B/B, Class I, sanded both sides, PS-1.

2. Steel

a. Steel forms shall be of such thickness that they shall remain true to shape. Metal forms, which do not present a smooth surface or do not properly align shall not be used.

B. Form Oil

1. The inside of the forms shall be coated with a non-staining form oil, such as:

a. Magic-Kote by Symons Manufacturing Company, Des Plaines, Illinois;

b. Form-coat by Concrete Service Company, Philadelphia, Pennsylvania.

c. Eucoslip by Euclid Chemical Company.

C. Form Ties

1. Form ties shall be snap-in form tie with a 1 inch minimum break off depth from the face of the concrete.

2. Ties shall be removed after forms are removed and holes shall then be filled with mortar that matches the adjacent surfaces.

3. Provide stainless steel form ties for all exterior surfaces exposed to view.

4. Approved Manufacturers

a. Dayton "Sure-Grip"

b. Hechman "Snapties"

c. Richmond "Snap-Tys"

D. Anchors

1. Zinc-coated dovetail slots (oriented vertically) shall be located at 3 feet - 0 inches on center horizontally wherever concrete surfaces adjoin masonry. Where concrete masonry (CMU) abuts columns, provide dovetail slot at centerline of adjoining CMU.

2. Approved Manufacturers

a. Hechman Number 100 Standard, 24 gauge

b. Hohman & Barnard, Inc., Number 305

c. Wire Products Company, Number F-17

d. DAS-STD by Gateway Building Products

E. Vapor Barrier: 0.006-inch thick, natural Visqueen polyethylene film, as manufactured by the Visking Company or equal.

PART 3 - EXECUTION

3.01 GENERAL:

A. Forms, bracing, and supports shall be designed and constructed to withstand the pressure of freshly placed concrete. Temperatures of the concrete at time of placing, effect of vibration, speed of placement, the height of plastic concrete and similar factors shall be considered in the design. Concrete surfaces that are to be exposed shall be free of misalignment, unsightly bulges, offsets or ledges.

B. Forms shall conform to the shape, lines, grades and dimensions of the concrete as called for on the drawings. Joints in forms shall be horizontal and vertical and shall be tightly fitted to prevent leakage of mortar. All vertical surfaces shall be formed.

C. Removable sections shall be provided at sufficient intervals at the base of walls and columns to allow cleaning and inspection before concrete is placed. All open joints, holes or other blemishes shall be filled to provide a blemish free surface.

D. Forms for concrete floor slabs shall have sufficient strength and stiffness to prevent sagging or deflection while subjected to the usual construction loads. Walking on forms will not be permitted. Planks (2 in. thick) shall be distributed over the forms to prevent abuse. Wheeling of concrete or other materials directly over the forms will not be permitted. Runways above the top of the finished concrete shall be required throughout the construction period. Runways shall not rest on the reinforcing steel.

E. Embedded structural steel shapes meant to provide support for other structural elements shall be bolted to the formwork to maintain accurate positioning. Wiring or nailing will not be permitted.

F. 3/4 inch by 3/4" chamfer strips shall be placed in the corners of forms to produce beveled edges on all permanently exposed surfaces. Corners, which abut masonry walls, shall not be chamfered.

G. Forms shall be checked just prior to placing concrete and tightened as required to produce flush surfaces.

H. Provisions shall be made for chases, offsets, openings, depressions, curbs and bulkheads.

I. Camber formwork to compensate for anticipated deflections in the formwork due to weight of forms and wet concrete, and/or any additional camber as shown on the drawings.

J. Floors have not been designed to carry the construction loads of the floor above. Contractor must design and furnish necessary shoring and reshoring to support the loads.

K. The shores and supports for the formwork shall have ample strength to support all applied loads without settlement. Provide positive means of adjustment (wedges or jacks) for shores to take up any settlement during placement.

L. Sills, if any, shall rest on solid ground, free from frost. Studs, walls, and bracing shall be dimension stock of sizes as required by form design. Dimensions of centering, bracing, etc. shall be in accordance with "ACI Recommended Practices for Concrete Formwork" (ACI 347).

M. Sleeves, Reglets, Inserts and Conduits: After forms are erected and before reinforcement is placed, all sleeves, reglets and inserts for mechanical trades must be set in place by the trade involved. Other sleeves, anchors, inserts, anchor bolts,

specialties and similar items embedded in the concrete shall be furnished, accurately located as shown and set by the Contractor. In general, electric conduits shall be placed within the middle one-third of the thickness of the concrete in which it is embedded.

N. Before placing reinforcement or concrete the surface of the form shall be coated with approved non-staining form oil to prevent bond with the concrete surface.

O. Reinforcements shall be adjusted to fit the sleeves, inserts, and openings, using additional bars where required around openings.

3.02 BULKHEADS:

A. Place bulkheads where end of days work requires a joint in a wall, beam or slab. Reinforcing steel shall extend through the bulkhead. All joints shall be keyed for 2 of the member thickness unless directed otherwise by the Architect/Engineer. Location of bulkhead must be approved by the Architect/Engineer.

3.03 REMOVAL OF FORMS:

A. Forms shall not be removed from concrete surfaces until the following minimum requirements are met.

1. Formwork for concrete slabs and beams shall remain in place for a minimum of 48 hours, and until the concrete has achieved 75% of its design strength. Strength shall be determined by tests on cylinders site-cured under the same conditions as the work in question.

2. Column and wall formwork can be removed in 48 hours provided curing compound is applied immediately. If Contractor elects not to provide curing compound, forms must remain in place 7 days minimum.

3.04 RESHORING:

A. When reshoring is permitted or required, the operations shall be planned in advance and shall be subject to approval. While reshoring is under way, no live load shall be permitted on the new construction.

B. In no case during reshoring shall concrete in beam, slab, column or any other structural member be subjected to combined dead and construction loads in excess of the loads permitted by the Architect/Engineer for the developed concrete strength at the time of reshoring. Reshores shall be placed as soon as practicable after

stripping operations are complete but in no case later than the end of the working day on which stripping occurs. Reshores shall be tightened to carry their required loads without over stressing the construction. Reshores shall remain in place until tests representative of the concrete being supported have reached the specified strength or the strength specified in the contract documents for removal of reshores.

C. Floors supporting shores under newly placed concrete shall have their original supporting shores left in place or shall be reshored. The reshoring system shall have a capacity sufficient to resist the anticipated loads and in all cases shall have a capacity equal to at least one half of the capacity of the shoring system above. The reshores shall be located directly under a shore position above unless other locations are acceptable.

3.05 REUSE OF FORMS:

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound to concrete contact form surfaces as specified for new formwork.

B. When forms are intended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, unless as acceptable to Architect/Engineer.

3.06 VAPOR BARRIER:

A. Before laying of sheet, subgrade must be smoothed eliminating any protrusions that may cause damage or rupturing of film.

B. Use widest practical widths; lapping where required shall be a Z-lock not less than 6 inches wide with top lap placed in the direction of the spreading of the concrete and underneath the reinforcing mesh prior to pouring.

END OF SECTION

SECTION 03 21 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 REFERENCE:

A. General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this Section.

1. 03 11 00 - Concrete Formwork
2. 03 30 00 - Cast-In-Place Concrete
3. 03 41 40 - Precast Prestressed Concrete

1.02 WORK INCLUDES:

A. Provide concrete, concrete masonry unit and precast concrete reinforcement as shown on the drawings, required by these specifications or necessary for proper completion of the work.

1.03 SUBMITTALS:

A. Shop drawings showing all bar sizes, supports, fabrication dimensions and location for placing of the reinforcing in accordance with the General Conditions of the Contractor for construction shall be submitted for approval. Approval shall be obtained prior to fabrication.

B. Comply with the ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, diagrams of bent bars, and arrangements of concrete reinforcement.

1.04 QUALITY ASSURANCE:

A. Codes and Standards: Comply with the provisions of the most recent edition of the following codes, specifications and standards, except as otherwise shown or specified.

1. ACI 301 - Guidelines for Structural Concrete for Building.

2. ACI 315 - Details and Detailing of Concrete Reinforcement.

3. ANSI/ASTM A83 - Cold Drawn Steel Wire for Concrete Reinforcement.

4. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

5. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

6. ANSI/AWS D1.4 - Structural Welding Code Reinforcing Steel.

7. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

8. ASTM A616 - Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.

9. ASTM A617 - Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.

10. CRSI - Manual of Practice.

11. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.

12. CRSI 65 - Recommended Practice for Placing Bar Supports, Guidelines and Nomenclature.

13. No foreign steel shall be used.

PART 2 - PRODUCTS

2.01 MATERIAL:

A. Reinforcing Bars shall be rolled from new billet steel, Grade 60 and deformed in accordance with ASTM A615, for bars numbers 3 to number 18 and shall be epoxy coated conforming to ASTM A776 81 for piles and grade beams only.

B. Welded wire fabric shall be ASTM A185, welded steel wire fabric. The yield strength of the steel wire shall not be less than 60,000 pounds per square inch and shall be epoxy coated conforming to ASTM A776 81.

C. Bar Supports and Spacers

1. For unexposed concrete, bar supports and spacers shall be manufactured of standard brights basic wire upturned legs.

2. For concrete which will be exposed to view from the underside upon completion of the structures, use plastic capped bar supports and spacers.

3. For slabs on grade, use bolsters with runners where base will not support chair legs.

4. Do not use wood, brick or other non-specified material.

D. Tie wire: Federal specifications QQ-W-461 Annealed Steel, 16 ga. minimum for use on epoxy coated steel reinforcement.

E. Welded electrodes: AWS A5.1, Low Hydrogen, E70 Series.

F. Welded Inserts: Provide wedge inserts for the support of brick ledger angles. Wedge inserts shall be placed at 4'-0" o.c. unless drawings indicate a more restrictive spacing. Provide the F-7 wedge insert and 3/4" diameter askew bolt, nut and washers as manufactured by Dayton Superior, 10101 C General Drive, Orlando, Florida, or equal.

Wedge inserts and 3/4" diameter bolts to be deemed equal shall submit test information documenting an ultimate capacity of at least 8,500 pounds when the shelf angle is loaded 2-1/4" from the face of concrete, with the bottom of the insert 1-1/2" clear from the beam bottom, for concrete strength of 4,000 psi.

PART 3 - EXECUTION

3.01 GENERAL:

A. Cleaning and storage reinforcement: Steel reinforcement at the time concrete is placed shall be free from heavy rust, scale or other coating that will destroy or reduce the bond.

B. All reinforcing steel shall be stored in neat piles at the site clear of the ground in such a manner that all bars can be readily identified when required.

C. Excessive form oil on the reinforcing shall be removed by washing the reinforcing with kerosene. Exercise due care that no smoking or welding is permitted in the area of cleaning. Provide fire extinguisher at cleaning site.

D. Supports for reinforcing steel: All reinforcing steel shall be rigidly supported, accurately located and held in position by the use of proper reinforcing steel

supports, spacers and accessories before the concrete placement begins.

E. The legs of all reinforcing supports shall be bent to form a foot so that the side and not the end of leg rods bears on the form.

F. Metal reinforcement shall be protected by the thickness of the concrete indicated on the drawings. Where not otherwise shown, the concrete cover shall be not less than the following:

1. 3 inches for footings and other principal structural members poured directly against the ground.

2. 2 inches for bars larger than number 5, and 1-1/2 inches for number 5 bars and smaller where concrete will be exposed to the ground or weather after removal of forms.

3. 1-1/2 inches in all beams, girders and columns.

4. 3/4 inches for all slabs and walls not exposed to the ground or weather.

5. In any event, there shall be not less than 3/4" of concrete protection over all reinforcing bars.

G. Do not use bar supports or reinforcing as support for concrete runways or construction loads.

H. Placing tolerances: Clear distance to formed surfaces: +/- 1/4 inch. Minimum spacing between bars: -1/4 inch:

1. Top Bars in Slabs or Beams:

Members 8" or less in depth: +/- 1/4 inch

Members 8" to 24" in depth: +/- 1/4 inch

Members 24" or greater in depth: +/- 1/2 inch

2. Crosswire of Slabs or Beams: Spaced evenly within 2 inches.

3. Lengthwise of Member: +/- 2 inches

I. Bending details: Typical bending and placing diagrams are shown on the drawings. For parts not shown, bending details and lengths shall conform to the requirements of the ACI Building Code 318 and "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315.

J. Bends for stirrups and ties shall be made around a pin having the diameter no less than 1-1/2 inches for number 3, and 2 inches for number 4.

K. Bends for other bars shall be made around a pin having a diameter not less than six bar diameters for number 3 to number 6, 8 bar diameters for number 9, number 10 and number 11, 10 bar diameters for number 14 and number 18.

L. All bars shall be bent cold. Heating of bars will not be allowed.

3.02 SPECIAL REINFORCING REQUIREMENTS:

A. Where walls or other items are shown as built integrally with other section, but are placed as separate pours, key and dowels must be provided. Dowels shall be the same size and at the same spacing as reinforcing.

B. Main reinforcing bars shall not be spliced unless so noted on the drawings or approved by the Architect/Engineer.

C. Provide 6 X 6 - W1.4 X W1.4 electrically welded wire fabric, ASTM A-185 reinforcing in all concrete slabs on ground unless shown otherwise.

D. Provide corner bars of same size and spacing as main reinforcement at all intersections and corners.

E. Where openings occur in walls, or slabs, provide two number 5 bars at all sides and extending at least two feet beyond the corners and two number 5 bars at least three feet long diagonally across each re-entrant corner.

F. Unless permitted by an Inspector employed by the owner reinforcement shall not be bent after being embedded in hardened concrete.

3.03 INSPECTION OF REINFORCEMENT:

A. Reinforcing placement must be checked by an Inspector employed by the owner before any concrete is placed. Any corrections shall be made before concrete is placed.

B. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within the placement area and retains the right to require necessary revisions be made before concrete is placed.

C. The Contractor shall notify the Inspector at least 24 hours in advance of concrete

placement for a particular portion of the building.

D. Galvanized wire ties of double loop and tightly fastened to secure the proper spacing of rods and ties are required.

3.04 LAP SPLICING:

A. Welded wire fabric shall be overlapped wherever successive mats or rolls are continuous such that the overlap measured between outermost cross wires is not less than one wire spacing plus 2 inches.

B. Longitudinal (continuous) footing reinforcing: Class B.

C. Beam Reinforcing: Class B.

D. Column Reinforcing: Class B Offset lap splices.

E. Column/footing dowels: Class B

F. Masonry vertical reinforcing: Class B.

G. Splices not included above: Class B.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 REFERENCE:

A. General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this Section.

1. 03 11 00 - Concrete Formwork
2. 03 21 00 - Concrete Reinforcement
3. 03 41 40 – Precast-Prestressed Concrete
4. 04 20 00 - Reinforced Unit Masonry System

1.02 WORK INCLUDES:

A. All labor and materials required for cast-in-place concrete shown on the drawings or specified herein. Concrete bases and pads for mechanical and electrical equipment. Coordinates with respective contractors. Concrete for grouting of concrete unit masonry.

1.03 QUALITY ASSURANCE:

A. Codes and Standards

1. Comply with the provisions of the most recent edition of the following codes, specifications and standards, except as otherwise shown or specified.
   a. ACI 318 "Building Code Requirements for Reinforced Concrete."
   b. ACI 301, "Specifications for Structural Concrete for Buildings."
   c. ACI 302, "Recommended Practice for Concrete Floor or Slab Construction."
   d. ACI 304 "Recommended Practice for Measuring Mixing, Transporting and Placing Concrete."

e. ACI 305 "Recommended Practice for Hot Weather Concreting."

f. ACI 307 "Recommended Practice for Cold Weather Concreting."

g. ACI 309 "Recommended Practice for Consolidation of Concrete."

h. CRSI Manual of Standard Practice.

i. CRSI Placing Reinforcing Bars.

j. ASTM C476, "Standard Specification for Grout for Reinforced or Non-Reinforced Masonry."

k. ASTM C-31, Making and Curing Concrete Compression and Flexure Strength Test Specimens in Field.

l. ASTM C-33, Concrete Aggregates.

m. ASTM C-39, Compressive Strength of Molded Concrete Cylinders.

n. ASTM C-42, Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

o. ASTM C-94, Ready-Mixed Concrete.

p. ASTM C-143, Slump of Portland Cement Concrete.

q. ASTM C-150, Portland Cement

r. ASTM C-172, Sampling Fresh Concrete.

1.04 QUALITY CONTROL:

A. Do not commence placement of concrete until mix designs have been approved by the Architect/Engineer.

B. Any concrete work which does not conform to the specified requirements, including strength, tolerance and finishes shall be corrected by the Contractor at his expense and as directed by the Architect/Engineer.

1.05 DIMENSIONAL TOLERANCES FOR FORMED SURFACES:

A. Variation from plumb:

1. In the lines and surfaces of columns, piers, walls and in arises:

In any 10 ft. of length.....1/4 in.

Maximum for the entire length

(length greater than 40'-0").....1 in.

2. Exposed corner columns, control-joint grooves, and other conspicuous lines:

In any 20 ft. of length.....1/4 in.

Maximum for the entire length.....1/2 in.

B. Variation from the level or from the grades specified in the contract documents:

1. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores

In any 10 ft. of length.....1/4 in.

In any bay or in any 20 ft. of length.....3/8 in.

Maximum for the entire length.....3/4 in.

2. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

In any bay or in 20 ft. length.....1/4 in.

Maximum for the entire length.....1/2 in.

C. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:

In any bay.....1/2 in.

In any 20 ft. of length.....1/2 in.

Maximum for the entire length.....1 in.

D. Variation in the sizes and location of sleeves, floor openings, and wall openings.....+1/4 in.

E. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:

Minus.....1/4 in.

Plus.....1/2 in.

F. Footings*

1. Variations in dimensions in plan:

Minus.....1/4 in.

Plus.....1/2 in.

2. Misplacement or eccentricity:

2 percent of the footing width in the direction of misplacement but not more than.....2 in.

3. Thickness:

Decrease in specified thickness.....5%

Increase in specified thickness.....No limit

G. Variation in steps:

1. In a flight of stairs:

Rise.....$\pm$1/8 in.

Tread.....$\pm$1/4 in.

2. In consecutive steps:

Rise.....$\pm$1/16 in.

Tread.....$\pm$1/8 in.

* Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

1.06 SUBMITTALS:

A. Concrete Mix Report

1. For each proposed concrete mix, submit two copies of the test mix report. Submit report at least 15 days prior to start of concrete pouring.

B. Material Certificates

1. Provide material certificates signed by material manufacturer, certifying that each material complies with the specified requirements.

C. Test Reports

1. Submit results of all compression, slump and air content tests performed during mix design and throughout the duration of the project as required by the Specifications.

2. Submit sieve analysis of coarse and fine aggregate intended for use in the project.

3. Submit a copy of State Certification that the concrete batching and weighing equipment has been inspected and approved.

4. Submit letters from the cement and aggregate suppliers certifying that furnished materials meet appropriate ASTM Standards.

1.07 TESTING:

A. Concrete shall be sampled and tested for Quality Control during placement of concrete.

B. Failure to detect defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate Architect/Engineer for final acceptance.

C. Required Sampling and Testing

1. Samples, for strength tests of each concrete mix shall be taken not less than once a day nor less than once for each 50 cu. yd. of concrete.

D. If the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given mix, tests shall be made from at least five randomly selected batches.

1. Secure composite samples in accordance with ASTM C172.

2. Mold and cure five specimens from each sample in accordance with ASTM C31.

a. Samples for test shall be taken at the 1/4 and 3/4 points of the load mixer.

b. Cure specimens under laboratory conditions except as follows:

1. When in the opinion of the Architect/Engineer there is a possibility of the surrounding air temperature failing below

40 degrees F, he may require additional specimens to be cured under job conditions.

2. In hot weather or periods of low humidity the Architect/Engineer may require additional specimens to be cured under job conditions

a. Test specimens in accordance with ASTM C39.

1. Test one specimen at 3 days.

2. Test one specimen at 7 days.

3. Test two specimens at 28 days for acceptance. This test of two specimens constitutes one strength test. The results of the strength test shall be the average of the strengths of the two specimens tested.

b. Hold one specimen for future use if test does not comply at 28 days.

c. Determine slump of the concrete sample for each strength test and whenever consistency appears to vary, using ASTM C143.

d. Determine air content for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.

e. Determine temperature of concrete sample for each strength test.

E. Evaluation of Test Results

1. For evaluation each specified concrete mix shall be represented by at least five strength tests.

F. The strength level of the concrete will be considered satisfactory if both of the following requirements are met.

1. The average of all sets of three consecutive strength tests (average of two cylinders) exceeds specified strength.

2. No individual strength test (average of two cylinders) falls below the specified strength by 500 psi.

G. If the strength level does not meet the above requirements, the Architect/Engineer shall consider the concrete to be deficient and shall have the right to reject the work or require load tests on the structure in the areas the tests represent at no cost to the Owner.

H. Report tests results in writing to the Architect/Engineer and the Contractor on the same day that tests are made. Reports of compressive strength tests shall contain:

1. Project identification name and number
2. Date of concrete placement
3. Name of Contractor
4. Name of Concrete Supplier and Truck Number
5. Name of Concrete Testing Service
6. Concrete type and class
7. Location of concrete batch in the structure
8. Design compressive strength at 28 days
9. Slump
10. Air Content
11. Concrete temperature
12. Concrete mix identification number
13. Compressive breaking strength
14. Type of break for both 7-day tests and 28-day tests.

1.08 TESTING SERVICES:

A. The Owner will employ an independent testing laboratory meeting the requirements of ASTM E329 and approved by the Architect/Engineer to perform the following services:

1. Sample concrete at placement and make slump, air content, temperature and compression tests as described above.

2. Report tests results to the Architect/Engineer.

B. Contractor Responsibilities

1. Pay for additional testing and inspection of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.

2. Provide the necessary testing services for the qualification of proposed materials and the establishment of mix designs; and for any other testing services required by the Contractor.

3. Furnish any necessary labor to assist the designated testing agency in obtaining and handling samples.

4. Advise the testing agency sufficiently in advance of operations to allow for completion of tests.

5. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens as required by ASTM C31.

6. The use of Testing Services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIAL:

A. Portland Cement

1. ASTM C150, Type I (Normal)

B. Aggregate

1. ASTM C 33, and as herein specified. Provide aggregates from a single source for all exposed concrete.

a. Fine Aggregate: Clean, sharp sand, free from loam, clay, lumps or other deleterious substance.

2. Coarse Aggregate For Normal Weight Concrete: Comply with ASTM C33 size #57. Clean, uncoated, processed aggregate of crushed stone or washed gravel containing no clay, mud, loam or foreign matter. Use of pit or bank run gravel is not permitted. Aggregate shall meet ASTM C33 Size No. 56 or 57.

3. Where contractor elects to place concrete by pumping he shall provide a pump with sufficient capacity to place this size of aggregate.

4. ASTM C404 for masonry grout. Maximum aggregate size shall be 3/8".

C. Water:

1. Water shall be fresh and potable. Water shall be obtained from city water system. The Contractor shall pay for the quantity of water used during construction and also furnish, install and maintain a water meter if required by the Water Department.

2. Air-Entraining Admixtures - ASTM C260

a. "Darex" by W.R. Grace

b. "SikaAer" by Sika Chemical Co.

c. "MBVR" by Master Builders

d. "Air-Mix" by Euclid

e. "Sealtight" by W.R. Meadows

D. Water Reducing Admixture - ASTM C494 Type A

1. "Pozzolith 300 Series" by Master Builders

2. "WRDA/HYCOL" by Grace

3. "Plastocrete 161" by Sika

4. "Eucon-WR-75" by Euclid

E. High Range Water Reducing Admixture (Superplasticizer)

1. Admixtures shall meet the requirements of ASTM C494 Type F and shall contain no chloride ions.

2. Acceptable Products

a. "Melmet" by American Admixtures

b. "WRDA 19" by W.R. Grace Co.

c. "Sikament" by Sika Chemical Co.

3. Dosage and use of any mix containing this admixture shall be in strict accordance with the manufacturers direction and only with the written permission of the Engineer.

4. A representative of the admixture manufacturer shall be present to observe the products use and to assure that it is being used in accordance with the manufacturers directions.

F. Water Reducing, Retarding Admixture

1. Shall comply with ASTM C494 Type D.

2. Acceptable Products

a. "Daratard 17" by W.R. Grace & Company

b. "Pozzolith 100XR" by Master Builders, Inc.

c. "Lubricon R" by American Admixture

d. "Plastocrete 161R" by Sika Chemical Co.

G. Calcium Chloride

1. Do not use calcium chloride in any concrete.

H. Concrete Color Admixtures

1. Carblack by Euclid Chemical Company

2. Integral Colors by Davis Colors

3. Chromix by L.M. Scofield

I. Integral Concrete Waterproofing: Shall be Anti-Hydro by Anti-Hydro Company or approved equal.

2.02 RELATED MATERIALS

A. Vapor Barrier:

1. Provide water-vapor cover over sub-grade materials as shown on the drawings. Use only materials which are resistant to decay when tested in accordance with ASTM E154.

B. Preformed Joint Fillers:

1. Provide preformed strips, non-staining, non-extruding and resilient bituminous type complying with ASTM D1751.

2. Thickness to be as indicated on drawings. If no thickness is indicated use 1/2".

C. Waterproof Sheet for Curing:

1. Conform to ASTM C171.

2. Polyethylene film thickness shall be at least 4 mils.

D. Membrane Curing Compound:

1. Conform to ASTM C171, Class B, Clear 100% resin type.

2. Do not use on any surface which will later receive paint, sealer, hardener, carpeting, tile or other bonded covering.

3. Acceptable Products:

a. Sealtight AR-30 W.R. Meadows

b. Kurez Euclid Chemical

c. Horncure W.R. Grace

d. Hydrocide Resin Sonneborn

E. Curing/ Sealing Compound:

1. Sodium Silicate Sealer

a. Acceptable Products

1) Cure Hard Meadows

2) Eucosil Euclid Chemical

3) WB-309 Grace

4) Sonosil Sonneborn

5)Acurion Anti-Hydro Waterproofing

2. Verify compatibility of finish with curing/sealing compounds.

F. Bonding Agent (Epoxy Type) ASTM C881:

1. Sikadur Hi-Mod Sika Chemical
2. Thiopoxy W.R. Grace
3. Epoxy #452 Euclid Chemical

G. Non-shrink, Non-metallic grout:

1. Five Star U.S. Grout
2. Euco NS Euclid Chemical
3. Masterflow 713 Master Builders

H. Water Stop:

1. Provide rubber or PVC flat, center build type water stops as shown on drawings.

PART 3 - EXECUTION

3.01. GENERAL

A. Proportioning

1. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with the latest edition of ACI 211.1.
2. Contractor shall provide all testing services for approval of mixes.
3. The Contractor shall furnish the Architect/Engineer for approval a mix design for each class of concrete at least 15 days prior to start of work.

B. Report to Include

1. Total weight of water, cement, coarse aggregate fine aggregate and admixtures to be used.

2. Slump.

3. Percent of Air.

4. Results of Compression Test for 6 cylinders cast and broken 7, 14 and 28 days.

5. Grain size curves for both aggregates.

C. Do not begin production until mixes have been approved by Architect/Engineer.

D. When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301-72. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least 30 consecutive tests in one group or the statistical average for 2 groups totaling 30 or more tests, representing similar materials and project conditions.

E. The proper proportions of cement, aggregate and water to obtain the required strength shall be determined from ACI 211.1 "Recommended Practice for Selection Proportions for Normal and Heavy Weight Concrete".

1. Strength requirements shall be 4000 and 3000 pounds per square inch.

2. In all cases, not more than 6 gallons of water per each sack of cement will be allowed.

3. The minimum weight of cement per yard for various strengths are listed below:

   a. 4,000 pounds per square inch concrete - 587 pounds of cement per yard minimum.

   b. 3,000 pounds per square inch concrete - 517 pounds of cement per yard minimum.

4. Unit weight for normal weight concrete shall be 150 pcf $\pm$ 5%.

5. Air content for mixes requiring air entrainment shall be 3.5% $\pm$ 1.5%.

6. Slump at the point of placement shall be not less than 4" and not more than 6".

7. Water/cement ratio not to exceed 0.4.

F. Concrete containing a high range water-reducing admixture (superplasticizer) shall have an initial slump or 1-1/2 to 2 inches and a final slump not to exceed 8 inches after addition of the admixture.

G. Mix design adjustments may be requested by the Contractor when characteristics of material, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as approved by the Architect/Engineer. Laboratory test data for revised mix and designs and strength results must be submitted to and accepted by the Architect/Engineer before using it in the work.

H. Ready-Mix Concrete shall be mixed and delivered in accordance with ASTM C94, "Specifications for Ready-Mix Concrete" and shall meet other applicable requirements of this Section.

3.02 AIR-ENTRAINING ADMIXTURE:

A. Use air-entraining admixture in all concrete exposed directly to the elements, such as foundation and retaining walls, exterior slabs-on-grade, concrete canopies and walkways.

B. Add air-entraining admixture in accordance with manufacturer's recommendations.

3.03 WATER REDUCING ADMIXTURE

A. Use water-reducing admixtures in all concrete and in strict compliance with the manufacturer's directions.

B. Admixture to increase cement dispersion, or provide increased workability for low-slump concrete, any be used at the Contractor's option subject to the Architect/Engineer's acceptance.

C. The reduced water content shall be taken into account when proportioning mixes.

3.04 MIXING

A. Unless otherwise approved by the Architect/Engineer use ready mix concrete conforming to ASTM C494.

B. Place concrete no more than 90 minutes after initial mixing.

C. Tempering: All concrete shall be placed within 1-1/2 hours after introduction of water to the mix. Under no conditions may additional water be added that will exceed the quantity of water called for in the design mix. Submit time stamped

batching tickets on delivery of concrete to job site. All concrete where the quantity of water has exceeded the design mix will be removed and replaced with proper concrete at no cost to the Owner.

D. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

1. When the air temperature is between 85 degrees Fahrenheit and 90 degrees Fahrenheit reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is over 90 degrees Fahrenheit, reduce the mixing and delivery time to 60 minutes.

3.05 PLACING CONCRETE

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts and contractors to permit the installation of their work; cooperate with other trades in setting such work, as required.

2. The Contractor shall notify the Inspector at least 24 hours in advance of concrete placement for a particular portion of the building. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within placement area & retains the right to require necessary revisions be made before concrete is placed.

B. PLACEMENT

1. Clean out all chips, saw dust, dirt and other foreign matter from forms and assure that inside of forms are free of frost. Remove any dirt, debris, and water from trenches and other excavations. Remove any dirt, debris and mud from tops of footings or pile caps before pouring walls.

2. Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints.

3. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section

cannot be placed continuously, provide construction joints as herein specified.

4. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use vibrators designed to operate with vibratory element submerged in concrete.

6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Do not insert vibrators into lower layers of concrete that have begun to set. Limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

7. Dropping the concrete a distance of more than 6 feet or depositing a large quantity at any point and running or working it along the forms will not be permitted. An "elephant trunk" shall be used for all wall pours, which are over 6 feet high.

C. Cold Weather Placing

1. Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

2. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55 degrees Fahrenheit, and not more than 80 degrees Fahrenheit at point of placement.

3. Do not use frozen materials or materials containing ice or snow.

4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

5. Do not use calcium chloride, salt and other materials containing antifreeze

agents or chemical accelerators.

D. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees Fahrenheit. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperatures immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures without the written approval of the Architect/Engineer.

6. Place concrete in column forms before beam and slab steel is in place. Place column concrete in not more than 36 inch lifts before vibrating.

7. Slabs and Beams: Thoroughly clean beam and slab forms after placing column concrete. Do not place concrete in roof or wall beams or slabs until concrete in columns have been in place at least 4 hours. Place concrete for slabs and beams continuously in layers not over 12 inches deep. Arrange the work so that the joints will be located at points indicated.

8. Place slabs on fill carefully to avoid damage to vapor barrier.

E. Compaction

1. Compact concrete in layers by internal vibrating equipment, supplemented by hand rodding and tamping as required. Do not use vibrators to move the concrete laterally inside the forms.

2. Internal vibrators should maintain a speed of at least 5,000 impulses per minute when submerged in concrete (at least one spare vibrator in working condition should be maintained at the site at all times).

3. Limit duration of vibration to the time necessary to produce satisfactory consolidation without causing segregation, but in no case more than 15 seconds per square foot of exposed surface. Move vibrator constantly and place in each specific spot only once.

F. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Bring slab surfaces to the correct level with a straight-edge and strike-off. Use bull floats and darbies to smooth the surface, leaving it free of humps or hollows.

4. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Concrete to be placed on grade shall be placed over 10 mil polyethylene film.

   a. This film shall be laid continuously and in as large of pieces as possible.

   b. Any holes or perforations caused by pipes, conduits, ducts and general construction activity shall be securely taped to make the film vapor tight.

6. Floor slabs shall be level or pitched to drains as required.

7. All top of slab elevations shall be determined by the use of preset runners supported at the proper elevation.

G. Joints

1. Construction Joints

   a. Construction joints not shown on the drawings shall be located so as not to impair the strength and appearance of the structure, and at

locations approved by the Architect/ Engineer.

b. Provide keyways at least 1-1/2 inches deep in all construction joints in walls and slabs. Accepted bulkheads designed for this purpose may be used in slabs.

c. Place construction joints perpendicular to main reinforcement.

d. Roughened construction joints where indicated on the drawings shall be clean, free of laitance and intentionally roughened to a full amplitude of 1/4 inch by raking. Remove laitance entirely by high pressure water blasting.

e. Continue all reinforcement across construction joints. Welded wire fabric in slabs on grade may stop at those joints, which are shown on the drawings.

2. Isolation Joints in Slabs-on-Grade

a. Locate where indicated or detailed on Drawings to points of contact between the slabs on ground and vertical surfaces, such as foundations, curbs, etc.

b. Install preformed joint filler according to manufacturer's recommendations. Filler shall be closely fitted to wall faces and to slab edges.

c. Reinforcement shall not extend through isolation joints.

3. Weakened-Plane (Control) Joints

a. Locate where required and as indicated on the drawings.

b. Form weakened-plane joints in fresh concrete by grooving top portion with a recommended jointing tool and finishing edges with an edger.

c. If joints are saw-cut cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw; and cutting shall be completed before shrinkage stresses become sufficient to project cracking.

d. Form or cut joints to a depth of 1/3 of slab or wall thickness.

H. Expansion Joints

1. Locate as shown on drawings.

2. Joints in on-grade walkways maximum at 20 feet o.c., at every change in thickness, direction and at center line of drives. Score and tool between expansion joints in equal bays at not over 5 feet o.c.

3. Joints shall be straight and smooth. They shall have hardened before fresh concrete is deposited against them.

I. Other Embedded Items

1. All sleeves, inserts, anchors, and embedded items required for adjoining work shall be placed prior to concreting.

2. All Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

3.06 FINISHES

A. Formed Surfaced

1. Patching: Immediately after stripping forms, patch all defective areas with mortar similar to the concrete mix; coarse aggregate should be omitted. Bulges, minor honeycomb and other minor defects, as designated by the Architect, shall be patched only where exposed to view. Clean, dampen and fill tie holes with patching mortar.

a. Defective Areas as judged by the Architect and Engineer, including those resulting from leakage of forms, excessive honeycomb, large bulges and large offsets at form joints shall be chipped away to a depth of at least 1/4 inch, and the surfaces that are to be patched shall be coated with an epoxy polysulfide adhesive. The patching mortar shall be pressed in for a complete bond and finished to match adjacent areas, or where defective areas impair the strength of the member in question (as judged by the Architect), the member should be removed or gunited as determined by the Architect and Engineer.

2. Finishes:

a. Rough or Board Finish: For all concrete surfaces not exposed to public view, including concrete in utility spaces.

b. Plywood Finish: For all other exposed exterior overhead surfaces.

c. Grout Cleaned Surfaces: For all other exposed exterior surfaces and exposed vertical interior surfaces.

1). Rough or board finish, reasonably true to line and plane. Tie holes and defects patched and ins exceeding 1/4 inch rubbed down; otherwise, surfaced may be left with texture imparted by forms.

2). Plywood Finish: Same as board finish except forms should be constructed of 5/8 inch minimum thickness plywood in as large size as practicable, arranged in an orderly and symmetrical manner. Sheets showing torn grain, worn edges, holes or similar defects shall not be used. Remove all fins.

3). Grout Cleaned Finish: After concrete, still freshly hardened, had been predampened, a slurry consistency of 1 part cement and 1-1/2 parts sand passing No. 16 sieve by dry loose volume shall be spread over the surface with burlap pads or rubber floats. Surplus shall be removed by scraping and then rubbing with clean burlap. Cure in an approved manner. (All work will conform with ACI Standard 301-72).

B. Unformed Surfaced - Flatwork (Interior)

1. Grade and screen the surfaces to the exact elevation or slope shown or required. Make proper allowances for setting beds for ceramic tile. After screening, tamp mixture thoroughly to drive the coarse aggregate down from the surfaces and apply the applicable finish indicated hereinafter. Always slope exterior walks away from the building a minimum of 1/4 inch per foot unless noted otherwise on the drawings. Covered walks between buildings always slope to drain to the exterior and away from the buildings. At cross

sections of the walks, warp the surfaces to drain water from the walls. Provide control joints as indicated on drawings.

2. Scratch Finish: For surfaces to receive thickset bonded continuous applications, i.e., ceramic tile, etc., refer to drawings for locations of depressed areas.

3. Float Finish: For surfaces to receive roofing waterproofing membranes.

4. Trowel Finish: For all interior floor surfaces intended as smooth waling surfaces or for receipt of floor coverings except as noted in paragraph 2 above.

5. Wood Float Finish: For exterior play courts.

6. Non-Slip Finish: Where indicated on drawings.

7. Definition of Finish Types:

   a. Scratch Finish: After concrete has been placed, struck off, consolidate and leveled to a Class C tolerance, surface shall be roughened with stiff brush, rakes or metal lather roller before final set.

   b. Float Finish: After concrete has been placed, struck off and consolidated and leveled, concrete shall not be worked further until water sheen has disappeared and/or when mix has stiffened sufficiently to permit proper operations or a power-driven float. Consolidated with power drive float, check trueness of surface, fill low spots and cut down high spots to achieve Class B tolerance. Refloat to uniform, smooth, granular texture.

   c. Trowel Finish: Finish same as above for floated finish and in addition, steel trowel the surface to produce a smooth, glassy, impervious surface free of trowel marks to a Class A tolerance. On surfaces intended to support floor coverings, defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

d. Broom Finish: Finish same as above for float finish to a Class B tolerance and then draw a broom or burlap belt across surface transversely.

8. Tolerances: Finishes as indicated above should be as follows:

a. Class A - true planes within 1/8 inch to 10 feet.

b. Class B - true planes within 1/4 inch to 10 feet.

c. Class C - true planes within 1/4 inch to 2 feet.

d. Tolerances should be measured by placing a 10-foot straightedge anywhere in any direction.

9. Sealer: Apply 2 coats Thompson's Waterseal (or equal) after concrete has cured as follows:

a. Where indicated on the finish schedule.

b. To floor slabs receiving ceramic tile (except shower rooms scheduled to receive waterproofing barrier membrane), application of sealer shall be made no more than 48 hours prior to installation of tile Contractors to coordinate.

10. It shall be the Contractors responsibility to provide the proper substrate to receive floor finishes as required by manufacturers thereof.

3.07 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or heat, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening.

2. For concrete not in contact with forms, one of the following curing methods shall be applied immediately after completion of placement and finishing. Floors to receive hardener or mortar bonded topping shall be cured in accordance with #3 listed below under Curing Methods.

3. Curing shall be continued for at least seven days. Curing may be terminated

in less than seven days if cylinder tests show that the concrete has reached 2/3 of the specified design strength.

4. For concrete surfaces placed against forms the concrete shall be cured by one of the following methods after form removal until the end of the time period specified above.

B. Curing Methods

1. Membrane Curing Compound: To be used on all exterior flatwork.

a. May not be used on surfaces to receive paint, sealer, hardener, carpeting, tile, or other bonded coating.

b. Spray or roll apply material as specified and in accordance with manufacturers directions immediately after any water sheen which may develop after finishing has disappeared from the concrete surface.

c. The compound shall form a uniform, continuous fill that will not check, crack or peel.

d. It is the Contractors responsibility to determine that the curing compound used will not leave discoloration on concrete exposed to view.

e. Recoat areas which are subject to heavy rainfall within 3 hours after initial application; maintain continuity of coating and repair damage during curing period.

2. Curing/Sealing Compound

a. All interior concrete floors and slabs except those to receive hardener or mortar bonded topping, shall be cured/sealed in this manner. Spray or roll apply the specified materials in accordance with the manufacturers directions immediately after any water sheen which may develop after finishing has disappeared from the concrete surface.

b. The compound shall form a uniform continuous film that will not check, crack or peel.

c. It is the Contractors responsibility to determine that the curing/sealing compound uses is compatible with any carpet, tile or specific brand of paint to be used.

3. Waterproof Sheet Material

a. Cover concrete surfaces with waterproof sheet material conforming to ASTM C171, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed with waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

4. Application of burlap mats kept continuously wet.

3.08 FLOOR HARDENER

A. Those areas noted to receive floor hardener shall be treated with materials as specified and in accordance with manufacturers directions.

B. Concrete shall be cured using waterproof sheet material or continuously wet burlap as described above. No curing or sealing compound may be applied to areas to receive hardener.

3.09 PATCHING CONCRETE

A. Any concrete work not formed as shown on the drawings or which for any reason is out of alignment or level, or shows defective surfaces, shall be considered as not conforming with the intent of the specifications and shall be removed unless the Architect/Engineer grant permission to patch a defective area.

B. Immediately after removing the forms, all concrete surfaces shall be inspected. Any pockets showing unsolidified materials, or any other defective areas permitted by the Architect/Engineer to be patched, and all holes and honeycombed areas shall be patched before the concrete is thoroughly dry. The patching shall be made of the same material and of the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and white cement shall be substituted for a part of the dry Portland cement to match color of surrounding concrete.

C. The mortar shall be thoroughly compacted into place and screened off so as to leave the patch slightly higher than the surrounding surface. It shall be left undisturbed for a period of one to two hours to permit shrinkage before being finally

finished. Patches shall be finished in such a manner and texture as to match the adjoining surface.

D. Patches shall be bonded with a re-wetable bonding agent.

3.10 EPOXY MORTAR REPAIR

A. The areas to be patched shall have all loose, unsound concrete removed and then cleaned by sandblasting, vacuumed and/or blown clean with oil-free compressed air. The sound concrete remaining shall then be scrubbed with the epoxy binder only (without aggregate) just prior to the placement of the epoxy mortar.

B. The epoxy mortar shall be mixed and placed in accordance with the manufacturer's printed instructions. Such instructions shall be supplied to the Contractor by the supplier of the epoxy system.

C. Do not apply mortar in layers greater than 1" thick. Maximum thickness for outdoor applications is 1/2".

3.11 EPOXY GROUTING OF BOLT AND REINFORCING BARS

A. Drill holes in concrete 1/4" larger than the diameter of the bolt or bar and to the depth required. Holes to be blown free of dust and to be dry prior to placing epoxy grout.

B. Use epoxy grout in accordance with these specifications and the manufacturers directions.

C. Fill hole 1/3 with epoxy grout, insert bolt or bar and move up and down several times while filling hole.

D. No load shall be applied to the bar or bolt for at least 24 hours.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in place construction. Provide other miscellaneous concrete filling shown or required to complete the work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners,

intersections and terminations slightly rounded.

C. Equipment Bases and Foundation: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment with a template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machines and equipment.

3.13 MINIMUM REQUIREMENTS FOR SIDEWALKS

A. Where the drawings do not specify thickness, reinforcement, or jointing, the following minimum requirements shall be met:

1. Minimum thickness shall be 4 (four) inches.

2. Minimum reinforcement shall be woven wired fabric 6 x 6 - W1.4 x W1.4 placed at slab mid-depth.

B. Sidewalks shall be formed or sawn into squares.

1. For sidewalks less than ten feet in width longitudinal spacing of formed or sawn joints shall be equal to sidewalk width.

2. For sidewalks greater than ten feet in width spacing of formed or sawn joints shall not exceed ten feet in either direction.

3. Sawn joint depth shall be one and one-half inches in depth.

4. Formed joints shall be keyed together. Key shall be at slab mid-depth and be 1-1/2" x 1-1/2" at mid-depth of slab.

5. Expansion joints shall be installed at no greater than fifty (50') foot intervals or at any change in direction or width of walk, at locations where walk abuts other concrete or masonry construction. An expansion joint is defined as wood or metal formed at one side, the two surfaces separated by a ½" preformed expansion joint filler.

C. Sidewalk concrete shall have a minimum 28-day compressive strength of 4,000 pounds per square inch.

END OF SECTION

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SECTION 03 35 00

CONCRETE FINISHING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work included: Provide finishes on cast-in-place concrete as called for on the Drawings, specified herein, and need-ed for a complete and proper installation.

B. Related work:

1. Section 03 30 00 - Cast-in-place concrete.

1.02 QUALITY ASSURANCE:

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Except as may be modified herein or otherwise directed by the Architect, comply with ACI 301, "Specifications for Structural Concrete for Buildings."

1.03 SUBMITTALS:

A. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

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. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General:

1. Carefully study the Drawings and these Specifications, and determine the location, extent, and type of required concrete finishes.

2. As required for the Work, provide the following materials, or equals approved in advance by the Architect.

B. Concrete materials: Comply with pertinent provisions of Section 03 30 00, except as may be modified herein.

C. Liquid bonding agent: “Weld-Crete,” manufactured by the Larsen Products Corporation.

D. Curing and protection paper:

1. Approved products:

a. "Sisalkraft, Orange Label";

b. Equal products complying with ASTM C171.

2. Where concrete will be exposed and will be subjected to abrasion, such as floor slabs, use non-staining paper such as "Sisalkraft, Seekure 896," or equal paper faced with polyethylene film.

E. Liquid curing agents:

1. Where application of specified finish materials will be inhibited by use of curing agents, cure the surface by water only; do not use chemical cure.

2. For curing other areas, use "Hunt TLF" manufactured by Hunt Process Company, Inc.

F. Floor sealer: Acceptable products:

1. "Superkote Special Clear Sealer" manufactured by Ven-Chem Company, Inc., P.O. Box 3186, Santa Barbara, California 93105 (213) 342-1195.

2. "Supershield" manufactured by James Darcey Company, Inc., 19712 Merridy Street, Chatsworth, California 91311 (213) 349-3705.

G. Slip-resistant abrasive aggregate:

1. Provide aluminum oxide, 14/36 grading.

2. Acceptable manufacturers:

a. Carborundum Company;

b. Norton Company;

c. L. M. Scofield Company.

2.02 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 Architect.

PART 3 - EXECUTION

3.01 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.

3.02 FINISHING OF FORMED SURFACES

A. General:

1. After removal of forms, give the concrete surfaces one or more of the finishes specified below where so indicated on the Drawings.

2. Revise the finishes as needed to secure the approval of the Architect.

B. As-cast finish:

1. Rough form finish:

a. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.

b. Remove fins exceeding 1/4" in height.

2. Smooth form finish:

a. Coordinate as necessary to secure form construction using

smooth, hard, uniform surfaces, with number of seams kept to a practical minimum and in a uniform and orderly pattern.

b. Patch tie holes and defects.

c. Remove fins completely.

C. Rubbed finishes:

1. Provide these finishes only where specifically called for, and then only on a "smooth form finish" base as described above.

2. Smooth rubbed finish:

a. Produce on newly hardened concrete no later than the day following form removal.

b. Wet the surfaces, and rub with carborundum brick or other abrasive until uniform color and texture are produced.

c. Do not use a cement grout other than the cement paste drawn from the concrete itself by the rubbing process.

3. Grout cleaned finish:

a. Do not start cleaning operations until all contiguous surfaces to be cleaned are completed and accessible.

b. Do not permit cleaning as the work progresses.

c. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint.

d. Substitute white portland cement for part of the gray portland cement as required to produce a color matching the color of surrounding concrete, as determined by a trial patch.

e. Wet the surface of the concrete sufficiently to prevent absorption of water from the grout, and apply the grout uniformly with brushes or spray gun.

f. Immediately after applying the grout, scrub the surface vigorously with a cork float or stone to coat the surface and fill all air bubbles and holes.

g. While the grout is still plastic, remove all excess grout by working the surface with a rubber float, sack, or other means.

h. After the surface whites from drying (about 30 minutes at normal temperatures), rub vigorously with clean burlap.

i. Keep the surface damp for at least 36 hours after final rubbing.

D. Unspecified finish: If the finish of formed surfaces is not specifically called out elsewhere in the Contract Documents, provide the following finishes as applicable.

1. Rough form finish:

a. For all concrete surfaces not exposed to public view.

2. Smooth form finish:

a. For all concrete surfaces exposed to public view.

3.03 FINISHING SLABS

A. Definition of finishing tolerances:

1. "Class A": True plane within 1/8" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.

2. "Class B": True plane within 1/4" in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.

3. "Class C": True plane within 1/4" in two feet as determined by a two foot straightedge placed anywhere on the slab in any direction.

B. Scratched finish: After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance, roughen the surface with stiff brushes or rakes before the final set.

C. Floated finish:

1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating.

2. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.

3. During or after the first floating, check the planeness of the surface with a ten-foot straightedge applied at not less than two different angles.

4. Cut down high spots and fill low spots, and produce a surface with a Class B tolerance throughout.

5. Refloat the slab immediately to a uniform sandy texture.

D. Troweled finish:

1. Provide a floated finish as described above, followed by a power troweling and then a hand troweling.

a. Produce an initial surface which is relatively free from defects, but which still may show some trowel marks.

b. Provide hand troweling when a ringing sound is produced as the trowel is moved over the surface.

c. Thoroughly consolidate the surface by hand troweling.

2. Provide a finished surface essentially free from trowel marks, uniform in texture and appearance, and in a plane of Class A tolerance.

a. For concrete on metal deck, Class B plane tolerance is acceptable.

b. On surfaces intended to support floor coverings, use grinding or other means as necessary and remove all defects of such magnitude as would show through the floor covering.

E. Broom finish:

1. Provide a floated finish as described above.

2. While the surface is still plastic, provide a textured finish by drawing a fiber bristle broom uniformly over the surface.

3. Unless otherwise directed by the Architect, provide the texturing in one direction only. Provide "light," "medium," or "coarse" texturing as directed by the Architect or otherwise called for on the Drawings,

4. Provide “light,” “medium,” or “coarse” texturing as directed by the Architect or otherwise called for on the Drawings.

F. Unspecified finish: If the finish of slab surfaces is not specifically called for elsewhere in the Contract Documents, provide the following finishes as applicable:

1. Scratched finish:

    a. For surfaces scheduled to receive bond-applied cementitious applications.

2. Floated finish:

    a. For surfaces intended to receive roofing.

3. Troweled finish:

    a. For floors intended as walking surfaces;

    b. Floors scheduled to receive floor coverings or waterproof membrane;

4. Broom finish:

    a. Exterior pedestrian ramps.

5. Non-slip finish:

    a. Platforms, steps, and landings;

    b. Exterior pedestrian ramps.

3.04 CURING AND PROTECTION

A. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures, and mechanical injury.

B. Preservation of moisture:

1. Unless otherwise directed by the Architect, apply one of the following procedures to concrete not in contact with forms, immediately after completion of placement and finishing.

    a. Ponding or continuous sprinkling;

    b. Application of absorptive mats or fabric kept continuously wet;

    c. Application of sand kept continuously wet;

    d. Continuous application of steam (not exceeding 150 degrees F) or mist spray;

    e. Application of waterproof sheet materials specified in Part 2 of this Section;

    f. Application of other moisture-retaining covering as approved by the

Architect;

g. Application of the curing agent specified in Part 2 of this Section or elsewhere in the Contract Documents.

2. Where forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safely.

3. Cure concrete by preserving moisture as specified above for at least seven days.

C. Temperature, wind, and humidity:

1. Cold weather:

a. When the mean daily temperature outdoors is less than 40 degrees F, maintain the temperature of the concrete between 50 degrees F and 70 degrees F for the required curing Period.

b. When necessary, provide proper and adequate heating system capable of maintaining the required heat without injury due to concentration of heat.

c. Do not use combustion heaters during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases, which contain carbon dioxide.

2. Hot weather: When necessary, provide wind breaks, fog spraying, shading, sprinkling, ponding, or wet covering with a light colored material, applying as quickly as concrete hardening and finishing operations will allow.

3. Rate of temperature change: Keep the temperature of the air immediately adjacent to the concrete during and immediately following the curing period as uniform as possible and not exceeding a change of 5 degrees F in any one hour period, or 50 degrees F in any 24 hour period.

D. Protection from mechanical injury:

1. During the curing period, protect the concrete from damaging mechanical disturbances such as heavy shock, load stresses, and excessive vibration.

2. Protect finished concrete surfaces from damage from construction equipment, materials, and methods, by application of curing procedures, and

by rain and running water.

3. Do not load self-supporting structures in such a way as to overstress the concrete.

END OF SECTION

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SECTION 03 41 40

PRECAST-PRESTRESSED CONCRETE

PART - 1 GENERAL

1.01 REFERENCE:

Drawings and general provisions of Contract, including General and Supplementary Conditions and division-1 Specification sections, apply to work of this section.

Related Sections:

A. 03 11 00 - Concrete Formwork

B. 03 21 00 - Concrete Reinforcement

C. 03 30 00 - Cast-In-Place Concrete

1.02 DESCRIPTION OF WORK:

A. Extent of structural precast concrete work is shown on drawings and in schedules, in order to provide a composite structural floor and/or roof system capable of supporting the specified design loads.

B. Structural precast concrete includes the following:

1. All prestressed units.

1.03 RELATED WORK

A. Cast-in-place concrete is specified in another Division- 3 section.

B. Joint sealants and backing are specified in Division-7.

C. Applied finishes are specified in Division-9.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated:

1. ACI 301 "Specifications for Structural Concrete for Buildings".

2. ACI 318 "Building Code Requirements for Reinforced Concrete".

3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

4. Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products".

B. Fabricator Qualifications: Firms which have from 5 years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.

1. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.

2. Produce precast concrete units at fabricating plant engaging primarily in manufacturing of similar units, in accordance with approved shop drawings.

C. Fire-resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring fire- resistance classification, provide units tested and listed by UL in "Fire Resistance Directory", or with each unit bearing UL label and marking.

1.05 SUBMITTALS

A. Product Date: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

B. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross- section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units. Indicate crowns, shore loads, connection details and other information pertinent to the work.

Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.

Include erection procedure for precast units and sequence of erection.

Provide complete design calculations prepared, signed and sealed by a registered Professional Engineer, licensed in the State of Florida.

1.06 DELIVERY, STORAGE AND HANDLING

Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.

PART 2 - Materials

2.01 FORMWORK:

Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.

A. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.

B. Prestress manufacturer to install and remove all formwork required to complete the field placed concrete that comprises the composite portion of the floor and/or roof system.

C. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

2.02 REINFORCING MATERIALS:

A. Reinforcing Steel: ASTM A 615 - Grade 60

B. Low-Alloy Steel Reinforcing Bars: ASTM A 706.

C. Steel Wire: ASTM A 82, plain, cold drawn, steel.

D. Welded Wire Fabric: ASTM A185.

E. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.

1. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.03 PRESTRESSING TENDONS:

A. Uncoated, 7-wire stress-relieved strand complying with ASTM A 416. Use Grade 250 unless Grade 270 indicated.

Strand similar to above, but having size and ultimate strength of wires increased so that ultimate strength of the strand is increased approximately 15%, or strand with increased strength but with fewer number of wires per strand, may be used at manufacturer's option.

2.04 CONCRETE MATERIALS:

A. Portland Cement: ASTM C 150, Type I or Type III.

Use only one brand and type of cement throughout project, unless otherwise acceptable to Architect.

B. Coarse Aggregates: ASTM C 33 or D.O.T. #9 and as herein specified. Provide aggregates from a single source for exposed concrete.

C. Fine Aggregate: D.O.T. STD. specifications for road and bridge construction Section 502.

D. Lightweight Aggregate: ASTM C 330.

E. Water: Drinkable and free from foreign materials in amounts harmful to concrete and embedded steel.

F. Air-Entraining Admixture: ASTM C260.

G. Water-Reducing Admixture: ASTM C 494, Type A.

2.05 GROUT MATERIALS:

A. Non-Metallic, Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

1. Products: Subject to compliance with requirements, provide one of the following:

Euco N.S.; Euclid Chemical Co.

Crystex; L&M Construction Chemicals.

Masterflow 713; Master Builders

Five Star Grout; U.S. Grout Corp.

Upcon; Upco Chemical Division, USM Corp.

Propak; Protex Industries, Inc.

2.06 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type of concrete required.

B. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.

C. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 318.

1. Produce standard-weight concrete consisting of specified Portland Cement, aggregates, admixtures, and water to produce the following properties:

a. Compressive strength; 6000psi minimum at 28 days.

b. Release strength for prestressed units: 3500 psi.

2. Cure compression test cylinder using same methods as used for precast concrete work.

D. Submit written reports to Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the work.

F. Admixtures

1. Use air-entraining admixture in concrete, unless otherwise indicated.

2. Addition of calcium chloride shall not be permitted.

G. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.

Use amount as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.07 FABRICATION:

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, and as specified for types of units required. Units to be produced in steel forms. Normal plant-run structural finish will be acceptable.

B. Ready-mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.

2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

3. When the air temperature is between 85°F. (30°C) and 90°F (32°C), reduce mixing and delivery time from 1½ hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

C. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

D. Clean reinforcement of loose rust and mill scale, earth and other materials, which reduce or destroy bond with concrete.

E. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as requested.

F. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

G. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCA MNL-116 requirements.

H. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

I. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface, which will not show in finished structure.

J. Curing by low-pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

K. Delay detensioning of prestressed units until concrete has attained at least 70% of design stress, as established by test cylinders.

1. If concrete has been heat-cured, perform detensioning while concrete is still warm and moist, to avoid dimensional changes which cause cracking or undesirable stresses in concrete.

2. Detensioning of pertensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

L. Finish of Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:

1. Precast-Prestressed Joists and Beams:

   Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycombs, or structural defects will be permitted.

M. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete, bring to proper level with straight edge, float, and trowel to a smooth, uniform finish.

PART 3 - EXECUTION

3.01 INSTALLATION AND SHORING:

A. Provide all labor, materials, equipment, fabrication, transportation, erection and supervision necessary to complete all precast, pre-stressed portions of the floor and/or roof system.

B. Power Actuated Fasteners: Do not use power-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

C. All pre-stressed units to be installed by manufacturer.

D. Shoring of pre-stressed units to be installed and removed solely by manufacturer.

E. Shoring to be designed (by a Professional Enigneer licensed in the state of Florida) to safely support construction loads without exceeding design loads of completed portions of the building supporting the shoring. Submit signed and sealed shop drawings for field use.

F. Installation Tolerances: Install precast units without exceeding following tolerances limits:

   1. Variations from plumb: 1/4" in any 20' run or story height, 1/2" total in any 40' or longer run.

   2. Variations from level or elevation: 1/4" in any 20' run; 1/2" in any 40' run; total plus or minus 1/2" at any location.

3. Variation from position in plan: plus or minus 1/2" maximum at any location.

4. Offsets in alignment of adjacent members at any joint: 1/16" in any 10' run; 1/4" maximum.

3.02 PLANT QUALITY CONTROL EVALUATIONS:

A. The owner may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.

B. The precast manufacturer shall allow Owner's testing facility access to materials storage area, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits, will be subject to additional testing as herein specified.

Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if large dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.

D. Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing process fails to comply with any of the requirements which may affect the strength of the precast units, including the following conditions.

1. Failure to meet compressive strength test requirements.

2. Reinforcement, and pretensioning, and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.

3. Concrete curing, and protection of precast units against extremes in temperature, not as specified.

4. Precast units damaged during handling and erection.

E. Testing Precast Units: When there is evidence that strength of precast concrete

units does not meet specification requirements, the concrete testing service shall take cores drilling from hardened concrete for compressive strength determination, complying with ASTM C 42 and as follows:

1. Take at least three representative cores from precast units of suspect strength, from locations directed by Architect.

2. Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet during use of completed structure.

3. Test cores in air-dry condition per ACI 318 if concrete will be dry during use of completed structure.

4. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is a least 85% of the 28-day design compressive strength.

5. Test results will be made in writing on the same day that tests were made, with copies to Architect/Engineer, Contractor, and precast manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, number, and type of member or members represented by core tests, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of testing.

F. Patching: Where core test results in satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

G. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section. The Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

END OF SECTION

SECTION 03 42 20

PRECAST CONCRETE VAULTS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, design, and installation of precast concrete vaults and structures.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data on precast concrete items. Show dimensions of vaults and thicknesses of walls, floors, and top slabs. Show reinforcing wire and steel. Show materials of construction by ASTM reference and grade.

C. Submit manufacturer's design calculations and certification signed and sealed by a professional structural engineer registered in the state of Florida that vault design and construction comply with the specified design load conditions and the referenced ASTM specifications (e.g., ASTM C857 and C858).

D. Submit drawings of access hatches. Show dimensions and reference materials of construction by ASTM designation and grade.

1.03 FGBC SUBMITTALS

A. Product data for Category 5, Credit 4.1 or 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and/or post-industrial recycled content.

   a. Include statement indicating costs for each product having recycled content.

B. Product Certificates for Category 5, Credit 8.1 and 8.2: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

   a. Include statement indicating costs for each regional material and the fraction by weight that is consider regional.

PART 2 MATERIALS

2.01 REGIONAL MATERIALS

Regional Materials shall be manufactured within 700 miles of Project site within the following states: Florida, Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 700 miles of Project site. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

2.02 MANUFACTURERS

Precast concrete vaults shall be manufactured by Brooks Products Inc., Utility Vault Company, or equal.

2.03 PRECAST CONCRETE VAULTS

A. Precast concrete vaults shall comply with ASTM C858 except as modified herein.

B. Design loads shall be in accordance with ASTM C857, except as modified herein. Traffic loads, unless otherwise stated, shall conform to Load Designation A-16 per Table 1. Soil lateral loads shall be as determined by ASTM C857 or loadings specified in the project soils report, whichever is greater. Alternate design by the strength design method shall include a load factor of 1.7 times the lateral earth or hydrostatic pressures.

C. Include the following load conditions in the design:

   a. Vault roof removed while structure is backfilled to grade and subject to live and dead loads.

   b. Vault roof in place and walls subject to simultaneous vertical and horizontal application of all live, impact, and dead loads. Include the case of an A-16 designated load placed directly above the wall.

D. Design shall also comply with the following restrictions:

   a. The maximum reinforcement ratio allowed is one-half the reinforcement ratio that would produce a balanced strain condition.

   b. Earth pressure shall be converted to a horizontal pressure using a coefficient of earth pressure at rest of 0.5 and not a coefficient of active earth pressure.

c. Include a live load surcharge of 2 feet of soil in the design of the walls.

E. Design all vaults to receive the specified traffic loading.

F. Precast vault construction shall be in the form of monolithic walls or horizontal wall sections; do not use panel walls.

G. Minimum wall thickness shall be 6 inches. Design knockout wall panels to accommodate loading pressures defined above.

H. Design and construct vaults to be watertight when subjected to groundwater over the entire height of the vault, except for precast vault without a floor slab.

I. Floor slab shall be precast concrete. Calculations for the floor slab design shall be included in the vault design submittal.

J. Design joints using a butyl rubber sealant per ASTM C990.

2.04 SEALANTS AND MORTAR

Butyl rubber sealing compound shall comply with ASTM C990. Mortar shall comply with ASTM C387, Type S or use grout complying with Section 033000.

2.05 ACCESS HATCHES

A. Access hatches shall be Bilco or Halliday of the size and configuration shown in the drawings. Aluminum doors shall be anodized. Latch and lifting mechanism assemblies, hold-open arms and guides, and brackets, hinges, pins, and fasteners shall be Type 316 stainless steel.

B. Locking and Latching Devices:

C. Lugs welded to the exterior door surface to receive a padlock.

D. Hinged hasp on exterior door surface.

E. Recessed hasp covered by a hinged lid flush with the exterior surface.

2.06 SUMP COVERS

Steel, minimum 1/4-inch thick, galvanized per ASTM A123.

2.07 INSERTS

Handling eyes, lifting inserts, and threaded inserts shall be galvanized steel. Design load capacity shall be 2,000 pounds unless shown otherwise in the drawings.

2.08 CEMENT

Cement shall be ASTM C150, Type II.

2.09 ADMIXTURES

Provide air-entraining and water-reducing concrete admixtures as specified in Section 033000.

2.010 CRUSHED ROCK BASE

Crushed rock base material shall comply with Section 312333.

PART 3 EXECUTION

3.01 VAULT BASE

A. Excavate for the vault and install a crushed rock base, 12 inches thick.

B. Crushed rock base material shall extend 1 foot beyond the outside edge of the concrete vault base. Compact to 85% relative density.

3.02 SEALING AND GROUTING

Fill joints between precast sections with either a butyl rubber sealing compound or mortar.

3.03 INSTALLING VAULTS

A. Set each precast concrete vault section plumb on a bed of sealant or cement mortar at least 1/2-inch thick to make a watertight joint with the concrete base and with the preceding unit. Point the inside joint and wipe off the excess mortar or sealant.

B. Install the concrete roof such that it slopes at least 1/8 inch per foot away the roof hatch.

3.04 BACKFILL AROUND VAULTS

Backfill and compact around the vaults using fill as specified in Section 312333. Compact to 95% relative compaction.

3.05 CORROSION PROTECTION OF ALUMINUM SURFACES

A. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry per Section 099000, System No. 30 before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

B. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

END OF SECTION

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SECTION 04 05 13

MORTAR

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for Masonry

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Joint Reinforcement
B. Metal Accessories
C. Masonry Units
D. Flashing and Steel Metal

1.03 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete
B. Section 04 05 16 - Masonry Grout
C. Section 04 05 23 - Masonry Accessories
D. Section 04 20 00 - Reinforced Unit Masonry System
E. Section 07 90 00 - Joint Sealants

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM) latest edition:

1. ASTM C91 - Masonry Cement
2. ASTM C144 - Aggregate for Masonry Mortar
3. ASTM C150 - Portland Cement
4. ASTM C207 - Hydrated Lime for Masonry Purposes
5. ASTM C270 - Mortar for Unit Masonry
6. ASTM C387 - Packaged, Dry, Combined Materials for Mortar and Concrete
7. ASTM C595 - Blended Hydraulic Cements

8. ASTM C780 - Standard Test Method for Prognostication and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

9. ASTM C1142 - Extended Life Mortar for Unit Masonry

10. ASTM C1180 - Standard Terminology of Mortar and Grout for Unit Masonry

11. ASTM C1329 - Mortar Cement

1.05 SUBMITTALS

A. Submit data indicating specifications used for mortar.

B. Submit test reports for mortar materials indicating conformance to ASTM C270.

C. Submit test reports for field sampling and testing mortar in conformance to ASTM C780.

D. Samples: Submit two ribbons of mortar for conformance with color.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver and store manufactured products in original, unopened containers.

B. Store materials in a clean, dry location protected from dampness and freezing.

C. Store cementitious ingredients in weather-tight enclosures and protect against contamination and warehouse set.

D. Stockpile and handle aggregates to prevent contamination from foreign materials.

E. Store admixtures to prevent contamination of damage from excessive temperature changes.

F. Keep water clean and free from harmful materials.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Heat sand and/or mixing water when the air temperature is below 40° to provide mortar and grout temperatures between 40°F and 120°F.

B. Do not heat sand or water above 120°F.

PART 2 PRODUCTS

2.01 MORTAR MATERIALS

A. Cement:

1. Portland Cement: ASTM C150, Type I or II
2. Mortar Cement: ASTM C1329
3. Masonry Cement: ASTM C91

B. Hydrated Lime: ASTM C207

C. Sand: ASTM C144

D. Admixtures:

1. The use of admixtures shall not be permitted except as specified by the Architect/Engineer and as approved by the Building Official.
2. No air entraining admixtures or material containing air entraining admixtures may be used.
3. No antifreeze compounds shall be added to mortar.
4. No admixtures containing chlorides shall be added to mortar.

E. Water:

1. Water shall be clean, potable and free from deleterious quantities of acids, alkalis and organic materials.
2. Water shall come from a domestic supply.

F. Mortar Pigment:

1. Mortar pigment shall not exceed 10% of the weight of Portland cement.
2. Carbon black shall not exceed 2% of the weight of Portland cement.

2.02 MORTAR MIXES

Mortar: ASTM C270, Type M, S, N or O.

PART 3 – EXECUTION

3.01 FIELD MIXING MORTAR

A. All cementitious materials and aggregate shall be mixed between 3 and 10 minutes in a mechanical mixer with the amount of water to produce a spreadable, workable consistency. Dry mixes for mortar which have been preblended in a factory shall be mixed at the jobsite until workable, but not to exceed 10 minutes.

B. Control batching procedure to ensure proper proportions by measuring material by volume.

C. The consistency of mortar and grout may be adjusted to the satisfaction of the mason by retempering with water. Mortar may be retempered once within 2½ hours after initial mixing to compensate for water lost due to initial evaporation. Retempering shall be done by adding water into a formed basin within the mortar and then working the mortar into the water. Mortar shall not be retempered by splashing water over the surface.

D. Discard all mortar which has begun to harden. Also discard mortar if more than 2½ hours old.

3.02 APPLICATION OF MORTAR

A. Ends of solid masonry units shall be buttered with sufficient mortar to fill head joints. Hollow unit masonry shall be mortared so that the head joint thickness is equal to the face shell thickness.

B. Mortar beds for solid units shall be slightly beveled towards the center of the wall so that the bed joints will be sufficiently filled when the masonry unit is brought into line. Furrowing of the joints is not permitted.

C. Closures shall be rocked into place with mortared head joints against two adjacent brick in place.

D. Corners and jambs may not be pounded into position to fit stretcher units.

E. Units which have been displaced after the mortar has begun to set shall be cleaned of all mortar and reset with fresh mortar.

F. Mortar fins and protrusions which protrude more than ½ inch into cells or spaces to grouted are to be avoided.

G. Mortar Joints shall be tooled as directed in Division 4.

END OF SECTION

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SECTION 04 05 16

MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grout for Masonry

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Reinforcing Steel

B. Metal Accessories

C. Masonry Units

D. Flashing and Steel Metal

1.03 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete

B. Section 04 05 13 - Mortar

C. Section 04 09 23 - Masonry Accessories

D. Section 04 20 00 - Reinforced Unit Masonry Systems

E. Section 07 90 00 - Joint Sealants

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM) latest edition:

1. ASTM C150 - Portland Cement
2. ASTM C207 - Hydrated Lime for Masonry Purposes
3. ASTM C387 - Packaged, Dry, Combined Materials for Mortar and Concrete
4. ASTM C404 - Aggregates for Masonry Grout
5. ASTM C476 - Grout for Masonry

6. ASTM C595 - Blended Hydraulic Cements

7. ASTM C1019 - Standard Method of Sampling and Testing Grout

1.05 SUBMITTALS

A. Submit test reports for grout materials including conformance to ASTM C476.

B. Submit test reports for field sampling and testing grout in conformance to ASTM C1019.

1.06 DELIVERY, STORAGE AND HANDLING

A. Grout may be plant-batched and shipped to project in ready mix trucks or grout may be mixed at project site.

B. Deliver and store manufactured products in original, unopened containers.

C. Store materials in a clean, dry location protected from dampness and freezing.

D. Store cementitious ingredients in weather-tight enclosures and protect against contamination and warehouse set.

E. Stockpile and handle aggregates to prevent contamination from foreign materials.

F. Store admixtures to prevent contamination of damage from excessive temperature changes.

G. Keep water clean and free from harmful materials.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Heat sand and/or mixing water when the air temperature is below 40°F to provide mortar and grout temperature between 40°F and 120°F when used.

B. Do not heat sand or water above 120°F.

PART 2 PRODUCTS

2.01 GROUT MATERIALS

A. Portland Cement: ASTM C150

B. Hydrated Lime: ASTM C207

C. Aggregate: ASTM C404

D. Admixtures:

1. The use of admixtures shall not be permitted except as specified by the Architect/Engineer and as approved by the Building Official.

2. An admixture shall be used in high lift grouting to counteract water loss and volume reduction.

E. Water:

1. Water shall be clean, potable and free from deleterious quantities of acids, alkalis and organic materials.

2. Water shall come from a domestic supply.

2.02 GROUT MIXES

Grout: ASTM C476

A. Fine Grout (1 part Portland cement; 2¼ to 3 parts sand)

B. Coarse Grout (1 part Portland cement; 2¼ to 3 parts sand; 1 to 2 parts gravel)

C. Slump: 8 to 11 inches

D. Minimum strength 2,000 psi

PART 3 EXECUTION

3.01 FIELD MIXING GROUT

A. All cementitious material and aggregate shall be mixed between 3 and 10 minutes in a mechanical mixer with the amount of water to produce a spreadable, workable consistency. Dry mixes for grout which have been preblended in a factory shall be mixed at the jobsite until workable, but not to exceed 10 minutes.

B. Control batching procedure to ensure proper proportions by measuring material by volume.

C. The consistency of grout may be adjusted to the satisfaction of the masonry by retempering with water.

D. Discard all grout which has begun to harden. Also discard grout which is more than 1½ hours old.

3.02 LOW LIFT GROUTING

A. Grout pours 12 inches and less:

1. If necessary, clean or roughen concrete foundation by sandblasting, chipping or other means to remove laitance.

2. Lay one course of masonry making sure no mortar extends into grout spaces.

3. Place all reinforcement which extends into grouted areas. Reinforcement shall be secured prior to grouting.

4. Grout to below one-half of the top unit height and consolidate by puddling to eliminate voids in the grout.

5. Lay an additional 12 inches of masonry units.

6. Grout each 12 inches as the units are laid. Hold the top of each grout pour approximately 1½ inches below the top of the wall. Provide at least ½ inch of grout cover above horizontal reinforcing steel.

7. At the completion of each wall, grout flush to the top of the units.

8. Remove all grout droppings as the work progresses.

B. Grout pours more than 12 inches and up to 5 feet.

1. Construct the masonry wall up to 5 feet above the foundation. Install all reinforcing steel, anchors and embedded items as masonry work progresses.

2. For two wythe walls, bond the wythes together with rectangular ties or joint reinforcing so that one cross wire secures approximately two square feet of wall.

3. For walls that are to be partially grouted, use expanded metal mesh or other material which will not interfere with bond to restrict the grout into only those cells which are to be grouted.

4. After the mortar joints have set, grout the wall to 1½ inches below the top

of the wall. Where bond beams occur, stop grout pour a minimum of ½ inch below top of masonry.

5. Consolidate the grout using a mechanical vibrator and reconsolidate after the excess water is absorbed into the masonry units.

6. Continue to lay up masonry and reinforcing steel, up to 5 feet at a time. After the mortar has set, grout and consolidate.

7. At the completion of the wall, fill the grout space flush with the top of the units and consolidate.

3.03 HIGH LIFT GROUTING

A. Construct the masonry wall up to a maximum of 24 feet above the foundation. Provide cleanout openings at the base of the wall at all vertical reinforcing bars but at a spacing no more than 32 inches on centers for solid grouted walls or a maximum of 48 inches on centers for partially grouted walls.

B. Install horizontal reinforcing steel, anchors and embedded items as masonry work progresses. Vertical reinforcing steel may be placed after the wall is constructed provided it is supported every 200 bar diameters with wire positioners or other devices to hold it in place. All reinforcement must be in place prior to grouting.

C. For two wythe walls, bond the wythes with rectangular ties or joint reinforcing so that one cross wire secures approximately two square feet of wall.

D. Install vertical grout dams at a maximum horizontal spacing of 30 feet to control the horizontal flow of grout.

For walls that are to be partially grouted, use expanded metal lath mesh or other material which will not interfere with bond to restrict the grout into only those cells which are to be grouted.

E. After the mortar joints have set, remove protruding mortar fins which excessively constrict the grout space. Remove all such droppings and debris through the cleanouts at the base of the wall.

F. After the cleanouts have been inspected, seal and brace the cleanouts.

G. Grout the walls in six foot lifts. All cells and spaces containing reinforcing steel

shall be solidly grouted for partially grouted walls. For solid grouted walls, all cells shall be grouted.

H. Consolidate the grout using a mechanical vibrator and reconsolidate after the excess water is absorbed into the masonry units.

I. Stop the grout 1½ inches below the top of the uppermost grouted unit if the grouting is to be stopped for more than one hour.

J. Continue to grout the wall in six foot lifts, consolidating and reconsolidating each lift.

K. Where additional masonry is to be laid above this point, stop the grout 1½ inches below the top of the masonry units. Otherwise, fill the grout space flush with the top of the units at the top of the wall and consolidate.

END OF SECTION

SECTION 04 05 23

MASONRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Masonry reinforcement and anchors.

B. Control and expansion joints.

1.02 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete

B. Section 04 05 13 - Mortar

C. Section 04 05 16 - Masonry Grout

D. Section 04 20 00 - Reinforced Unit Masonry Systems

E. Section 07 90 00 - Joint Sealants

1.03 REFERENCES

American Society for Testing and Materials (ASTM) latest edition:

A. ASTM A116 - Metallic Coated Steel Woven Wire Fence Fabric

B. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware

C. ASTM A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

D. ASTM A951 - Steel Wire for Masonry Joint Reinforcement

1.04 SUBMITTALS

Submit shop drawings of the following items:

A. Reinforcement for masonry lintels, bond beams, etc.

B. Control and/or expansion joints.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcement bars for lintels, bond beams, pilasters and other masonry reinforcement shall conform to ASTM A615, Grade 60.

B. Joint reinforcement shall conform to ASTM A951 and hot dipped galvanized in accordance with ASTM A153. Provide prefabricated pieces for corners and intersections of walls. Reinforcement shall be truss type approximately 2 inches narrower than the nominal thickness of the wall or partition.

C. Reinforcement used in cavity walls shall have a drip between masonry wythes.

D. Wire mesh ties shall be 16 gage or larger diameter zinc-coated steel wire woven into ½-inch mesh and cut into strips 1-inch narrower than the width of walls in which they are used. Zinc-coating shall conform to ASTM A116, Class 2 or 3 coating.

2.02 RIGID STEEL ANCHORS

Rigid steel anchors shall be a minimum of 1" x 1/4" x 26" long with each end turned up not less than 2 inches. Anchors shall be zinc-coated conforming to ASTM A116, Class 2 or 3.

2.03 SEALS AND GASKETS FOR CONTROL AND EXPANSION JOINTS

Seals and gaskets for control and expansion joint shall be of closed cell natural or synthetic rubber. Provide seals and gaskets of indicated shapes and in locations as specified or indicated on Drawings. Seals and gaskets shall be resistant to oils and solvents and shall be flexible after being exposed to temperature of minus 40° F.

2.04 WIRE TIES

A. Wire ties shall be fabricated from 3/16-inch diameter zinc-coated steel wire conforming to ASTM A116, Class 2 or 3 coating. Ties shall be at least 4 inches wide and embedded 4 inches into backup material, unless otherwise indicated on the Drawings.

B. Ties used in cavity walls shall have a drip between masonry wythes.

PART 3 EXECUTION

3.01 JOINT REINFORCEMENT

A. Install horizontal continuous joint reinforcement in all unit masonry walls, back-ups, and partitions. Reinforcement shall start not more than 8 inches above the masonry supporting surface and end within the top full mortar joint, or as indicated on the Drawings, and shall be spaced at maximum 16-inch centers vertically.

B. Reinforcement shall be placed in the first three mortar joints above lintels and below openings. Extend the reinforcement at least 24 inches past jambs. In addition, provide wire ties alternating with reinforcement 16 inches on centers vertically and within 12 inches of opening jambs.

C. Reinforcement shall be continuous but shall not pass through vertical masonry expansion or control joints unless otherwise shown on the Drawings. Side rods of horizontal joint reinforcement shall be lapped at least 6 inches at splices.

D. Joint reinforcement shall be placed in a manner to assure 5/8-inch mortar cover on the exterior face of walls and 1/2-inch mortar cover on interior faces.

E. At intersections bond each course with wire mesh ties or prefabricated joint reinforcement spaced not to exceed 16 inches vertically.

3.02 VERTICAL REINFORCEMENT

Install vertical reinforcement bars in the hollow cores of masonry units where indicated on the Drawings. Fill all cells containing reinforcement with masonry grout or Class A concrete for the full height of the reinforcement.

3.03 ANCHORAGE

A. All masonry unit partitions that abut exterior walls, except when control joints occur at such locations, shall be anchored once every 16 inches vertically with rigid steel anchors. Anchors shall extend at least 4 inches into wall and not less than 18 inches into partition.

B. When intersecting walls are carried up separately, the vertical joint shall be regularly toothed or bonded with 8-inch offsets and the joints provided with rigid steel anchors spaced not more than 24 inches apart vertically.

C. At intersecting partitions, the vertical joint shall be tied with wire mesh ties spaced at 16 inches vertically.

END OF SECTION

SECTION 04 20 00

REINFORCED UNIT MASONRY SYSTEM

PART 1 - GENERAL

1.01 GENERAL

A. Related Sections: General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this section.

1. 03 21 00 - Concrete Reinforcement

B. Work Includes: Structural load bearing concrete masonry units, defined as all concrete masonry walls shown on the structural drawings. Liquid polymeric admixture added to the concrete masonry units at the time of manufacture. Mortar and liquid polymeric admixture added to the mortar for wall construction at the time of mixing. Jointing and cleaning.

1.02 QUALITY ASSURANCE

A. Codes and Standards

1. ANSI/ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement
2. ANSI/ASTM C55 - Concrete Building Brick
3. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
4. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process
5. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement
6. ASTM C90 - Hollow Load Bearing Concrete Masonry Units
7. IMIAC - International Masonry Industry All-Weather Council; Recommended Practices and Guide Specifications for Cold Weather Masonry Construction
8. ACI 531 - Building Code Requirements for Concrete Masonry Structures.
9. ASTM E 514, “Standard Test method for Water Penetration and Leakage

through Masonry."

10. ASTM C 1357, "Standard Test Method for Evaluating Masonry Bond Strength."

11. ASTM C 1314, "Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry."

12. ASTM C 1148, "Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar."

13. ASTM C 426, "Standard Test Method for Drying Shrinkage of Concrete Masonry Units."

14. Test consistent with the Department of State Architect of California requirements in California State Chapter 2405(c)3.C. Test method is described in Concrete Masonry Association of California and Nevada document, "Recommended Grouting Procedure for Hollow Concrete Masonry Constructed Under CAC Title 24."

15. CMU producer shall be qualified by manufacturer of integral CMU water-repellent admixture.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with General Conditions of the Contract for Construction. Submit shop drawings indicating bars sizes, spacings, locations, quantities of reinforcement, bending and cutting schedules, supporting and spacing devices.

B. Submit product data for masonry units and fabricated wire reinforcement. Submit samples under provisions of Section 01 33 00. Submit manufacturer's certification that products meet or exceed specified requirements.

C. Spec-Data® Sheet on Grace Construction Products DRY-BLOCK System of Integral Water-Repellent Admixtures for Block and Mortar.

D. Data Sheet on DRY-BLOCK II Mortar Admixture.

E. Technical Bulletin on Cleaning Masonry Containing DRY-BLOCK.

F. Test Reports prepared by a qualified independent laboratory indicating compliance

with the performance requirements for integral mortar water-repellency as tested using:

1. ASTM E 514, extended to 72 hours.
2. ASTM C 1357.
3. ASTM C 1314.
4. ASTM C 1148.
5. California State Chapter 2405(c) 3.C test for Grout Shear Bond Strength.

G. Current “Qualified Producer Certification” issued by manufacturer of integral CMU water-repellent admixture, indicating that CMU producer is qualified to produce CMU units containing manufacturer’s admixture.

H. Sample Panel: Construct a sample panel to determine the compatibility of materials and the effect of the materials and construction procedures on the final appearance of the wall. Use jobsite materials, including specified water-repellent CMU and mortar to construct sample panel. The CMU sample panels erected shall represent the range of texture and color permitted for the project. Prepare more than one sample batch of mortar, especially when coloring pigments are added to the mortar, to establish desired aesthetics and performance. Perform all construction procedures on sample panel, including cleaning and application of coatings and sealants. Retain sample panel during construction as standard for judging completed masonry work. Acceptance of sample panel does not constitute approval of deviations from materials contained in sample panel, unless such deviations are specifically approved by Architect in writing.

1.04 DELIVERY, STORAGE AND HANDLING

A. Masonry units delivered to the site must comply with acceptable moisture content limitations. Store units above ground. Store on platform, which permits air circulation. Cover and protect units against moisture.

B. Store integral water-repellent mortar admixture in an area where temperature is maintained between 4ºC (40ºF) to 38ºC (100ºF).

1. Do not allow integral water-repellent mortar admixture to freeze; discard any frozen admixture.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.

1.06 WARRANTY

A. Integral CMU water-repellent admixture shall be warranted by admixture manufacturer to be free of defects and to meet manufacturer's published physical and chemical properties.

B. CMU producer shall warrant that integral CMU water-repellent admixture has been provided at appropriate dosage rate in all CMU units shipped to project site for use in exterior wall construction.

C. Installer shall warrant that only CMU containing integral CMU water-repellent admixture have been placed in exterior CMU walls.

D. Integral water-repellent mortar admixture shall be warranted by admixture manufacturer to be free of defects and to meet manufacturer's published physical and chemical properties.

E. Installer shall warrant that only mortar containing integral water-repellent mortar admixture at the manufacturer's recommended addition rate has been placed in exterior walls.

PART 2 - PRODUCT

2.01 MASONRY UNITS

A. Hollow load bearing masonry conforming to ASTM C-90-90, Grade N of standard sizes as shown on drawings. No broken or chipped block permitted. Moisture content should not exceed 50% of total absorption. Net cross sectional area - 50% of gross.

B. Standard masonry unit shall be square ended block such that cores align vertically for unobstructed grouting. The only exception is listed below

C. Masonry units: Nominal modular size as shown on the drawings. Provide special units for bond beams and lintels.

D. Masonry Unit Finish/Pattern: Provide split faced units. Color as selected by Architect.

E. Integral CMU Water-Repellent equivalent to DRY-BLOCK Block Admixture, an

integral liquid polymeric water-repellent CMU admixture manufactured by Grace Construction Products.:

1. Description: Integral liquid polymeric admixture mixed with concrete during production of CMU.
2. Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.
3. Flexural Bond Strength of Masonry: An increase of minimum 10% in masonry flexural bond strength shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar tested according to ASTM C 1357.
4. Compressive Strength of Masonry Prisms: Maximum 5% decrease in compressive strength of prisms shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1314.
5. Drying Shrinkage of CMU: Maximum 5% increase in drying shrinkage of the CMU shall occur as a result of adding integral water-repellent CMU admixture when compared to a control (containing no admixtures) CMU when tested according to ASTM C 426.
6. Grout Shear Bond Strength: Maximum 5% decrease in grout shear bond strength shall occur as a result of adding integral water-repellent admixture to the CMU compared to a control (containing no admixtures) CMU when tested according to California State Chapter 2405(c)3.C test for Grout Shear Bond Strength.

2.02 MORTAR

A. Conform to "Tentative Specifications for Mortar for Unit Masonry" ASTM C-270, Type S, property specifications. All ingredients shall meet appropriate ASTM Specifications. Water: Potable.

B. Mixing: All mortar shall be thoroughly mixed for a period of at least five minutes after all materials are in mixer designed for this purpose. These requirements shall not be

waived except for minor jobs and then only upon the written approval of the Owner's Representative.

C. Time Limit: All mortar to be used and placed in final position within 2-/12 hours after mixing with air temperature is 80 degrees F or higher and within 3-1/2 hours when air temperatures is less than 80 degrees F. Mortar not used within these time limits shall be discarded.

D. Retempering: Mortar that has stiffened within the allowable time limit because of evaporation of moisture may be retempered to restore workability by adding water.

E. Integral Water-Repellent Mortar Admixture equivalent to “DRY-BLOCK” Mortar Admixture, an integral water-repellent mortar admixture manufactured by Grace Construction Products.

1. Description: Integral liquid polymeric admixture for mortar added during mixing.

2. Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.

3. Flexural Bond Strength of Masonry: An increase of minimum 10% in masonry flexural bond strength shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1357.

4. Compressive Strength of Masonry Prisms: Maximum 5% decrease in compressive strength of prisms shall occur as a result of adding integral water-repellent CMU and mortar admixtures when compared to a control (containing no admixtures) CMU and mortar when tested according to ASTM C 1314.

5. Drying Shrinkage of Mortar: Maximum 5% increase in shrinkage of mortar shall occur as a result of adding integral water-repellent mortar admixture when compared to a control (containing no admixture) mortar when tested according to ASTM C 1148.

2.03 REINFORCEMENT AND ANCHORAGE

A. Joint Reinforcement: Ladder type; hot-dip galvanized after fabrication cold-drawn

steel conforming to ANSI/ASTM A82, 3/18 inch side rods with 9 gage cross ties. Finish to be galvanized with 0.4 ounces of zinc Class 1. Use 3 wire Type (tripod) in cavity walls and 2 wire in single width walls. Provide prefabricated corner and tee units.

B. Acceptable Manufacturers: Hohmann & Barnard, Duro-Wall, Masonry Reinforcing Corporation of America, TY-Wall, AA Wire Products Company.

PART 3 - EXECUTION

3.01 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other Sections. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.03 PLACING AND BONDING

A. Lay all masonry units in a "full" bed of mortar. Buttering corners of joints or excessive furrowing of mortar joints are not permitted. Remove excess mortar as work progresses. Interlock intersections and external corners.

B. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Cut mortar joints flush where ceramic or quarry wall tile is scheduled, cement parging is required.

3.04 INTEGRAL WATER-REPELLENT

A. Integral Water-Repellent CMU and Mortar Admixture:

1. Installer shall use only concrete masonry units containing compatible integral water-repellent CMU admixture for exterior wall construction.

2. Installer shall use only mortar containing integral water-repellent mortar

admixture at the manufacturer's recommended addition rate and mixed according to the manufacturer's recommended instructions.

3. Fill head and bed joints for full thickness of the faceshells to provide the greatest resistance to water penetration.

4. Tooling:

   a. Tool the mortar joints concave or to a V-profile to provide the greatest resistance to water-penetration. Do not use raked, flush, extruded, struck, beaded, weathered, or other joint profiles due to their reduced water-resistance.

   b. Tool the mortar joints when they are thumbprint hard to provide the greatest resistance to water-penetration and to help minimize hairline cracks between the mortar and the CMU.

5. Cover the top of unfinished masonry work to protect it from the weather and to prevent accumulation of water in the cores of the CMU.

6. Cleaning:

   a. Remove "primary" efflorescence from masonry walls exposed in the finished work in accordance with the manufacturer's recommendations and the NCMA TEK Bulletin #8-3A.

   b. Remove dirt or stains from masonry walls exposed in the finished work in accordance with the manufacturer's recommendations and the NCMA TEK Bulletin #8-2A.

   c. Promptly remove excess wet mortar containing integral water-repellent mortar admixture from the face of the masonry as work progresses. Do not use strong acids, overaggressive sandblasting or high-pressure cleaning methods.

   d. Comply with applicable environmental laws and restrictions.

7. At least two weeks before starting above-grade masonry work, schedule a pre-installation conference at the to discuss compliance with the requirements of the contract documents. Give two weeks advance notice to the participants, including the contractor, mason contractor, flashing installer, CMU producer and/or the manufacturer of the integral water-repellent mortar admixture. Advise

the architect of the scheduled meeting date.

3.05 REINFORCEMENT AND ANCHORAGES

A. Install horizontal joint reinforcement at a maximum spacing inches o.c. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening. Lap joint reinforcement ends minimum 12 inches.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position. Embed anchors embedded in concrete. Embed anchorages in every second block joint.

C. Reinforce joint corners and intersections with a vertical #4 bar grouted in the cell at the intersection and one cell each side of the intersection.

3.05 REINFORCEMENT AND GROUTING

A. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed. Place mortar in masonry unit bed joints back 1/4 inch (6 mm) from edge of unit grout spaces, bevel back and upward. Reinforce masonry unit cores with reinforcement bars and grout.

B. Retain vertical reinforcement in position at top and bottom and at intervals not exceeding 192 bar diameters. Lap splices in deformed reinforcing bars shall be 48 bar diameters minimum. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout space 2 inches or greater in width with course grout using high or low lift grouting techniques.

C. When grouting is stopped for more than one hour, terminate grout 1-1/2 inches below top of upper masonry unit to form a positive key for subsequent grout placements.

D. Low Lift Grouting: Place first lift of grout to a height of 16 inches and rod for grout consolidation with a 1 inch by 2 inch wood stick or a mechanical vibrator. Place subsequent lifts in 8-inch increments and rod for grout consolidation.

E. High Lift Grouting: Provide clean out opening no less than 4 inches high and 12 square inches in area at the bottom of each cell to be grouted by cutting one face shell of masonry unit below the top of floor slab so that repair is not visible in the finished construction. Do not use high lift grouting until masonry units have been in

place 72 hours. Remove mortar fins protruding more than 1/2 inch into the grout space by dislodging the projections with a rod or stick as the work progresses or by washing the grout space at least twice a day during erection using a high-pressure stream of water.

F. Clean masonry cells or mortar droppings and other foreign materials. Request the Inspector to inspect the cells. Allow 3 days advance notice of inspection. After cleaning and cell inspection, seal openings. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.

G. Limit grout lift to 60 inches and rod for grout consolidation. Wait a minimum of 30 minutes and a maximum of 60 minutes before placing next lift. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidated with the vibrator extending 12 to 18 inches into the previous lift. Do not insert vibrators into lower pours that are in a semi-solidified state. Repeat the waiting, pouring, and consolidating process until the top of the grout pour is reached. Reconsolidate the top our after the required waiting period.

3.06 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints. 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 elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant. Size control joint in accordance with Section 07900 for sealant performance. Form expansion joint as detailed.

3.07 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other Sections of work to provide correct size, shape and location. Obtain Architect/Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired. Cutting may only be done with a power saw.

3.08 CLEANING

A. Clean work under provisions of Section 017423. Remove excess mortar and mortar smears. Replace defective mortar. Match adjacent work. Clean soiled surfaces with cleaning solution. Use non-metallic tools in cleaning operations.

3.09 PROTECTION OF FINISHED WORK

A. Protect finish installation. Without damaging completed work, provide protective boards at exposed external corners, which may be damaged by construction activities.

END OF SECTION

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SECTION 05 05 20

METAL MATERIALS, METHODS AND FASTENING

PART 1 GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere

A. This Section includes the basic materials and methods required for the work of Division 5, Metals.

B. Related Work Specified Elsewhere - Painting - Section 09 90 00

PART 2 PRODUCTS

2.01 STEEL

A. Steel shall comply with ASTM A36, unless otherwise specified.

B. Structural steel tubing shall comply with ASTM A500, Grade B or ASTM A501.

C. Steel pipe shall comply with ASTM A53, Grade B.

2.02 STAINLESS STEEL

Stainless steel shall comply with ASTM A167, type 316.

2.03 ALUMINUM

A. Aluminum for structural and rolled shapes shall be Aluminum Association alloy 6061-T6.

B. Aluminum for extruded shapes shall be Aluminum Association alloy 6063-T6.

C. Aluminum for pipe shall be Aluminum Association alloy 6063-T6.

D. Aluminum for castings shall be Aluminum Association alloy F-514, or approved equal.

2.04 CAST IRON

A. Gray iron for castings shall comply with ASTM A48, Class 30 or approved equal.

B. Malleable iron castings shall be made of high grade white iron, fully annealed, of uniform ductile strength and shall comply with ASTM A197.

2.05 BOLTS

A. High strength bolts shall comply with ASTM A325 with suitable nuts and washers, complying with ASTM A354, Grade BC.

B. Anchor bolts and connection bolts for steel assemblies shall comply with ASTM A307.

C. Anchor bolts and connection bolts for aluminum shall be stainless steel.

2.06 WELDING ELECTRODES

Filler metal for welding shall comply with AWS D1.1, Structural Welding Code.

2.07 GROUT

Grout for bedding and grouting structural steel shall be non-shrink grout as specified in Section 03300.

2.08 FABRICATION

A. General

1. Fabricate all metal parts to comply with the design indicated on the Drawings. Make field measurements and prepare templates as required to ensure proper fit. Assemblies shall be fitted together in the shop and delivered to the site complete and ready for installation.

2. Form metal shapes with sharp lines and angles, and finish with smooth surfaces. Shearings and punchings shall be clean and true. In general, holes for bolts shall be drilled or reamed 1/16_inch larger than the diameter of the bolt. Holes for anchor bolts shall be 1-1/3 times the anchor bolt diameter.

3. Metal thicknesses, assembly details, and supports shall provide ample strength and stiffness. Joints shall be designed to prevent trapping of moisture.

B. Shop Coatings

1. Prepare and shop prime ferrous metal in compliance with Section 09900. Do not shop prime stainless steel, aluminum, galvanized or plated metals, bronze, or machined bearing surfaces.

2. Anchors, sleeves, and metal parts built into masonry or concrete shall be galvanized or coated with a bituminous paint.

3. Castings for exterior exposure shall be cleaned and coated with coal-tar-pitch varnish.

4. Hot-dip galvanizing for products fabricated from steel shapes, plates, bars, and strips shall comply with ASTM A123. Hot-dip galvanizing for assembled steel products shall comply with ASTM A386. Except for bolts and nuts for field assembly, galvanize all subassemblies immediately after fabrication. Hardware shall be galvanized in compliance with ASTM A153.

5. Aluminum in direct contact with dissimilar metals, concrete, or masonry shall be coated with a heavy-bodied bituminous paint or covered with non-absorptive insulating tape or gasket.

C. Fasteners and Connections

1. Provide fastening devices as required and in compliance with the Drawings and shop drawings. Provide welded shop connections or concealed fastenings wherever practicable.

2. Power-driven fasteners shall be of the types and sizes recommended by the manufacturer for the particular application. Power-driven fasteners that will be exposed to view shall be set through a steel finishing disc. When set in concrete or masonry, the minimum penetration of power-driven fasteners shall be six times the diameter of the shank.

3. Structural joints made using high strength bolts, hardened washers, and nuts tightened to a high bolt tension shall comply with the "Specification for Structural Joints Using ASTM A325 or A490 Bolts", issued by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

4. Welded joints shall comply with AWS D1.1, Structural Welding Code, and AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings". All welds shall be made by operators who have been previously qualified as prescribed by AWS B3.0, Welding Procedure and Performance Qualification. All welds exposed to view shall be dressed smooth.

5. Anchor holes in concrete or masonry for grouted bolts shall be a minimum of 1-1/2 times the bolt shank diameter. Anchor holes in concrete and masonry for expansion type anchor bolts shall comply with the bolt manufacturer's recommendations.

6. Screw heads shall be countersunk. Bolt threads shall be nicked to prevent nut loosening.

2.09 TEMPLATES, LEVELING PLATES, AND APPURTENANCES

Provide all templates, leveling plates, and appurtenances required for the installation of metal work.

END OF SECTION

SECTION 05 12 10

MISCELLANEOUS METAL ASSEMBLIES

PART 1 GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere

A. Work under this Section includes:

1. Lintels, plates, and miscellaneous angles.
2. Equipment supports.
3. Fabricated frames.
4. Pit and trench covers and frames.
5. Bar screen (trash rack).
6. Truck guards.
7. Stop plates, grooves, and stop log grooves.
8. Aluminum hatch covers.
9. Aluminum louvers.

B. Related Work Specified Elsewhere

1. Metal Materials, Methods, and Fastening - Section 05 05 20.
2. Painting - Section 09 90 00.

1.02 SUBMITTALS

Submit shop drawings and product data for the work of this Section in compliance with Section 01 30 00.

PART 2 PRODUCTS

2.01 MATERIALS, FABRICATION, AND CONNECTIONS

Materials, fabrication, shop coatings, and fasteners and connections shall comply with Section 05025.

2.02 LINTELS, PLATES, AND MISCELLANEOUS ANGLES

Provide lintels, plates, and miscellaneous angles as required. Lintels shall have a minimum 8-inch bearing at each end unless otherwise indicated. Weld or bolt members together to form a complete assembly. Install plates and angles as indicated on the Drawings. Where bolts and straps are shown attached to plates, angles, and lintels, provide a 1 ¾ -inch diameter by 15-inch long anchor bolt or 2 ¼ -inch by 1-inch by 8-inch long strap anchor at each end, unless otherwise indicated on the Drawings. Properly embed fasteners into concrete or masonry.

2.03 EQUIPMENT SUPPORTS

Provide equipment supports as required to support and anchor mechanical equipment, including roof-mounted items.

2.04 FABRICATED FRAMES

Provide fabricated frames for openings in floors and walls as indicated on the Drawings. Construct frames of channels, angles, and flat or bent plates or combinations of shapes and materials as detailed. Frames shall be accurately squared, mitered, butted, or coped as necessary, shall be fully welded, and all welds on exposed surfaces shall be ground smooth. Weld straps or anchors of sizes and spacing indicated to the back of frames for anchoring into concrete or masonry. Where size and spacing of anchors are not indicated, use 1/4" x 2" x 8" straps with ends hooked 2 inches, and space the straps not more than 18 inches apart. Frames shall be aligned and accurately leveled to finish flush with adjacent surfaces.

2.05 PIT AND TRENCH COVERS AND FRAMES

Provide steel frames and non-skid steel plate covers where indicated on the Drawings. Unless otherwise indicated, provide 1-inch x 8-inch long bent bar anchors, welded to frames and spaced not more than 18 inches on centers. Frames shall be aligned and accurately leveled to finish flush with adjacent surfaces. Covers shall be in sections not more than 4 feet long; allow approximately 1/8-inch between the ends of adjoining sections. Provide hinges and suitable lift-holes near the ends of each section of cover.

2.06 BAR SCREEN (TRASH RACK) – N/A

2.07 TRUCK GUARDS

Provide truck guards where indicated on the Drawings. Fabricate truck guards of required lengths using concrete filled steel tubing or pipe or steel angles with masonry anchors, set flush with adjacent surfaces.

2.08 STOP PLATES, GROOVES, AND STOP LOG GROOVES

A. Stop Plates for weirs and baffles shall be fabricated from 3/8-inch minimum aluminum alloy 6061-T6 or 6063-T6 or fiberglass, as indicated on the Drawings. Corners shall be rounded approximately 1/8-inch radius for smooth sliding.

B. Stop Plate Grooves for weirs and baffles shall be extruded aluminum alloys 6061-T6 or 6063-T6 as indicated on the Drawings. Grooves shall be one piece, have integral concrete anchors and welded miter corners, and be designed for the thickness of stop plates plus 1/8-inch. Grooves shall be as manufactured by Washington Aluminum Co., Baltimore, MD; Neenah Foundry Co., Neenah, WI; or equal. All aluminum in contact with or embedded in concrete shall be protected in accordance with the AA Specification.

C. Aluminum Angles shall be attached in pairs to form grooves on the face of existing concrete. Use 2-inch by 2-inch by 3/8-inch angles and expansion anchors, unless otherwise indicated on the Drawings. Protect all aluminum in contact with dissimilar materials in accordance with AA recommendations.

D. Stop Log Grooves shall be of cast iron or fabricated metal sections of the type and dimensions indicated on the Drawings.

2.09 ALUMINUM HATCH COVERS – N/A

2.10 ALUMINUM LOUVERS – See Section 08900 “Louvers and Vents”

PART 3 – EXECUTION – Not Used

END OF SECTION

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SECTION 05 51 00

STAIRS AND STAIR NOSINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of prefabricated alternating tread stairs, stair nosings, and stair treads.

1.02 DESIGN CRITERIA

Handrails, Walkways, Ladders, and Personnel Platforms: OSHA and FBC.

1.03 SUBMITTALS

Submit drawings of stairs, and stair nosings. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

2.01 ALTERNATING TREAD ALUMINUM STAIRS

A. Stairs shall be welded, alternating-tread type stairs, having a center spine and a cast integrally welded combination mounting plate and top landing, coplanar with the upper floor level. Handrails shall be custom formed and contoured to provide close body support and shall be welded onto the balusters which extend directly from the treads. Risers shall be equal, including the first and last risers, and treads shall be cast aluminum having antiskid surfaces. The stringer bottoms shall be bent and/or cut and welded to the vertical and welded to a cast aluminum floor plate. The stair shall sustain a minimum loading of 100 psf based on the projected plan area, without structural failure, deformation, or deflection.

B. Landing, tread, and floor plate castings shall be aluminum Alloy AAF356F. Half treads shall be at least 9 inches wide and 10 inches deep.

C. The central stringer shall be aluminum Alloy 6063-T52, 1-3/4-inch by 1/8-inch box shape.

D. Handrails shall be aluminum Alloy 6061-T4.

E. Finish shall be natural aluminum.

F. Stairs shall be as manufactured by Lapeyre Stair, Inc., or equal.

2.02 ALUMINUM ABRASIVE STAIR NOSINGS

Abrasive stair nosings for concrete stairs shall be aluminum (Alloy 6061T6) angles 2 1/2 inches by 2 1/2 inches by 8 inches less than the concrete width. The walking surfaces of the nosings shall have integrally cast abrasive grit to provide antislip protection. Front edge of nosings shall be rounded. Nosings shall include concrete anchors. Nosings shall be American Abrasive Metals Company Curb Bar CB2, Barry Craft CB25A, or equal.

2.03 STAIR TREADS

Stair treads shall be of aluminum design with 1-1/4 -inch by 3/16-inch bars spaced 1 3/16 inches on center. Treads shall have extruded aluminum corrugated nosings. Treads shall be as manufactured by Grating Pacific, IKG Industries, or equal.

2.04 WELDING ELECTRODES

Welding electrodes for aluminum shall be ER4043 filler metal.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 CORROSION PROTECTION FOR ALUMINUM SURFACES

A. Coat aluminum surfaces to be embedded or which will be in contact with concrete or per Section 09 90 00 before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

B. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

END OF SECTION

SECTION 06 10 00

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. Preservative treated wood materials.

B. Miscellaneous framing and sheathing.

C. Communications and electrical room mounting boards.

D. Concealed wood blocking, nailers, and supports.

E. Miscellaneous wood nailers, furring, and grounds.

1.03 REFERENCES

A. AFPA T10 - Wood Frame Construction Manual; American Forest and Paper Association; 2001.

B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2007.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.05 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials and application instructions.

B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

B. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

1.07 DELIVERY, STORAGE AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 EXPOSED DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

2.03 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Southern Pine.

E. Grade: No. 2, 2 Common, or Construction.

2.04 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:

1. Manufacturers:

a. Chemical Specialties, Inc: www.treatedwood.com.

b. Substitutions: See Section 01600 - Product Requirements.

C. Preservative Pressure Treatment of Lumber Above Grade: AWPA Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.

1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION – GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

3.04 BLOCKING, NAILERS AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

D. Specifically, provide the following non-structural framing and blocking:

1. Joints of rigid wall coverings that occur between studs.

3.05 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in

30 feet maximum.

3.06 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01732.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 06 70 00

FIBERGLASS REINFORCED PLASTIC PRODUCTS

1.01 GENERAL

This specification covers Fiberglass reinforced plastic products for use in fabricating the potable water natural draft aerator specified for this project.

Related Section: Section 33 16 23 – Natural Draft Aerator

1.02 QUALIFICATIONS and EXPERIENCE OF THE MANUFACTURER

The Manufacturer shall be a specialist in the design and fabrication of Fiberglass reinforced plastic products intended for use in water and wastewater applications, and shall have at least five years experience in this specialty.

The Manufacturer shall have such production facilities as will assure prompt manufacture and shipment of these Fiberglass products. The Manufacturer shall continually monitor production in order to insure that the control of quality is maintained. Upon request, the Manufacturer shall furnish certified test reports on the raw materials used in fabrication.

The Manufacturer shall have on its staff a full-time registered professional engineer having no less than five years experience in the design and fabrication of Fiberglass reinforced plastic products, who will be in responsible engineering charge of the work to be done. All shop drawings shall carry the seal of such registered professional engineer.

1.03 GUARANTEE

The Manufacturer shall guarantee workmanship and materials on the finished Fiberglass reinforced plastic products for a period of five years from date of acceptance of the work.

1.04 DRAWINGS

The Manufacturer shall submit a drawing showing thicknesses and dimensions pertaining to the aerator and installation. Drawings must be approved before production may proceed.

1.05 RESINS

A. Polyester Resin

General purpose polyester resin, Polygard PG 300, or equal, shall be used. The resin shall be of a commercial grade that has been evaluated by testing or previous service, and found to be acceptable for the specific environment. The resin shall be resistant to the corrosive action of water and wastewater.

B. Catalyst

The polyester resin shall be cured by polymerization, resulting in a hard, rigid, solid product. The catalyst used for polymerization shall be MEK peroxide, Polygard 46-700 or equal.

C. Gel Coat Gel coat shall consist of polyester resin, a catalyst, and a colorant. White gel coat shall be Polygard 6631T or equal..

1.06 GLASS FIBER REINFORCING MATERIALS

Glass fiber reinforcing materials shall be of commercial grade. To insure chemical adherence between the glass reinforcement and the polyester resin, a special silane treatment shall be applied to the glass filaments. One or more of the following glass fiber reinforcing materials shall be used.

A. Chopped Roving:

Multiple strands of monofilament glass fibers made into a continuous untwisted ribbon and automatically chopped to approximately 1-inch lengths, and placed by machine in the spray-up method of Fiberglass manufacture.

B. Reinforcing Mat:

Made from roving chopped to approximately 2-inch lengths, then uniformly dispersed and manufactured into a smooth mat with weights ranging from ¾ ounce to 1½ ounces per square foot, suitable for the hand lay-up method of **Fiberglass** manufacture. In the manufacture of reinforcing mat, the glass strands shall be bonded together into the mat shape with a styrene soluble binder.

C. Woven Roving:

Made from continuous roving, and woven into a heavy fabric suitable for the hand lay-up method of Fiberglass manufacture.

D. Woven Cloth and Tape:

Made from twisted yarns of glass fiber strands, and woven into a light fabric suitable for the hand lay-up method of Fiberglass manufacture.

E. Core Material

A continuous filament polyester needle punched, heat set, non-woven fabric used for the hand lay-up method of Fiberglass manufacture. Minimum weight is 7.3 oz/sq/yd; average thickness of 86 mils.

1.07 LAMINATED FIBERGLASS COMPONENTS

A. Laminate Construction:

Laminated Fiberglass components shall be manufactured by a combination of the spray-up method and the hand lay-up method.

The laminate shall consist of a series of layers of resin and glass reinforcement applied upon a mold made specifically for the end product being manufactured. The surface of the mold shall be free of cracks, pits, and crazing. The mold shall have a smooth finish.

The initial coating placed against the mold shall be a gel coat 20 to 25 mils thick. White gel coat shall be used for molded surfaces that will be exposed to weather. The second layer in the laminate shall be no less than 25 mils thick and shall consist of polyester resin reinforced with no less than 30 percent chopped roving and reinforcing mat. The remaining thickness of the laminate shall be designed and manufactured to provide the strength necessary to meet tensile and flexural requirements and shall consist of layers of polyester resin and any one or a combination of glass fiber reinforcing materials described under Paragraph 6.

If multiple layers of woven roving or woven cloth are used, a layer of chopped roving shall be placed in alternate layers.

The glass fiber content of the completed laminate shall be no less than 30 percent by weight. Throughout the laminate, the resin shall thoroughly saturate the glass fiber reinforcement.

B. Laminate Appearance:

The Fiberglass product shall be of uniformly high quality. The finished molded surface shall be free of visual defects, foreign inclusions, dry spots, air bubbles, pin holes and delaminations. Edges shall be straight and true.

The finished lay-up surface shall be smooth and shall be thoroughly coated with gel coat. There shall be no exposed glass fibers or sharp projections. All cut edges shall be straight, and shall be coated with gel coat so that no glass fibers are exposed, and so that all voids are filled.

C. Laminate Thickness:

The Fiberglass reinforced plastic laminate shall have a thickness of no less than ¼ inch. At no point in the laminate shall the thickness be less than this minimum.

D. Laminate Properties:

The Fiberglass reinforced plastic laminate shall have the following physical properties, and where required, shall be tested in accordance with the ASTM standards indicated:

	ASTM
Specific Gravity: 1.5	D792
Water Absorption, 24 hours: 0.50%	D570
Ultimate Flexural Strength: 20,000 psi	D790
Ultimate Tensile Strength: 20,000 psi	D638
Ultimate Compressive Strength: 20,000 psi	D695
Ultimate Shear Strength: 10,000 psi	D732

Design of all components shall use a factor of safety of 4.0 based on the ultimate strength.

The average Barcol hardness of the laminate shall be no less than 30. Barcol Impressor Model GYZJ 934-1 shall be used for determining hardness. Calibration of the Barcol instrument shall be verified by comparing with a blank specimen having a known hardness reading of 85-87. For each Fiberglass component, 10 readings on the clean laminate surface shall be made. After eliminating the two high and two low readings, the average of the remainder shall be the reported hardness reading.

1.08 PREFABRICATED STRUCTURAL COMPONENTS

Prefabricated structural components used in the manufacture of all Fiberglass products shall be made of polyester resin reinforced with glass fibers and produced by a continuous forming process.

Prefabricated structural components shall have the following physical properties:

Specific Gravity: 1.52

Water Absorption, 24 Hours: 0.75%

Barcol Hardness: 50

Ultimate Tensile Strength: 20,000 psi

Ultimate Compressive Strength: 20,000 psi

Ultimate Shear Strength: 3,000 psi

Design of all components shall use a factor of safety of 4.0 based on the ultimate strength.

1.09 FASTENERS

All fasteners used in the assembly and erection of Fiberglass reinforced plastic products shall be Type 316 stainless steel. A ratio of fastener diameter to Fiberglass thickness (D/t) of no less than one (1) shall be used.

1.010 DESIGN

The assembled Fiberglass reinforced plastic products and each of their structural components, both laminated and prefabricated, shall be designed for all live and dead loads. Empirical designs of assembled Fiberglass reinforced plastic products shall be acceptable provided they are substantiated by a satisfactory service history of no less than 10 years. *All surfaces in contact with potable water will be fabricated from or coated with products that meet NSF Std. 61.*

END OF SECTION

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SECTION 07 19 00

WATER REPELLENTS

PART I GENERAL

1.01 SUMMARY

A. Section Includes:

1. Volatile Organic Compound (VOC) compliant water-based penetrating sealer field applied to completed exterior DRY-BLOCK CMU wall construction to:

a. Further prevent intrusion of water into completed wall.

b. Reduce attack from water-borne contaminants.

c. Minimize the occurrence of efflorescence, mold, mildew, and algae.

B. Related Sections:

1. Section 04 20 00 – Reinforced Unit Masonry System.

1.02 PERFORMANCE REQUIREMENTS

A. ASTM E 514, “Standard Test Method for Water Penetration and Leakage through Masonry.”

B. VOC Content: EPA Method 24.

C. ASTM E 96, “Test Methods for Water Vapor Transmission of Materials.”

D. Water Repellency Test – Capillary Test: “Grace Construction Products, Method 698.”

E. Water Repellency Test – 63.5 mm (2½ in.) Hydrostatic Head: “Grace Construction Products, Method HU 698.”

F. Accelerated Weathering: QUV (2,000 hours).

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:

1. Reduce absorption of water and waterborne contaminants into substrate.

2. Permit water vapor transmittance.

3. No change to slight darkening of substrate after application.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300

1. Spec-Data® Sheet on Grace Construction Products INFINISEAL DB Water-Repellent Sealer for DRY-BLOCK Admixture Wall Systems.

2. Technical Brochure on Grace Construction Products INFINISEAL DB Water-Repellent Sealer.

3.. Test Report prepared by a qualified independent laboratory indicating compliance with the performance requirements for water-repellent sealer compatible with the integral water-repellent admixture wall system as tested using ASTM E 514, extended to 72 hours.

4. Technical data sheet indicating compliance with the performance requirements for water-repellent sealer compatible with the integral water-repellent admixture wall system as tested using:

a. EPA Method 24.

b. ASTM E 96.

c. “Grace Construction Products Method 698.”

d. “Grace Construction Products Method HU 698.”

e. QUV for 2,000 hours.

5. Material Safety Data Sheets (MSDS) for water-repellent sealer maintained on project site during application period.

1.05 QUALITY ASSURANCE

A. Mockups:

1. Perform application test to 1.5 m x 1.5 m (5 ft x 5 ft) section of CMU wall surface to determine:

    a. Proper sealer coverage rate for type of CMU being sealed. Typical sealer coverage rate ranges from 1.2 to 3.7 m2/L (50 to 150 ft2/gal). Where overall coverage rates are less than 1.9 m2/L (80 ft2/gal), use 2-coat application method.

    b. Desired water-repellency properties.

    c. Desired surface appearance after sealer is fully dry.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store materials in a dry area at a temperature between 40º and 100º F (0 to 38 degrees C). Provide adequate ventilation and keep away from ignition sources.

B. Do not allow water-repellent sealer to freeze; discard any frozen sealer.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply water-repellent sealer when wall surface, air, and sealer temperatures are less than 4°C (40°F) or greater than 38°C (100°F).

2. Do not apply if rain or temperatures below 40 degrees F (4 degrees C) are expected within 6 hours after application.

3. Do not apply during winds that could carry water repellent to adjacent surfaces, properties, or vegetation.

4. Do not apply sooner than 24 hours after surface has been exposed to rain or other water source.

B. Substrate:

1. Cured minimum 30 days.

2. Not frozen or frost covered.

3. Clean, sound, and dry.

C. Ensure adequate ventilation in application areas.

D. Joint sealers, paints, and glazing compounds and sealants fully cured.

1.08 SEQUENCING

A. Apply water repellents after installation of joint sealers.

1.09 WARRANTIES

A. Provide manufacturer's 5 year material replacement warranty.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Grace Construction Products

62 Whittemore Avenue

Cambridge, MA 02140

www.graceconstruction.com

B. Professional Products of Kansas, Nc.: www.watersealant.com

2.02 MATERIALS

A. Water Repellent Product: INFINISEAL DB Water-Repellent Sealer manufactured by Grace Construction Products.

1. Description: Specially-formulated, VOC-compliant, clear, penetrating sealer consisting of water-based blend of silanes and siloxanes to provide maximum water-repellency when post-applied to integrally water-repellent-treated CMU wall construction.
2. Water Permeance: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.
3. Volatile Organic Compound Content: Maximum 320 g/L.
4. Moisture Vapor Transmission Rate: Minimum 95% compared to unsealed normal weight integral water-repellent sample using ASTM E 96.

5. Depth of Penetration: 15 mm (9⁄16 in.) to 35 mm (13⁄8 in.) depending on density of CMU, as observed visually.

6. Water Repellency – Capillary Test: Minimum 82% reduction in water uptake versus unsealed normal weight integral water-repellent CMU using Method 698.

7. Water Repellency – 63.5 mm (21⁄2 in.) Hydrostatic Head Pressure: Minimum 86% reduction in water uptake versus unsealed normal weight integral water-repellent CMU using Method HU 698.

8. Accelerated Weathering: Minimal color change using QUV for 2,000 hours.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation:

1. Ensure surface area of CMU to be treated is clean and dry, free of chemical cleaners, efflorescence, dirt, oils, mortar smears, and other surface contaminants.

2. Repoint any loose, cracked, or disintegrated mortar a minimum of 7 days before applying water-repellent sealer.

3. Ensure all joint sealants and caulking is fully cured.

B. Surrounding Area Protection:

1. Take necessary precautions to protect all areas surrounding surfaces to be treated with water-repellent sealer, including masking windows and metals, and covering plants, grass, and any other non-CMU surfaces with either polyethylene sheeting or drop cloth materials before and during sealer application.

2. Take necessary safety precautions to keep all personnel not involved in application of water-repellent sealer and pedestrians away from application area.

3. Avoid overspray by wind drift and/or improper application procedures.

3.02 APPLICATION

A. Spray Application:

1. Use low-pressure airless spray equipment fitted with fan tip between 0.6 mm (0.025 in.) and 0.8 mm (0.035 in.).

2. Apply at lowest pressure setting that ensures continuous spray without surge.

3. Using 0.9 m to 1.2 m (3 ft to 4 ft) wide swathes, start spraying from bottom of CMU wall and work to top of wall, avoiding spray atomization and applying sufficient material to saturate CMU wall with maximum 150 mm (6 in.) sealer rundown.

4. When necessary, apply second coat, wet-on-wet, at twice the coverage rate as first coat within one hour of first spray application, per pre-application testing to ensure proper surface saturation, coverage, and product performance.

B. Brush or Roller Application:

1. Use either nylon or other synthetic brushes or rollers resistant to alkalinity.

2. Apply water-repellent sealer to area to be treated, thoroughly saturating CMU and avoiding excessive overlapping.

3. Cleaning:

a. Clean all equipment with hot, soapy water.

b. Clean all windows or surrounding areas accidentally oversprayed on same day of application using warm, soapy water.

c. If feasible, to make cleaning easier, pretreat windows with soapy water just prior to sealer application and clean windows immediately after sealer application, while the sealer is still wet.

d. If overspray is allowed to dry, clean surface with solvents such as mineral spirits or typical scraping methods.

3.03 FIELD QUALITY CONTROL

A. At least two weeks before starting above-grade masonry work, schedule a pre-installation conference at the jobsite in accordance with Section 01200 to discuss compliance with the requirements of the contract documents. Give two weeks advance notice to the participants, including the contractor, mason contractor, flashing installer, CMU producer, and/or the manufacturer of the integral water-repellent CMU admixture and sealer. Advise the architect of the scheduled meeting date.

B. Inspection: Inspect the water repellent work with the Contractor, Architect, and applicator and compare with test panel results approved by the Architect. Determine if the substrates are suitably protected by the water repellents. After coating has dried, test surfaces with water spray and Material Absorption Tube test; reapply to any areas showing water absorption.

3.04 FINAL CLEANING

A. Clean site of all unused water repellents, residues, rinse water, wastes, and effluents in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and non-masonry surfaces, following completion of the work of this section.

C. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to water repellents.

END OF SECTION

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SECTION 07 21 00

FOAMED-IN-PLACE MASONRY WALL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of insulation work is shown on drawings and indicated by provisions of this section.

B. Applications of insulation specified in this section include the following:

1. Foamed-In-Place masonry insulation for thermal & sound values.

1.02 RELATED REQUIREMENTS

A.. Section 04 20 00 - Reinforced Unit Masonry Systems

1.03 SUBMITTALS

A. Product and technical presentation as provided by the manufacturer.

1. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.

2. Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.04 QUALITY ASSURANCE

A. Manufacturing Standards: Provide insulation produced by a single and approved manufacturer. The product must come from the manufacturer pre-mixed to ensure consistency.

B. Installer Qualifications for Foamed-In-Place Masonry Insulation: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than three years direct experience in the installation of the product used.

C. Warranty: Upon request, a one year product and installation warranty will be

issued by both the manufacturer and installer.

D. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.

1. Product must be classified by Underwriters Laboratory ® (“UL”) as to Surface Burning Characteristics
2. Fire Resistance Ratings: ASTM E-119
3. Surface Burning Characteristics: ASTM E-84
4. Combustion Characteristics: ASTM E-136

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers of Foamed-In-Place Masonry Insulation: Subject to compliance with requirements, provide products from the following:

1. "Core-Fill 500™"; Tailored Chemical Products, P.O. Drawer 4186, Hickory, N.C. 28603, (800) 627-1687
2. Requests for substitutions will be considered in accordance with provisions of Section 01 630.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

B. Foamed-In-Place Masonry Insulation: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.

C. Fire-Resistance Ratings: Minimum four (4) hour fire resistance wall rating (ASTM E-119) for 8" and 12" concrete masonry units when used in standard

two (2) hour rated CMUs.

D. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.

1. Combustion Characteristics: Must be noncombustible, Class A building material.

2. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177.

3. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90).

E. Environmental Safety:

1. Core-Fill 500™ complies easily with all relevant codes and standards (SBBCI, BOCA, ICBO, DOE, HUD, EPA, ASTM and others). Since it contains no polystyrenes, polyisocyanurates, polyurethane or petrochemicals, it is completely safe for the environment.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Application Assemblies:

1. Block Walls: Exterior 8"concrete masonry units

3.02 INSTALLATION OF FOAMED-IN-PLACE INSULATION

A. General: Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.

1. Installation: Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of

holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

END OF SECTION

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified Herein and Elsewhere

1. Work under this Section includes:

   a. Board-type roof insulation.

   b. Cants and edge strips.

   c. Vapor barrier.

2. Related work specified elsewhere:

   a. Rough Carpentry – Section 06 10 00

   b. Membrane Roofing - Section 07 50 00.

1.02 SUBMITTALS

A. Shop Drawings and Product Data

1. Submit shop drawings and product data for the products of this and including the following:

   a. Layout drawings showing slopes, thicknesses and all details.

B. Certification

1. Submit a letter certifying the following:

   a. The insulation is an acceptable base to the manufacturer of the roofing specified in Section 07 50 00.

   b. All materials comply with the Specifications and are suitable to be a component of Factory Mutual Class I Construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289

2.02 MANUFACTURERS

A. Atlas Roofing Corporation: www.atlasroofing.com.

B. Dow Chemical Co: www.dow.com.

C. GAF Materials Corporation: www.gaf.com.

D. Substitutions: See Section 013300 – Submittals.

2.03 ADHESIVE

A. The adhesive shall be as approved by the Manufacturer.

2.04 CANT/EDGE STRIP

A. Cant/Edge Strip shall be preformed fiberboard or treated wood compatible with the insulation material, and set in adhesive or mastic, except where shown on drawings as integral metal water dam cant fascia and scupper.

2.05 FASTENERS

A. Fasteners shall be approved by the Manufacturer for intended use.

PART 3 - PRODUCTS

3.01 INSPECTION OF COMPLETED SYSTEM

A. All work must be carefully inspected for construction damage and imperfections prior to the installation of the roofing. Any holes or tears must be patched with the appropriate material. The patch must extend at least 12 inches in all directions from the edges of the tear or puncture. Seal into position with appropriate adhesive.

3.02 CLEAN-UP

A. Keep premises free from accumulation of waste material and rubbish.

END OF SECTION

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SECTION 07 50 00

MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. SBS-modified bituminous membrane roofing.

B. Cover board.

C. Roof insulation.

1.02 RELATED SECTIONS

A. Division 06 Section "Rough Carpentry" for wood nailers, cants, curbs, and blocking

B. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.

1.03 REFERENCES

A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:

1. ASTM D 1079 “Terminology Relating to Roofing and Waterproofing.”
2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual.”
3. Roof Consultants Institute “Glossary of Roofing Terms” for definition of terms related to roofing work in this Section.

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

C. Hot Roofing Asphalt: Roofing asphalt heated to temperature recommended by roofing manufacturer to flux modified roofing membrane, measured at the mop cart or mechanical spreader immediately before application.

1.04 DESIGN CRITERIA

A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7-10.

1. Field-of-Roof Uplift Pressure: -37 psf
2. Perimeter Uplift Pressure: -62 psf
3. Corner Uplift Pressure: -93 psf

D. FMG Listing: Roofing membrane, base flashings, and component materials shall comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's “RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Roofing system shall comply with RoofNav #: 13517-48573-0
2. Fire/Windstorm Classification: Class NC/A-300
3. Hail Resistance: SH

E. FBC Listing: Roofing membrane, base flashings, and component materials shall comply with requirements in Florida Building Code as part of a roofing system and that is listed in Florida Department of Business & Professional Regulation’s Product Approval for noncombustible construction, as applicable.

1. Roofing system shall comply with FL2948-R8.
    a. Evaluation Report: J8230.03.08-R7
    b. System # C-21
    c. Maximum Design Pressure (Field of Roof): -150 psf

F. List of approved manufactures:

1. Johns Manville
2. Siplast
3. Soprema

1.05 SUBMITTALS

A. Product Data: Manufacturer’s data sheets for each product to be provided.

B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details attachment to other Work, including:

1. Base flashings, cants, and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns.

C. Verification Samples: Provide for each product specified.

D. Maintenance Data: Refer to Johns Manville's latest published documents on www.JM.com.

E. Guarantees: Special guarantees specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Test Reports:

1. Roof drain and leader test or submit plumber's verification.
2. Roof deck fastener pullout test.

E. Source Limitations: Obtain all components from the single source roofing system manufacturer guaranteeing the roofing system. All products used in the system shall be labeled by the single source roofing manufacturer issuing the guarantee.

F. Provide evidence of CERTA training for any installer of torch-applied modified bitumen membrane. Copies of certifications are required prior to award and must be maintained on the jobsite for inspection at any time.

G. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to

authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.09 GUARANTEE

A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

1. Single-Source special guarantee includes roofing plies, base flashings, liquid applied flashing, roofing membrane accessories, roof insulation, fasteners, cover board, manufacturer’s edge metal products and other single-source components of roofing system marketed by the manufacturer.
2. Guarantee Period: 20 years from date of Substantial Completion.

B. Installer's Guarantee: Submit roofing Installer's guarantee, signed by Installer, covering Work of this Section, including all components of roofing system, for the following guarantee period:

1. Guarantee Period: Two Years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SBS-MODIFIED ASPHALT-SHEET MATERIALS

A. Roofing Membrane Sheet: ASTM D 6163, Grade S, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified. Basis of Design: DynaWeld Base

B. Roofing Membrane Cap Sheet: ASTM D 6163, Grade G, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified. Basis of Design: DynaWeld Cap FR

2.02 BASE FLASHING SHEET MATERIALS - SBS

A. Backer Sheet: [ASTM D 6163, Grade S, Type I, glass-fiber-reinforced] SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified. Basis of Design: DynaWeld Base

B. Flashing Sheet: [ASTM D 6163, Grade G, Type I, glass-fiber-reinforced], SBS-modified asphalt sheet; granular surfaced; suitable for application method specified. Basis of Design: DynaWeld Cap FR

C. Liquid Applied Flashing: A liquid and fabric reinforced flashing system created with a stitchbonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator. Basis of Design: PermaFlash System

2.03 AUXILIARY ROOFING MEMBRANE - BITUMINOUS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.

B. Asphalt Primer: ASTM D 41. Basis of Design: Asphalt Primer

C. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application. Basis of Design: MBR Utility Cement

D. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, trowel-grade, cold-applied adhesive specially formulated for compatibility and use with flashing applications. Basis of Design: MBR Flashing Cement

E. Mastic Sealant: As required by Johns Manville.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer. Basis of Design: UltraFast Fasteners and Plates

G. Roofing Granules: Ceramic-coated roofing granules matching specified cap sheet, provided by roofing system manufacturer.

H. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.04 AUXILIARY ROOFING SYSTEM COMPONENTS

A. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a bifurcation process. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of Design: [Expand-O-Flash] [Expand-O-Gard]

B. Coping System: Manufacturer’s factory fabricated coping consisting of a base piece and a snap-on cap. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of Design: Presto-Lock Coping

C. Fascia System: Manufacturer’s factory fabricated fascia consisting of a base piece and a snap-on cover. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee. Basis of Design: Presto-Tite Fascia

D. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.05 COVER BOARD

A. Perlite Board: ASTM C 728; composed of expanded perlite, cellulosic fibers, binders and waterproofing agents with top surface seal-coated. Basis of Design: : 1/2" DuraBoard

2.06 ROOF INSULATION

A. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, Basis of Design: ENRGY 3

1. Provide insulation package with R Value greater than 19.
2. Provide insulation package with minimum thickness 3.3 inches.
3. Provide insulation package in multiple layers.

2.07 TAPERED INSULATION

A. Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48). Basis of Design: Tapered ENRGY 3

2.08 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. Basis of Design: Tapered Pre-Cut Cricket Tapered Fesco Edge Strip.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer. Basis of Design: UltraFast Fasteners and Plates

D. Urethane Adhesive: Manufacturer’s two component urethane adhesive formulated to adhere insulation to substrate. Basis of Design: JM Two-Part Urethane Insulation Adhesive

E. Insulation Cant Strips: ASTM C 728, perlite insulation board. Basis of Design: FesCant Plus

F. Wood Nailer Strips: Comply with requirements in Division 06 Section **"**Miscellaneous Rough Carpentry**."**

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
5. Ensure general rigidity and proper slope for drainage.
6. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. Prime surface of concrete deck as required with asphalt primer at a rate recommended by roofing manufacturer and allow primer to dry.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSULATION INSTALLATION

A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer’s instruction.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with like material.

F. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

G. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Adhered Insulation: Install each layer of insulation and cover board and adhere to substrate as follows:

1. Install each layer in a two-part urethane adhesive according to roofing system manufacturer’s instruction.

J. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with cover board.

1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Adhered Cover Board: Adhere cover board to substrate as follows:

1. Install in a two-part urethane adhesive according to roofing system manufacturer’s instruction.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.05 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches (1:24, contact the membrane manufacturer for installation instructions regarding installation direction and backnailing

D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

E. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

F. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install one modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Torch-apply to substrate according to roofing system manufacturer’s instruction.
2. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.
2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing membrane sheets so side and end laps shed water.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.07 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer Sheet Application: Install backer sheet and torch apply substrate as required by roofing system manufacturer.

3. Flashing Sheet Application: Torch apply flashing sheet to substrate as required by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing with a strip of glass-fiber fabric set in MBR Flashing cement.

D. Roof Drains: Flash drain using PermaFlash system. Clamp roofing membrane, flashing, and stripping into roof-drain clamping ring.

1. Install stripping according to roofing system manufacturer's written instructions.

E. Flash all penetrations using PermaFlash system.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.08 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.

C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 60 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Formed roof drainage sheet metal fabrications.
2. Formed low-slope roof sheet metal fabrications.
3. Formed wall sheet metal fabrications.
4. Formed overhead-piping safety pans.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.

1.03 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 and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.

2. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.

3. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft.: 208-lbf/sq. ft. perimeter uplift force, 312-lbf/sq. ft. corner uplift force, and 104-lbf/sq. ft. outward force.

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, ambient; 180 deg F, material surfaces.

1.04 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, 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 edge conditions, including eaves, crickets and counterflashings as applicable.

6. Details of special conditions.

7. Details of connections to adjoining work.

8. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches 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, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

3. Accessories and Miscellaneous Materials: Full-size Sample.

D. Qualification Data: For qualified fabricator.

E. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.05 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. 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, 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.

1.06 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.

1.07 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.

PART 2 - PRODUCTS

2.01 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240, Type 304, dead-soft, fully annealed stainless-steel sheet of minimum uncoated thickness indicated; coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin), with factory-applied gray pre-weathering.

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.

2. Surface: Smooth, flat.

3. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish 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.

4. Color: Match manufactured roof panels, unless otherwise indicated on Drawings.

5. 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 mils.

2.02 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils 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.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.

3. Products: Subject to compliance with requirements, 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.

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.03 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 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.

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.

   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 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, non-sag, nontoxic, non-staining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane 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, non-corrosive, 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.

2.04 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 on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form non-expansion 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 deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal. Cleats and attachment device sizes shall be as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

F. Fabricate 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.

1. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

G. Do not use graphite pencils to mark metal surfaces.

2.05 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 10-foot long, sections. Furnish with 6-inch wide, joint cover plates.

1. Joint Style: Butt, with 12-inch wide, concealed backup plate.

a. Prepainted, Metallic-Coated Steel: 0.02i7-thick.

B. Copings: Fabricate in minimum 96-inch long, but not exceeding 10-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: Butt, with 12-inch wide, concealed backup plate.

a. Prepainted, Metallic-Coated Steel: 0.0396-thick.

C. Base Flashing:

1. Fabricate from the following materials:

a. Galvanized Steel: 0.0276 inch thick.

D. Counterflashing and Flashing Receivers :

1. Fabricate from the following materials:

a. Galvanized Steel: 0.0217 inch thick.

E. Roof-Penetration Flashing:

1. Fabricate from the following materials:

a. Lead: 4.0 lb/sq. ft., hard tempered.

F. Roof-Drain Flashing:

1. Fabricate from the following materials:

a. Lead: 4.0 lb/sq. ft., hard tempered.

2.06 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Overhead-Piping Safety Pans:

1. Fabricate from the following materials:

a. Galvanized Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.01 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.

3.02 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 staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.03 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 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 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 with no joints allowed within 24 inches 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 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 for nails and not less than 3/4 inch for wood screws and 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 into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, 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.

2. Prepare joints and apply sealants to comply with requirements in Division 07 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, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder aluminum sheet.

2. Pre-tinning is not required for zinc-tin alloy-coated stainless steel.

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.

3.04 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements 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 centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.

2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. 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 over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.05 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.

3.06 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.

3.07 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.08 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

C. 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.

D. 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

SECTION 07 71 23

MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

B. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

A. Section 07 50 00 MEMBRANE ROOFING

B. Section 07 60 00 – SHEET METAL FLASHING AND TRIM

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Conform to SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Conform to applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

D. Samples: Submit two samples, 6 inch (6 mm) long illustrating component design, finish, color, and configuration.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gutters and Downspouts:

1. ATAS International, Inc : www.atas.com.
2. Cheney Flashing Company : www.cheneyflashing.com.
3. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc : www.saf.com/persys.
4. W.P. Hickman Company ; Wind Resistant Gutter: www.wph.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M) ; 0.032 inch (0.8 mm) thick.

1. Finish: Plain, shop pre-coated with modified silicone coating.
2. Color: As selected from manufacturer's standard colors.

B. Protective Backing Paint: Zinc molybdate alkyd.

2.03 COMPONENTS

A. Downspouts: SMACNA Rectangular profile.

B. Anchors and Supports: Profiled to suit gutters and downspouts.

1. Anchoring Devices: In accordance with SMACNA requirements.
2. Gutter Supports: Brackets.
3. Downspout Supports: Brackets.

C. Fasteners: Same material and finish as gutters and downspouts , with soft neoprene washers.

2.04 ACCESSORIES

A. Splash Pads: Precast concrete type, size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.

2.05 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.06 FINISHES

A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as scheduled.

B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Set splash pads under downspouts.

END OF SECTION

SECTION 07 90 00

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 REFERENCES

A. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.

B. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2010.

C. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

1.03 SUBMITTALS

A. See Section 013300 - Product Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Manufacturer's Installation Instructions: Indicate special procedures.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.07 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.08 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Polyurethane Sealants:

1. Bostik, Inc: www.bostik-us.com.
2. Pecora Corporation: www.pecora.com.
3. BASF Construction Chemicals, Inc: www.chemrex.com.

B. Polysulfide Sealants:

1. Pecora Corporation: www.pecora.com.
2. BASF Construction Chemicals, Inc: www.chemrex.com.

C. Acrylic Sealants:

1. Tremco, Inc: www.tremcosealants.com.

2.02 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Type 2 - General Purpose Exterior Sealant for joints in vertical and sloping surfaces; Polyurethane and Polysulfide; single component.

1. Color: Standard colors matching finishing surfaces.

C. Type 1; self-leveling - General Purpose Exterior Sealant for joints on horizontal surfaces; Polyurethane and Polysulfide; single component.

1. Color: Standard colors matching finished surfaces.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell

PVC; oversized 25 to 50 percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C 1193.

C. Perform acoustical sealant application work in accordance with ASTM C 919.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

END OF SECTION

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SECTION 08 16 13

FIBERGLASS DOORS & ALUMINUM FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic (FRP) doors.

B. Aluminum doors and frames.

C. Hinges and other door hardware.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Other door hardware.

1.03 REFERENCE STANDARDS

A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

D. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007 (Reapproved 2016).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard details, installation instructions, and hardware and anchor recommendations.

C. Test Reports: Show compliance with specified criteria.

D. Shop Drawings: Show layout and profiles; include assembly methods.

1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.

2. Indicate wall conditions, door and frame elevations, sections, materials, gages, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on Drawings to identify details and openings.

E. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

F. Verification Samples: Submit door surface samples for each finish specified, 10 inch (254 mm) by 10 inch (254 mm) in size, illustrating finishes, colors, and textures.

G. Door Corner Sample: Submit corner cross sections, 10 inch (254 mm) by 10 inch (254 mm) in size, illustrating construction, finish, color, and texture.

H. Maintenance Data: Include instructions for repair of minor scratches and damage.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer; include detailed terms of warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Mark doors with location of installation, door type, color, and weight.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.

1. Store at temperature and humidity conditions recommended by manufacturer.
2. Do not use non-vented plastic or canvas shelters.
3. Immediately remove wet wrappers.

D. Store in position recommended by manufacturer, elevated minimum 4 inch (102 mm) above grade, with minimum 1/4 inch (6.4 mm) space between doors.

1.08 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty covering materials and workmanship , including degradation or failure due to chemical contact.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laminated Fiberglass Doors:

1. Ceco Door Products : www.cecodoor.com.
2. Corrim Company : www.corrim.com.
3. Fib-R-Dor : www.fibrdor.com.
4. Oregon Door : www.oregondoor.com.
5. PPG Industries (Aluminum Frames)
6. Cline Aluminum Doors, Inc. (Aluminum Frames)
7. Libby Owens Ford (Aluminum Frames)
8. Aluma Pro LP (Aluminum Frames)
9. Frameworks Manufacturing, Inc. (Aluminum Frames)
10. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.

1. Door and frame pre-assembled , complete with hinges; shipped with braces, spreaders, and packaging as required to prevent damage.
2. Mechanical Durability: Tested to ANSI/SDI A250.4 Level A (1,000,000 cycles), minimum; tested with hardware and fasteners intended for use on project.
3. Screw-Holding Capacity: Tested to 900 psi (6200 kPa), minimum.
4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A; when tested in accordance with ASTM E84.
5. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
6. Chemical Resistance: Resist degradation due to exposure to tap water and distilled water.
    a. Sewage and moisture-laden air in sewage treatment areas.
    b. Chlorine-treated moisture in air.
    c. Ocean salt spray.
7. Clearance between Door and Frame: 1/8 inch (3 mm), maximum.
8. Clearance Between Bottom of Door and Finished Floor: 3/4 inch (19 mm), maximum; not less than 1/4 inch (6 mm) clearance to threshold.

2.03 COMPONENTS

A. Doors: Through-color gel coating on fiberglass reinforced polyester resin construction with reinforced core.

1. Thickness: 1-3/4 inches (44 mm), overall.
2. Door Construction: Fiberglass faces laminated to core with subsequently applied gel coating, or molded in one piece including gel coating on all sides.
3. Subframe and Reinforcements: Fiberglass pultrusions or polymer foam; no metal or wood.
4. Waterproof Integrity: All edges, cut-outs, and hardware preparations factory

fabricated of fiberglass reinforced plastic; provide cut-outs with joints sealed independently of glazing or louver inserts or trim.

5. Hardware Preparations: Factory reinforce, machine, and prepare for all hardware including field installed items; provide solid blocking for each hardware item; make field cutting, drilling or tapping unnecessary; obtain manufacturer's templates for hardware preparations.

6. Gel Coating: Ultraviolet stabilized polyester, marine grade NPG-isophthalic, with slightly textured semi-gloss final finish.

7. Gel Coating Thickness: Minimum 15 mils (0.38 mm) wet, plus/minus 3 mils (0.07 mm).

8. Gel Coating Color: As selected by Architect.

B. Frames: Profiles and dimensions as indicated on drawings; same type and construction used in mechanical durability test for doors.

1. Extruded Aluminum: ASTM B 221 alloy 6063-T5 or allow and temper required to suit structural and finish requirements.

a. Provide aluminum frame components that comply with dimensions, profiles and relationships to adjoining work of components indicated on the drawings.

b. Extruded aluminum, rabbet wall thickness is nominal 0.062 inch thick, reinforced for hinges and strikes.

2. Corner Joints: Mitered with concealed corner blocks or angles of same material as frame; fiberglass and aluminum joined with screws; steel and stainless steel spot welded; sealed watertight with silicone sealant.

3. At hardware cut-outs provide continuous backing or mortar guards of same material as frame, sealed watertight.

4. Frame Anchors: Stainless steel, Type 304; provide 3 anchors in each jamb for heights up to 84 inches (2130 mm) with one additional anchor for each additional 24 inches (610 mm) in height.

C. Hinge and Hardware Fasteners: Stainless steel, Type 304; wood screws.

2.04 ACCESSORIES

A. Louver Stops: Pultruded fiberglass unless otherwise indicated or required by fire

rating; provided by door manufacturer to fit factory made openings, color and texture to match door; fasteners not penetrating waterproof integrity.

1. Exterior Doors: Provide non-removable stops on outside and continuous compression gasket weatherseal.
2. Opening Sizes: As indicated on drawings.

B. Louvers for Non-Fire-Rated Doors: Same materials, construction, finish, and color as door; fixed vanes, 45 degree sloped vanes.

1. Insect Screens: Fiberglass mesh.

C. Hardware: As specified in Section 08 71 00.

D. Thresholds: Pultruded fiberglass, with skid resistant surface, full width of door opening, 1/2 inch (13 mm) high by 6 inches (150 mm) wide; same color as frame.

E. For Aluminum frames: Use nonmagnetic stainless steel or other non-corrsive metla fasteners compatible with frames, stops, panels, reinforced plates, hardware, anchors and other items being fastened.

F. Door silencers (Mutes): manufacturer’s standard mohair or vinyl.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean and prepare substrate in accordance with manufacturer's directions.

C. Protect adjacent work and finish surfaces from damage during installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Install exterior doors in accordance with ASTM E2112.

C. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

D. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints; fill jambs with grout as walls are laid up.

E. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

F. Repair or replace damaged installed products.

3.04 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

3.05 CLEANING

A. Clean installed products in accordance with manufacturer’s instructions prior to owner’s acceptance.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling doors , operating hardware, exterior, electric operation.

B. Wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

A. Section 26 27 17 - Equipment Wiring: Power to disconnect.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel ; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products ; 2015.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes ; 2013.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric] ; 2013.

E. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc. ; current edition.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association ; 2014.

G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; National Electrical Manufacturers Association ; 2000 (R2005), with errata, 2008.

H. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association ; 2014.

I. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc. ; current edition.

J. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc. ; current edition.

K. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems ; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, electrical equipment, and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures .

E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:

1. Alpine Overhead Doors, Inc : www.alpinedoors.com.
2. The Cookson Company : www.cooksondoor.com.
3. Wayne-Dalton, a Division of Overhead Door Corporation ; Advanced Systems - 800c ADV : www.wayne-dalton.com.

2.02 COILING DOORS

A. Exterior Coiling Doors: Aluminum slat curtain.

1. Capable of withstanding positive and negative wind loads without undue

deflection or damage to components.

a. Windload Design:

1) Windload shall meet or exceed:

(a) Miami-Dade County NOA 12-03-13.03.

(b) FBC certification FL# 1421 & 1672.

2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1 (RSI-value of 1.43).

3. Nominal Slat Size: 2 inches (50 mm) wide x required length.

4. Finish: Anodized, color as selected.

5. Finish: Factory painted, color as selected by owner.

6. Guides: Angles; galvanized steel.

7. Hood Enclosure: Manufacturer's standard; primed steel.

8. Mounting: As indicated on drawings.

9. Locking Devices: Slide bolt on inside.

2.03 MATERIALS

A. Curtain Construction: Interlocking slats.

1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.

2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.

3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.

B. Aluminum Slats: ASTM B221 (ASTM B221M) , aluminum alloy Type 6063 ; 1 ¾" inch minimum thickness.

C. Guide Construction: Continuous, of profile to retain door in place , mounting brackets of same metal.

D. Steel Guides: ASTM A36/A36M steel angles, size as required for wind loading, hot-dip galvanized per ASTM A 123/A 123M.

E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

F. Lock Hardware:

1. For motor operated units, additional lock or latching mechanisms are not required.

2. Latching Mechanism: Inside mounted, adjustable keeper, spring activated latch bar feature to keep in locked or retracted position.

3. Slide Bolt: Provide on single-jamb side, extending into slot in guides , with padlock on one side.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

2.04 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (BMD), UL (EAUED), or testing agency acceptable to authorities having jurisdiction.

1. Provide interlock switches on motor operated units.

B. Electric Operators:

1. Mounting: Side mounted.

2. Motor Enclosure:

a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.

3. Motor Rating: 1/3 hp (250 W); continuous duty.

a. Voltage rating: 480v, 30

4. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.

5. Controller Enclosure: NEMA 250, Type 1.

6. Opening Speed: 12 inches per second (300 mm/s).

7. Brake: Adjustable friction clutch type, activated by motor controller.

8. Manual override in case of power failure.

C. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary

control for each operator.

1. 24 volt circuit.
2. Surface mounted.

D. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 26 27 17.

F. Complete wiring from disconnect to unit components.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).

C. Maximum Variation From Level: 1/16 inch (1.5 mm).

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

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 commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 101 - Life Safety Code.
4. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.03 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.

   b. Manufacturer of each item.

   c. Fastenings and other pertinent information.

   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

   e. Explanation of abbreviations, symbols, and codes contained in schedule.

   f. Mounting locations for door hardware.

   g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected

by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

E. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.04 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified

Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

   a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

   b. Door Closers: Comply with the following maximum opening-force requirements indicated:

      1) Interior Hinged Doors: 5 lbf applied perpendicular to door.

      2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

   c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

3. NFPA 101: Comply with the following for means of egress doors:

   a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

   b. Thresholds: Not more than 1/2 inch high.

4. Fire-Rated Door Assemblies: Provide door hardware for 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 (neutral pressure at 40" above sill) or UL-10C.

a. Test Pressure: Positive pressure labeling.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.06 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

1.07 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.

2. Twenty five years for manual surface door closers.

1.08 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.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of

establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.02 HANGING DEVICES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

    a. Bommer Industries (BO).

    b. McKinney Products (MK).

    c. Pemko Manufacturing (PE).

2.03 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU).

b. No Substitution – Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:

1. Master Key System: Cylinders are operated by a change key and a master key.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Group): Two (2)
3. Grand Master Keys (per Grand Master Key Group): Two (2)
4. Construction Keys (where required): Ten (10)

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List: Provide keying transcript list to Owner's representative.

2.04 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Acceptable Manufacturers:

a. Corbin Russwin Hardware (RU) – ML2000 Series.

B. Lock Trim Design: As specified in Hardware Sets.

2.05 EXIT DEVICES

A. Multi-Point Exit Devices for Severe Storm Shelters Openings: Multi-point exit devices specifically engineered for out-swinging door applications on tornado or hurricane resistant safe shelter rooms. Extra heavy duty steel component construction with each of the latching points automatically activated when the device is locked. The multi-point exit device is approved for usage as part of a complete ICC 500 (2008) and FEMA 361 door, frame and hardware assembly.

1. Acceptable Manufacturers:

    a. Yale Locks and Hardware (YA) - 7180F Series.

B. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish. Provide keyed removable feature, stabilizers, and mounting brackets as specified in the Hardware Sets. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturers approved mullion and accessories to meet applicable state and local windstorm codes.

1. Acceptable Manufacturers:

    a. Yale Locks and Hardware (YA) - M200 Series.

2.06 DOOR CLOSERS

A. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Acceptable Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC6000 Series.

b. Norton Door Controls (NO) - 8500 Series.

c. Sargent Manufacturing (SA) - 1431 Series.

d. Yale Locks and Hardware (YA) - 3500 Series.

2.07 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

a. Burns Manufacturing (BU).

b. Rockwood Manufacturing (RO).

c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

a. Rixson Door Controls (RF).

b. Rockwood Manufacturing (RO).

c. Sargent Manufacturing (SA).

2.08 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where

indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Acceptable Manufacturers:

1. Pemko Manufacturing (PE).
2. Reese Enterprises, Inc. (RS).
3. Zero International (ZE).

2.09 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.010 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine scheduled openings, 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. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.05 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.

3.06 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Refer to drawings for hardware sets.

C. Manufacturer’s Abbreviations:

1. PE - Pemko

2. RU - Corbin Russwin

3. YA - Yale

4. RF - Rixson

5. RO - Rockwood

END OF SECTION

SECTION 08 90 00

LOUVERS & VENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Formed aluminum stationary acoustical louvers.

1.02 RELATED SECTIONS

A. Section 04 340 – Reinforced Unit Masonry

B. Section 06100 – Rough Carpentry

C. Section 07620 – Sheet Metal Flashing and Trim

D. Section 07920 – Joint Sealants

E. Section 09900 – Painting

1.03 REFERENCES *NOTE TO SPECIFIER* Delete references not applicable.

A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AAMA 2605 – High Performance Organic Coatings on Architectural Extrusions and Panels.

C. AMCA 500-L – Test Methods for Louvers.

D. AMCA 511 – Certified Ratings Program for Air Control Devices.

E. ASCE 7 – Minimum Design Loads for Buildings and Other Structures

F. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B221 – Standard Specifications for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposure of Paint and Related Coatings.

I. ASTM D4214 – Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films.

J. ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

K. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.

L. ASTM E90 – Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

1.04 SUBMITTALS

A. Product Data: For each product to be used, including:

1. Manufacturer's product data including performance data.
2. Installation Instructions
3. Maintenance and Operations Manuals

B. Shop Drawings

1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

C. Samples

1. Submit color chip sample for units with factory-applied paint.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.

B. Production Qualifications:

1. Louvers shall be licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and

comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.08 WARRANTY

A. Manufacturer shall provide a standard limited warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the owner.

B. Manufacturer shall provide 20 year limited warranty for fluoropolymer-based finish on aluminum substrates.

1. Finish Coating shall not peel, blister, chip, crack, or check.

2. Chalking, fading, or erosion of finish when measured by the following tests:

a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.

b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822

c. Finish coating shall not erode at a rate in excess of .01 mils/year confirmed by Florida test samples.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Industrial Louvers Inc. (ILI) - Contact: 511 South 7th Street, Delano, MN 55328; Telephone: (763) 972-2981; Fax: (763) 972-2911.

B. Arrow United Industries: www.arrowunited.com

C. Or Approved Equal per Section 01300.

2.02 FORMED ALUMINUM ACOUSTICAL LOUVERS

A. Fabrication:

1. Model: 880A [880S] or as noted on Mechanical Drawings
2. Frame:
    a. Frame Depth: 8 inches (203.2 mm)
    b. Material: Formed aluminum, 5005 [Formed galvanized steel]
    c. Wall Thickness: 0.081 inch (2.1 mm), nominal [16ga, 1.6mm]
3. Blades:
    a. Style: Acoustical
    b. Material: Formed aluminum, 5005 [Formed galvanized steel]
    c. Wall Thickness: 0.081 inch (2.1 mm), nominal [16ga, 1.6mm]
    d. Insulation: 6-lb density rockwool
    e. Angle: 45 degrees
    f. Centers: 8.5 inches (215.9 mm), nominal

B. Performance Data:

1. Free Area: 28% (4.43 sq.ft.)
2. Water Penetration: Maximum of .01 ounces at an air flow of 949.4 FPM
3. Static Pressure Loss: Not more than .15 inch of water gauge at an air flow of 1214 FPM free area velocity.
4. Sound Data: Tested in accordance with ASTM E90.

Selected 1/3 Octave Bands Center Frequency HZ	**125**	**250**	**500**	**1000**	**2000**	**4000**
Transmission Loss in Decibels	6	6	10	14	17	12
Free Field Noise	12	12	16	20	23	18

2.03 LOUVER ACCESSORIES

A. Extended Aluminum Sill: Provide sill flashing of same material and finish as louvers where indicated on the drawings.

B. Louver Screens: Provide framed removable, re-wire-able screens for exterior louvers.

1. Bird Screen:
   a. Aluminum: Aluminum, ½ inch by 0.063 inch (12.7 mm by 1.6 mm), expanded, flattened.
2. Insect Screen:
   a. 18 x 14 aluminum charcoal mesh 0.011 inch (0.28 mm) diameter wire.

2.04 FABRICATION

A. Fabrication Requirements:

1. Performance: Fabricate as required for optimum performance with respect to water penetration, strength, durability, and appearance.
2. Size: Fabricate louvers in walls to meet dimensions indicated on Contract Documents.

1. Field Measurement: Verify size, location, and placement of louvers before fabrication.
2. Shop Assembly:
    a. Fabricate to minimize field adjustments, splicing, mechanical joints and field assembly of units.
    b. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling.
    c. Clearly mark units for reassemble and coordinated installation.
3. Accessories: Include supports, anchorages and accessories required for complete assembly.
4. Vertical Mullions: Provide vertical mullions of type and spacing indicated but not further apart than recommended by the manufacturer.
5. Horizontal Mullions: Provide horizontal mullions at horizontal joints between louver units except where continuous vertical assemblies are indicated.
6. Connections: Join frame and blade members to one another by welding, except where field bolted connections between frame members are made necessary by size of louvers.
7. Spacing: Maintain equal blade spacing to produce uniform appearance.

2.05 FINISHES (FACTORY)

A. General: Comply with NAAMM “Metal Finishes Manual” for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide color as indicated or, if not otherwise indicated, as selected by architect.

B. Standard mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean opening thoroughly prior to installation

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install louvers at locations as indicated on the drawings and in accordance with the manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. Install joint sealants as specified in Section 07900.

3.04 CLEANING

A. Clean louver surface in accordance with manufacturer's instructions.

B. Touch-up paint, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 09 90 00

PAINTING

PART 1 GENERAL

1.01 Section Includes

Painting of plaster, wood, metal, masonry, and other surfaces designated to be painted except factory-applied finishes.

1.02 Related Sections

A. Section 07 90 00 - Joint Sealant

1.03 References

A. American Water Works Association, Inc. (AWWA) latest edition:

1. AWWA D100 - Welded Steel Tanks For Water Storage
2. AWWA D102 - Coating Steel Water Storage Tanks

B. Steel Structures Painting Council (SSPC) latest edition Specifications:

1. SSPC-SP 1 - Solvent Cleaning
2. SSPC-SP 2 - Hand Tool Cleaning
3. SSPC-SP 3 - Power Tool Cleaning
4. SSPC-SP 5 - White Metal Blast Cleaning
5. SSPC-SP 6 - Commercial Blast Cleaning
6. SSPC-SP 7 - Brush Off Blast Cleaning
7. SSPC-SP10 - Near White Blast Cleaning
8. Steel Structures Painting Manual - Volume 2

C. OSHA

1. 1926 Subpart C – General Safety and Health Provisions
2. 1926 Subpart D – Occupational Health and Environmental Controls

3. 1926 Subpart E – Personal Protective and Life Saving Equipment

4. 1926 Subpart F – Fire Protection and Prevention

5. 1926 Subpart H – Material Handling, Storage, Use, and Disposal

6. 1926 Subpart Z – Toxic and Hazardous Substances

1.04 Definitions

A. Coating = emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, whether used as prime, intermediate, or finish coats.

B. DFT = abbreviation for Dry Film Thickness.

1.05 System Description

A schedule of coating colors will be provided by the E/A after award. The Contractor shall base his bid on ceilings of a color different than walls and an average of two wall colors per room or area. Colors other than those shown in the manufacturer's standard color charts may be required for building finishes. Strong colors may be selected for doors, piping, equipment, and miscellaneous features. Exterior building or structure colors will be limited to two plus trim.

1.06 Submittals

A. Within 30 days after award of the Contract, the Contractor shall notify the E/A, in writing, the name of the paint manufacturer for the Project.

B. Prior to submitting shop drawings for any item requiring shop or field applied primer or finish coatings, submit to the E/A a Painting Schedule, indicating major items to be painted, preparation, paint manufacturer, product designation, and dry mill thickness. This submittal shall include the manufacturer's written recommendation of the type paint for each item to be painted.

C. Upon request submit three 8-1/2 inch x 11-inch samples of requested colors for approval by the E/A.

1.07 Quality Assurance

A. Unless otherwise specified, all work and materials for the preparation and coating of all metal surfaces shall conform to the applicable requirements specified in the Steel Structures Painting Manual, Volume 2, Systems and Specifications Revised,

latest edition, published by the Steel Structures Painting Council.

B. It is the intent of this Specification that the Contractor use one paint manufacturer throughout, unless otherwise approved by the E/A. Products shall be manufactured by one of the following:

1. Tnemec - Tnemec Co., Inc., North Kansas City, Missouri.

2. Substitutions not permitted

C. Manufacturers other than the above shall submit product data for all products specified in this Section to the E/A for approval. No request for substitution will be considered which decreases the dry film thickness and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Bidders desiring to use paints other than those specified shall submit their proposal based on the specified materials, together with the information noted above, and indicate the sum which will be added to or deducted from the base bid, should the alternate materials be acceptable.

1.08 Painting Conference

A. At the request of the Owner/Engineer the Contractor shall schedule a conference of the painter, Owner, a technical representative of the paint supplier, and the E/A to discuss painting requirements and finalize color selections before painting is started.

B. Prior to painting any surface the Contractor shall schedule a meeting with the painter and an Owners/Engineers representative to inspect the surface preparation and verify that the surface is ready for painting. Failure to inspect a surface prior to coating could result in the rejection of the coating.

1.09 Samples

A. Paint colors will be selected by the Engineer with final approval by the Owner. Compliance with all other requirements is the exclusive responsibility of the Contractor.

B. Samples of each finish and color shall be submitted to the Engineer for approval before any work is started.

C. Samples shall be prepared so that an area of each sample indicates the

appearance of the various coats, For example, where three coat work is special, the sample shall be divided into three areas: one showing application of one coat only, one showing the application of two coats, and the third showing the application of three coats.

D. Such samples when approved in writing shall constitute a standard, as to color and finish only, of acceptance or rejection of the finish work.

E. For piping, valves, equipment, and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish and the general characteristics.

F. Rejected samples shall be resubmitted until approved.

G. Before proceeding with room painting, the Contractor shall finish paint one complete room. After approval, this sample room shall serve as a standard for texture and workmanship throughout the project.

1.10 Delivery and Storage

A. All materials shall be delivered to the job in original sealed and labeled containers of the paint manufacturer, and shall be subject to inspection by the E/A. Labels shall show name of manufacturer, type of coating, formulation, color and instructions for reducing.

B. Storage areas out side of the structures being constructed will be submitted by the Contractor for the E/A to review for the storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. The Contractor shall take all safety precautions in accordance with Section 7 of AWWA D102, NFPA Bulletin No. 101 and all federal, state and local regulations. Proper containers outside of the buildings/structures shall be provided and used by the Contractor for painting wastes.

C. Exercise every precaution in the storing of paints, solvents, cleaning fluids, rags, and similar materials as to eliminate the risk of spontaneous combustion or other hazardous conditions.

PART 2 PRODUCTS

2.01 Materials

A. All materials used in the work except oils, thinners and driers, shall be of the brands and qualities specified.

B. All cleaners, thinners, driers and other additives and surface pretreatment materials shall only be those approved for use by the manufacturer of the coatings.

C. Do not dilute paints except as recommended by the paint manufacturer.

D. Paint containing lead or chromate is not allowed.

E. Protective coatings for surfaces which will be in contact with potable water shall be listed by NSF International as approved for potable water contact in accordance with ANSI/NSF Std. 61, Section 5 Protective (Barrier) Materials.

F. Emulsion and alkyd paint shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.

2.02 Paint Systems Guide

A. The following table illustrates the general features of the standard coating systems and is provided as a general guideline, and may be superseded by specific coating requirements outlined within this specification or on the Drawings:

System No.	Generic Type	Surface Material	Finish	Typical Function
1	Epoxy / Polyurethane	Ferrous Metal, Non-galvanized	Gloss	Exterior metals not subject to immersion or frequent splashing
2	Polyurethane	Ferrous Metal, galvanized	Gloss	Exterior metals not subject to immersion or frequent splashing

System No.	Generic Type	Surface Material	Finish	Typical Function
3	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Interior metals not subject to immersion or frequent splashing or condensation
4	Alkyd	Ferrous Metal, galvanized	Semi-gloss	Interior metals not subject to immersion or frequent splashing or condensation
5	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Interior metals subject to condensation
6	Epoxy	Ferrous Metal, galvanized	Semi-gloss	Interior metals subject to condensation
7	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Metals subject to immersion or frequent splashing
8	Epoxy	Ferrous Metal, galvanized	Semi-gloss	Metals subject to immersion or frequent splashing
9	Epoxy	Concrete	Semi-gloss	Interior
10	Epoxy	Concrete	Tile-like gloss	Interior walls of washrooms
11	Acrylic	Concrete	Low sheen	Precast concrete ceilings, beams, columns
12	Elastomeric	Concrete	Low sheen	Exterior concrete

System No.	Generic Type	Surface Material	Finish	Typical Function
13	Epoxy	Masonry	Semi-gloss	Interior masonry
14	Epoxy	Masonry	Tile-like gloss	Interior walls of washrooms
15	Elastomeric	Masonry	Low sheen	Exterior masonry
16	Acrylic	Masonry	Low sheen	Interior masonry
17	Acrylic	Drywall, plaster	Low sheen	Interior drywall, plaster
18	Acrylic	Plaster, stucco	Low sheen	Exterior plaster, stucco
19	Alkyd	Wood	Gloss	Exterior wood
20	Alkyd	Wood	Semi-gloss	Exterior wood
21	Alkyd	Wood	Gloss	Interior wood
22	Alkyd	Wood	Semi-gloss	Interior wood
23	Acrylic	Wood	Low sheen	Interior wood
24	Acrylic	Canvas wrapped insulation	Semi-gloss	Canvas wrapped insulated piping
25	Coal Tar Epoxy	Ferrous Metal	Semi-gloss	Metals submerged in non-potable water

System No.	Generic Type	Surface Material	Finish	Typical Function
26	Coal Tar Epoxy	Concrete	Semi-gloss	Concrete in non-potable water or below grade
27	Epoxy	Ferrous Metal	Semi-gloss	Metals submerged in potable water
28	Epoxy	Concrete	Semi-gloss	Concrete submerged in potable water
29	Sealer, Hardener	Concrete	Semi-gloss	Concrete Floors

2.03 Coating Systems

A. System No. 1

1. System No. 1 shall be used for exterior non-galvanized ferrous metals that are not subject to immersion or frequent splashing of water or wastewater, including but not limited to the following:

    a. Exposed exterior piping, valves and fittings.

    b. Exterior mechanical equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.

2. System No. 1 surface preparation shall be SP 6.

3. System No. 1 shop primer shall be one coat of one of the following, or equal:

    a. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT.

4. System No. 1 field touch-up shall be the same material as Shop Primer.

5. System No. 1 intermediate coats shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series N69 @ 4.0-6.0 mils DFT

6. System No. 1 finish shall be one full coat of High Gloss aliphatic polyurethane, of one of the following, or equal:

    a. Tnemec Series 72 Endra-Shield (gloss) @ 2.5-4.0 mils DFT

B. System No. 2

1. System No. 2 shall be used for exterior galvanized ferrous metals which are not subject to immersion or frequent splashing of water or wastewater, including but not limited to the following:

    a. Exposed galvanized piping and fittings.

    b. Exposed galvanized conduit, equipment, miscellaneous metal, etc. without a factory-applied final finish.

2. System No. 2 surface preparation shall be SSPC-SP1 Followed by Hand or Power Tool Cleaning to scarify.

3. System No. 2 primer shall be one coat of one of the following, or equal:

    a. Tnemec Series N69 @ 3.0-5.0 mils DFT

4. System No. 2 finish shall be two 1 coat of one of the following or equal:

    a. Tnemec Series 72 Endrua-Shield @ 2.0-3.0 mils DFT .

C. System No. 3

1. System No. 3 shall be used for interior, non-galvanized, ferrous metals not subject to immersion, frequent splashing or condensation, including but not limited to the following:

    a. Interior piping, valves and fittings, except piping subject to condensation.

    b. Exposed structural steel.

    c. Steel stairs and railings.

    d. Interior cranes and hoists.

    e. Steel doors and frames.

    f. Interior equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.

2. System No. 3 surface preparation shall be SSPC-SP6 Commercial Blast Cleaning.

3. System No. 3 shop primer shall be one coat of one of the following, or equal:

    a. Tnemec Series 1 Omni-Thane @ 2.5-3.5 mils DFT

4. System No. 3 field touch-up shall be the same material as the shop primer.

5. System No. 3 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.

D. System No. 4

1. System No. 4 shall be used for interior, galvanized, ferrous metals not subject to immersion, frequent splashing or condensation, including but not limited to the following:

    a. Interior galvanized piping, except piping subject to condensation.

    b. Interior galvanized conduit, mechanical equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.

    c. Metal decking

2. System No. 4 surface preparation shall be SSPC-SP:1

3. System No. 4 primer shall be one coat of one of the following, or equal:

    a. Tnemec Series 115 Uni-Bond DF @ 2.0-4.0 mils DFT

4. System No. 4 finish coat shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.

E. System No. 5

1. System No. 5 shall be used for interior, non-galvanized ferrous metals subject to condensation, including but not limited to the following:

    a. Interior liquid process and water piping.

    b. Chemical piping.

c. Air intake piping.

2. System No. 5 surface preparation shall be SSPC-SP6 Commercial Blast Cleaning

3. System No. 5 shop primer shall be one coat of one of the following, or equal:

a. Tnemec 37-77 Chem-Prime Universal Primer at 2.0 mils DFT.Series 1 Omnithane @ 2.5-3.5 mils DFT.

4. System No. 5 field touch-up shall be the same material as the shop primer.

5. System No. 5 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series N69 Epoxoline II @ 3.0-5.0 mils DFT per coat.

F. System No. 6

1. System No. 6 shall be used for interior, galvanized, ferrous metals subject to condensation, including but not limited to interior galvanized liquid process and water piping.

2. System No. 6 surface preparation shall be SP M1 or SP 7.

3. System No. 6 primer shall be one coat of one of the following, or equal:

a. Tnemec: Series N69 @ 2.5-3.5 mils DFT

4. System No. 6 finish shall be two (1) coat of one of the following, or equal:

a. Tnemec Series N69 @ 2.5-3.5 mils DFT (Maximum DFT for galvanized steel *should be 7.0 mils.*

G. System No. 7

1. System No. 7 shall be used for non-galvanized, ferrous metals subject to immersion or frequent splashing, including but not limited to the following:

a. Submerged piping and piping subject to splashing.

b. Submersible pumps.

c. Submerged miscellaneous metal, equipment, etc. without a factory-applied final finish.

2. System No. 7 surface preparation shall be SSPC-SP10.

3. System No. 7 shop primer shall be one coat of one of the following, or equal:

   a. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

4. Field touch-up shall be the same material as shop primer.

5. Finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 446 Perma-Thane @ 5.0-7.0

H. System No. 8

1. System No. 8 shall be used for galvanized, ferrous metals subject to immersion or frequent splashing, including but not limited to the following:

   a. Submerged galvanized piping and piping subject to splashing.

   b. Submerged galvanized conduit, miscellaneous metal, equipment, etc. without a factory-applied final finish.

2. System No. 8 surface preparation shall be SP M1 and SP 7.

3. System No. 8 primer shall be one coat of one of the following, or equal:

   a. Tnemec: Series N69 @ 2.5-3.5 mils DFT

4. System No. 8 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series N69 @ 2.5-3.5 mils DFT

I. System No. 9

1. System No. 9 shall be used for interior, exterior, , except concrete requiring a tile-like epoxy finish, including but not limited to the following:

   a. Interior cast-in-place concrete walls, except washroom walls.

   b. Pipe gallery walls and ceiling.

2. System No. 9 surface preparation shall be SP C2 or SP C3 (horizontal surfaces only).

3. System No. 9 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish. Delete filler for all submerged

concrete):

a. Tnemec 54-561 Modified Epoxy Masonry Filler at 80 square feet per gallon.

4. System No. 9 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 66 Epoxoline at 5.0 mils DFT per coat.

System 9A: Submerged Concrete in Wastewater or Concrete Exposed to Wastewater Splash or Wastewater Fumes (**moderate environment**).

System 9A Surface Preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 MortarClad at an average of 1/16". Fill deep voids (greater than 3/8" and up to 4") with Tnemec Series 217 MortarCrete

System 9A Finish System:

1st Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT

2nd Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT

System 9B: Submerged Concrete in Wastewater or Concrete Exposed to Wastewater Splash or Wastewater Fumes (**severe environment** such as headworks, digesters, influent structures, grit chambers, lift stations, etc).

System 9B Surface Preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 at an average of 1/16". Fill deep voids (greater than 3/8" and up to 4") with Tnemec Series 217 MortarCrete.

System 9B Finish System:

1st Coat: Tnemec Series 434 Perma-Shield @ 1/8"

2nd Coat: Tnemec Series 435 Perma-Glaze @ 18.0-20.0 mils DFT

J. System No. 10

1. System No. 10 shall be used for interior concrete and CMU requiring a

tile-like epoxy finish, including but not limited to interior washroom walls.

2. System No. 10 surface preparation: Allow new Concrete to cure for 28 days. All surfaces must be clean and dry.

3. System No. 10 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish):

   a. Tnemec Series 1254 Epoxoblock WB @ 100-125 SF / GL (CMU Only)

4. System No. 10 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 84 Ceramlon ENV at 4.0-6.0 mils DFT per coat.

K. System No. 11

1. System No. 11 shall be used for interior concrete and Concrete Masonry requiring a matte finish, including but not limited to precast concrete ceilings, CMU walls, beams and columns.

2. System No. 11 surface preparation shall be SP C2.

3. System No. 11 filler shall be one coat of one of the following, or equal:

   a. Tnemec Series 1254 Epoxoblock WB @ 100-125 SF / GL square feet per gallon.

4. System No. 11 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.

L. System No. 12

1. System No. 12 shall be used for exterior concrete and CMU requiring a matte finish.

2. System No. 12 surface preparation shall be SP C2.

3. System No. 12 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish):

   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon.

4. System No. 12 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.

M. System No. 13

1. System No. 13 shall be used for interior masonry, including but not limited to masonry walls, except washroom walls.

2. System No. 13 surface preparation shall be SP C1.

3. System No. 13 filler shall be one coat of one of the following, or equal:

   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon, CMU only

4. System No. 13 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 66 Epoxoline at 4.0-6.0 mils DFT per coat.

N. System No. 14

1. System No. 14 shall be used for masonry walls requiring a tile-like epoxy finish, including but not limited to interior washroom walls.

2. System No. 14 surface preparation shall be SP C1.

3. System No. 14 filler shall be one coat of one of the following, or equal:

   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon

4. System No. 14 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 84 Ceramlon at 4.0-6.0 mils DFT per coat.

O. System No. 15

1. System No. 15 shall be used for exterior masonry requiring a matte finish.

2. System No. 15 surface preparation shall be SP C2.

3. System No. 15 filler shall be one coat of one of the following, or equal:

   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon

4. System No. 15 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

P. System No. 16

1. System No. 16 shall be used for interior masonry requiring a matte finish.

2. System No. 16 surface preparation shall be SP C2.

3. System No. 16 filler shall be one coat of one of the following, or equal:

    a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon

4. System No. 16 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

Q. System No. 17

1. System No. 17 shall be used for the following interior surfaces:

    a. Drywall

    b. Plaster

    c. Stucco

2. System No. 17 surface preparation shall be SP P1 (Drywall) or SP P2 (Plaster and Stucco).

3. System No. 17 primer shall be one coat of one of the following, or equal:

    a. Tnemec 51PVA Sealer at 1.5 mils DFT.

4. System No. 17 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

R. System No. 18

1. System No. 18 shall be used for the following exterior surfaces:

    a. Concrete columns and beams

    b. Stucco

2. System No. 18 surface preparation shall be SP C2.

3. System No. 18 filler shall be one coat of one of the following, or equal:

    a. Tnemec 54-561 Modified Epoxy Masonry Surfacer at 80 square feet per gallon.

4. System No. 18 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.

S. System No. 20

1. System No. 20 shall be used for exterior wood surfaces requiring a semi-gloss finish.

2. System No. 20 surface preparation shall be SP W1.

3. System No. 20 primer shall be one coat of one of the following, or equal:

    a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

4. System No. 20 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 1029 Enduratone at 2.0-3.0 mils DFT per coat.

T. System No. 21

1. System No. 21 shall be used for interior wood surfaces requiring a gloss finish.

2. System No. 21 surface preparation shall be SP W1.

3. System No. 21 primer shall be one coat of one of the following, or equal:

    a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

4. System No. 21 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 1028 Endruatone Gloss @ 2.0-3.0 mils DFT per coat.

U. System No. 22

1. System No. 22 shall be used for interior wood surfaces requiring a semi-gloss finish.

2. System No. 22 surface preparation shall be SP W1.

3. System No. 22 primer shall be one coat of one of the following, or equal:

    a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

4. System No. 22 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 1029 Enduratone at 2.0-3.0 mils DFT per coat.

V. System No. 23

1. System No. 23 shall be used for interior wood surfaces requiring a low-sheen finish.

2. System No. 23 surface preparation shall be SP W1.

3. System No. 23 primer shall be one coat of one of the following, or equal:

    a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

    b. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

W. System No. 24 -

1. System No. 24 shall be used for insulated and canvas-wrapped piping.

2. System No. 24 surface preparation shall be general cleaning.

3. System No. 24 primer shall be one coat of one of the following, or equal:

    a. Tnemec 51-792 PVA Sealer at 1.5 mils DFT.

4. System No. 24 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.

X. System No. 25

1. System No. 25 shall be used for metal surfaces.

2. System No. 25 surface preparation shall be SP 10.

3. System No. 25 shop primer shall be one coat of one of the following, or equal:

    a. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

4. System No. 25 field touch-up shall be one of the following, or equal:

    a. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

5. System No. 25 finish shall be two (2) coats of one of the following, or equal:

    a. Tnemec Series 446 Perma-Thane @ 5.0-7.0 mils DFT per coat;

apply second coat within 96 hours of first coat.

Y. System No. 26

1. System No. 26 shall be used for concrete surfaces.

2. System No. 26 surface preparation shall be SP C1.

3. System No. 26 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec 46H-413 Tneme-Tar at 8.0-10.0 mils DFT per coat; apply second coat within 96 hours of first coat.

Z. System No. 27

1. System No. 27 shall be used for steel surfaces in potable water immersion.

2. System No. 27 surface preparation shall be SSPC-SP 10 Near White Metal Blast.

3. System No. 27 shop primer shall be one coat of the following system or equal:

a. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

Stripe coat welds and seams using Tnemec Series N140-1255 Beige Pota-Pox Plus @ 3.0-5.0 mils DFT

.Intermediate Coat: Tnemec Series N140-15BL Tank White Pota-Pox Plus @ 4.0-6.0 mils DFT

Finish Coat: Tnemec Series N140-00WH White @ 4.0-6.0 mils DFT.

AA. System No. 28

1. System No. 28 shall be used for concrete surfaces in potable water immersion.

2. System No. 28 surface preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 MortarClad at an average of 1/16”. .

3. System No. 28 shop primer shall be one coat of the following system or

equal: Coating System:

a. Primer: Tnemec Series N140-1255 Beige Pota-Pox Plus @ 3.0-5.0 mils DFT

Intermediate Coat: Tnemec Series N140-15BL Tank White Pota-Pox Plus @ 4.0-6.0 mils DFT

Finish Coat: Tnemec Series N140-00WH White @ 4.0-6.0 mils DFT.

BB. System No. 29

1. System No. 29 shall be used for all non-painted, exposed concrete flooring surfaces.

2. System No. 29 surface preparation shall be SP C1

3. System No. 29 shall be three coats of Sonneborn “Kure-N-Seal”, Euclid Chemical Co. “Surfhard”, or Lambert Corp. “Solidus” applied per the manufacturer’s installation instructions, or an approved equal.

PART 3 EXECUTION

3.01 General

All painting shall be done in strict accordance with the recommendations of the manufacturer and shall be performed in a manner satisfactory to the Owner/Engineer.

A. All recommendations of the paint manufacture in regard to mixing, applying, thinning and curing as well as the health and safety of the workers shall be followed.

B. Dry film thickness for masonry is approximate for application to a smooth surface.

C. Sequence painting to ensure work area is dust free.

3.02 Mixing

A. Exercise care to keep fire hazards to a minimum. Provide an approved hand fire extinguisher near each paint storage and mixing area. No oily waste, rags, or painting equipment shall be left scattered throughout the premises.

B. Mix coatings in accordance with manufacturer's instructions. Colors shall be thoroughly mixed with no streaks or separation of color. Do not add thinners, driers or other additives except as recommended by the coating manufacturer. Do not incorporate in the coating any thinners or solvents used for cleaning brushes or equipment.

C. Protect all adjacent areas against damage and leave storage and mixing areas clean at the completion of painting.

3.03 Acceptance of Surfaces

A. Inspect all surfaces and adjoining work and report to the E/A in writing any existing unsatisfactory conditions. No painting work shall be started until the unsatisfactory conditions are remedied.

B. Commencement of surface preparation and painting shall constitute the acceptance of existing conditions and any defects appearing in the painting work thereafter shall be by the Contractor at no additional cost.

3.04 Protection of Adjacent Surfaces

A. Provide necessary protection for completed work and all adjoining surfaces. Provide temporary closures as required to prevent circulation of dust from adjacent areas where other work is in progress. Where it is necessary to remove existing protection of work of others, such protection shall be fully replaced.

B. Locate and protect all existing utilities, structures, or appurtenances.

3.05 Ventilation

A. Provide adequate ventilation for safe application and for proper drying of coatings on interior surfaces. Ensure solvent vapors are released during and after application of coatings. Remove vapors by exhausting air from the lowest portions of tanks or enclosed spaces and keep tops open and clear. During coating application in enclosed areas the capacity of ventilating fans shall be at least 300 cfm per gallon of coating applied per hour. Provide continuous forced ventilation at a rate of at least one complete air change per 4 hours for at least 7 days after coating application is completed.

3.06 General Surface Preparation Requirements

A. Prepare all surfaces in accordance with the coating manufacturer's instructions and as specified. Surfaces shall be uniform texture, dry, and free from dust, grit, oil, grease, or any material which will adversely affect adhesion or appearance of the coating. Rough edges of metal, weld seams and sharp edges from scaffold lugs shall be ground to a curve.

B. Surfaces that have been cleaned, pretreated, and/or otherwise prepared for painting shall be given a coat of the first-coat material as soon as practicable prior to any deterioration of the prepared surface.

C. Hardware, accessories, plates, fixtures, and similar items in contact with coated surfaces shall be removed, masked, or otherwise protected prior to surface preparation and painting operations.

D. Exposed nails and other ferrous metals on surfaces to be coated shall be spot-primed with a metal primer compatible with the finish.

3.07 Surface Preparation

A. Surface Preparation SP 3 - Power Tool Cleaning

1. Remove all oil and grease from surface. Power tool clean the surface removing all loose mill scale, loose rust, loose paint and other detrimental foreign matter by the methods outlined in the SSPC SP 3. Feather out edges of chipped or abraded areas to prevent flaws from showing through finish coats.

2. The cleaned surface shall be primed as soon as possible and before any rusting of the surface occurs.

B. Surface Preparation SP 6 - Commercial Blast Cleaning

1. Remove all oil and grease from the surface. Blast clean surface to a Commercial Finish, removing mill scale, dirt, rust, and foreign matter by the methods outlined in SSPC SP 6. Two thirds of each square inch of surface area shall be free of all visible residues.

2. Blasting shall be done with centrifugal wheel or compressed air blast using either steel grit or flint silica sand. Abrasive should provide a profile depth of 1.0 to 2.0 mils. Steel Grit #G-80 or flint silica sand 20-50 mesh is

recommended to obtain proper profile depth. Remove all dust and sand by vacuuming.

3. The blast cleaned surface shall be primed as soon as possible and before any rusting of the surface occurs.

C. Surface Preparation SP 7 - Brush-Off Blast : Prepare metal as outlined in SSPC SP 7 to provide for proper adhesion of coating.

D. Surface Preparation SP l0 - White Blast Cleaning

1. Steel surfaces shall be dry and clean. Remove all grease, oils and contaminants with rags soaked in toluol or xylol. Solvent Clean all surfaces per SSPC-SP 1 Solvent Cleaning.

2. Remove all weld spatter. Grind all rough welds and sharp edges to a smooth rounded contour. Blast clean the surface to a Near White Metal finish, removing nearly all mill scale, rust, rust-scale, paint or foreign matter by the recommended methods outlined in SSPC SP l0. At least 95 percent of each square inch shall be free of all visible residues and staining.

3. Blasting shall be done with centrifugal wheel or compressed air blast nozzles using either steel grit or flint silica sand. Abrasive should provide profile depth of l.0 to 2.0 mils. Steel Grit #G-80 or flint silica sand 20-50 mesh is recommended to obtain proper profile depth. Remove all dust and sand by vacuuming.

4. The blast cleaned surface should be primed as soon as possible and before any rusting of the surface occurs.

E. Surface Preparation SP C1 - General Cleaning: Allow concrete and masonry to cure in place for 28 days. Remove all dirt, dust, form oil, curing compounds, grease stains, or efflorescence from surfaces and roughen as required to provide good adhesion of coatings. If washing of the surface is required, use tri-sodium phosphate solution followed by a clean water rinse. Fill all minor holes to produce uniform surface textures.

F. Surface Preparation SP C2 - Sweep Sand Blasting

1. Concrete surfaces must be clean, dry and free of existing coatings. Cure

new concrete a minimum of 28 days. Fill and seal structural cracks and defects.

2. Concrete shall be cleaned and etched by sweep sandblasting (brush-off blast) so the surface is grainy to the touch. All dust or foreign matter shall be removed by vacuuming.

G. Surface Preparation SP C3 - Acid Etching (Horizontal Surfaces Only)

1. Concrete surfaces must be clean and dry. Cure new concrete a minimum of 28 days. Remove all dirt, dust, grease, oil and other contaminants from surface.

2. Etch concrete surface with l5 to 20 percent muriatic acid. Thoroughly coat the concrete with solution applied with a mop or brush. When foaming stops, thoroughly neutralize with clear water to remove soluble salts. Test the rinse water with litmus paper to verify the neutralization.

3. After etching, the surface shall be "grainy" to the touch; if not, repeat the treatment.

4. Permit surface to thoroughly dry a minimum of 72 hours before coating, while maintaining the cleanliness of the surface.

H. Surface Preparation SP M1 - Solvent Cleaning: Non-ferrous and galvanized ferrous surfaces scheduled to receive paint shall be solvent cleaned to remove all oils, salts, and contaminants prior to application of pretreatments or primers.

I. Surface Preparation SP P1 – Drywall: Fill all surface irregularities with spackling compound and sand to a smooth level surface prior to applying finish. Care shall be exercised to avoid raising nap on the paper.

J. Surface Preparation SP P2 - Plaster and Stucco: Rake cracks, scratches and abrasions deeply. Soak with water and fill with patching plaster or spackling compound. Treat with aqueous solution of zinc sulphate, 4 lbs. to l gallon of water. Add to solution enough phenophthalein to act as a color warning of alkali. Allow to dry for 3 days. Remove loose crystals before coating.

K. Surface Preparation SP W1 – Wood: Sandpaper to a smooth even surface and vacuum or dust off. Treat all knots and sap spots with mineral spirits and, when

dry, touch up with an approved sealer. Subsequent to priming and staining, thoroughly fill holes and cracks with plastic wood filler for transparent finishes and putty for painted wood. Unless otherwise approved, paint only when the moisture content of the wood is below l2 percent. Do not apply primer or sealer to wood in areas where cement, mortar, or plaster is not thoroughly dry.

3.08 Application

A. All work shall be performed by skilled painters. Surfaces shall be free of drops, ridges, waves, laps and brush marks. Edges of paint adjoining other colors or materials shall be sharp and true.

B. Do not apply coatings in temperatures below 50 degrees F except where the manufacturer specifically allows for lower temperatures. No exterior painting shall be done during inclement weather when relative humidity exceeds 85%, the ambient temperature is within 5 degrees F of the Dew Point or under conditions identified by the manufacturer as unsuitable.

C. The average rate of application shall not exceed the theoretical rate of coverage recommended by the coating manufacturer for the type of surface involved, less an allowance for losses. Average DFT shall not be less than thickness set forth under Painting Systems. Not more than l0-20% of points inspected may be less than 90% of the specified thickness. Deficiencies shall be corrected by application of additional coating.

D. Each coat shall be uniform in coverage and color. Successive coats shall perceptibly vary in color. Each coat shall be carefully examined and faulty material, poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Comply with coating manufacturer's recommendations for drying time between coats.

E. Bottoms, sides and edges of doors shall receive same finish as faces of doors. If refitting of wood doors is done prior to final acceptance, refinish at no extra cost.

F. Incidental niches, recesses, passages, closets, etc., shall be finished to match similar or adjacent spaces. Access doors, panels, convectors, grilles and similar items shall be coated the same color as adjacent work, except for non-ferrous metal or where otherwise directed by the E/A. Primed hardware shall be coated to

match adjacent work to which they are attached.

G. In the event that the finished surfaces are not acceptable, completely refinish entire unit areas or sections as necessary in order to eliminate visible laps or other indications of repairs.

H. Mixing, thinning, pot life, application procedure, equipment, coverage, curing, re-coating, storage and number of coats shall be in accordance with coating manufacturer's instructions.

I. Avoid degradation and contamination of blasted surfaces, and avoid between coat contamination. Surfaces contaminated shall be cleaned before applying next coat. Method of cleaning contaminated surface shall be approved by the Engineer or owner□s representative.

J. Each application of material shall be worked into corners, crevices, joints, etc., and distributed evenly over flat surfaces. Spraying techniques that result in a uniform wet pattern shall be used and dry spraying should be avoided. Dry spray shall be removed prior to coating being applied.

K. All bolts, welds, sharp edges, and difficult access areas shall receive a primer brush coat or spray coat prior to primer spray application.

3.09 Pipe Color Coding

A. Coat all exposed piping, conduit and appurtenances to conform to a color code as approved by the E/A.

B. Submit for the E/A to approve a coating schedule for the color coding of exposed piping, conduit and appurtenances.

3.10 Clean-Up

At completion of the painting work, clean off all paint spots and other paint materials from surfaces where they are not intended to be. Remove from the premises all rubbish and accumulated material and leave the work in clean orderly condition, acceptable to the E/A. All cloths and waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site and/or destroyed in an approved and legal manner.

3.11 Extra Stock

Upon completion of painting work, the Owner shall be furnished at no additional cost, one gallon of each type and color of finish paint for touching up. Paint container labels shall be complete with the manufacturer's name, generic type, number, color and location in which the paint is applied.

3.12 Damaged Coatings

A. Damaged coatings, pinholes, and holidays shall have edges feathered and repaired in accordance with the recommendations of the manufacturer, as approved by the Engineer.

B. All finish coats, including touch up and damage-repair coats shall be applied in a manner which will present a uniform texture and color-match appearance.

3.13 Unsatisfactory Application

A. If the item has an improper finish, color, or insufficient dry film thickness, the surface shall be cleaned and top coated with the specified material to obtain the specified color and coverage. Specific surface preparation information to be secured from the coatings manufacturer and the Engineer.

B. All visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the specifications.

C. Work shall be free of runs, bridges, shiners, laps, or other imperfections. Evidence of these conditions shall be cause for rejection.

D. Any defects in the coating system shall be repaired by the Contractor per written recommendations of the coating manufacturer.

E. Any repairs made on steel surfaces for immersion service shall be holiday detected in accordance with ASTM G 62 low voltage holiday detection. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The Engineer shall be notified of time of testing so that he might be present to witness testing.

3.14 Guarantee and Anniversary Inspection

A. All work shall be warranted for a period of one year from date of acceptance of the project.

B. The Owner will notify the Contractor at least 30 days prior to the anniversary date and shall establish a date for the inspection. Any defects in the coating system shall be repaired by the Contractor at no additional cost to the Owner. Should a failure occur to 25% of the painted surface, either interior or exterior, the entire surface shall be cleaned and painted in accordance with these specifications.

END OF SECTION

SECTION 09 97 61

FUSION-BONDED EPOXY LININGS AND COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes materials, application, and testing of one-part, fusion-bonded, heat-cured, thermosetting, 100% solids epoxy linings and coatings on steel, cast-iron, and ductile-iron equipment, such as valves, flexible pipe couplings, and steel and ductile iron pipe. All coatings in contact with potable water, raw water, or aerated water are to be coated with an NSF 61 approved coating.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00 and the following:

B. Submit manufacturer's catalog literature and product data sheets, describing the physical and chemical properties of the epoxy coating. Describe application and curing procedure.

C. Submit coating application test records for measuring coating thickness and holiday detection for each item or pipe section and fitting. Describe repair procedures used.

D. Submit NSF 61 certification for coatings that come into contact with potable water, raw water, or aerated water.

PART 2 - MATERIALS

2.01 PIPING AND EQUIPMENT SURFACES

A. The Contractor shall require the equipment suppliers to provide equipment that is free of salts, oil, and grease to the coating applicator.

B. The Contractor shall require pipe suppliers to provide bare pipe that is free of salts, oil, and grease to the coating applicator.

2.02 SHOP-APPLIED EPOXY LINING AND COATING

A. Lining and coating shall be a 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin: Scotchkote 134 or 206N, Valspar "Pipeclad 1500 Red," or equal. Epoxy lining and coating shall meet or exceed the following requirements:

Hardness (minimum)	Barcol 17 (ASTM D2583) Rockwell 50 ("M" scale)
Abrasion resistance (maximum value)	1,000 cycles: 0.05 gram removed
	5,000 cycles: 0.115 gram removed
	ASTM D1044, Tabor CS 17 wheel, 1,000-gram weight
Adhesion (minimum)	3,000 psi (Elcometer)
Tensile strength	7,300 psi (ASTM D2370)
Penetration	0 mil (ASTM G17)
Adhesion overlap shear, 1/8-inch steel panel, 0.010 glue line	4,300 psi, ASTM D1002
Impact (minimum value)	100 inch-pounds (Gardner 5/8-inch diameter tup)

2.03 FIELD-APPLIED EPOXY COATING FOR PATCHING

A. Use a minimum 80% solids liquid epoxy resin, such as Scotchkote 306 or 323.

2.04 PAINTING AND COATING OF GROOVED-END AND FLEXIBLE PIPE COUPLINGS

A. Line and coat couplings the same as the pipe. Color shall match the color of the pipe fusion epoxy coating.

PART 3 - EXECUTION

3.01 SHOP APPLICATION OF FUSION-BONDED EPOXY LINING AND COATING-GENERAL

A. Grind surface irregularities, welds, and weld spatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed 1 square foot per item or piece of equipment. Do not use any item, pipe, or piece of equipment in which these requirements cannot be met.

B. Remove surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

C. Uniformly preheat the pipe, item, or piece of equipment prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the surface temperature is at least 5°F above the dew point temperature during blast cleaning and inspection.

D. Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.

E. After cleaning and surface preparation, test the surface for residual chloride concentration. If the residual chloride concentration exceeds 5 $\mu g/cm^2$, then apply a phosphoric acid wash to the surface after sandblasting. The average temperature, measured at three different locations, shall be 80°F to 130°F during the acid wash procedure. The acid wash shall be a 5% by weight phosphoric acid solution. The duration in which the acid is in contact with the surface shall be determined by using the average temperature as tabulated below:

Surface Temperature (°F)	Contact Time (seconds)
80	52
85	45
90	36
95	33
100	28
105	24
110	21
130	10

After the acid wash has been completed, remove the acid with demineralized water having a maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2,500 psi.

F. Apply lining and coating by the electrostatic spray or fluidized bed process. Minimum thickness of lining or coating shall be 15 mils. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Do not allow oxidation of surfaces to occur prior to coating. Do not permit surfaces to flash rust before coating.

3.02 SHOP APPLICATION OF FUSION-BONDED EPOXY LINING AND COATING TO PIPE--ADDITIONAL REQUIREMENTS

A. Apply lining and coating per AWWA C213 except as modified herein.

B. Grind 0.020 inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

3.03 SHOP APPLICATION OF FUSION-BONDED EPOXY LINNG AND COATING TO JOINT AREAS OF DUCTILE-IRON AND CAST-IRON FITTINGS—ADDITIONAL REQUIREMENTS

A. Limit the protective coating thickness in the joints of ductile-iron and cast-iron fittings to maintain a leak-proof joint. However, the coating thickness in the joint area shall not be less than 4 mils.

3.04 QUALITY OF LINING AND COATING APPLICATIONS

A. The cured lining or coating shall be smooth and glossy, with no graininess or roughness. The lining or coating shall have no blisters, cracks, bubbles, underfilm voids, mechanical damage, discontinuities, or holidays.

3.05 FACTORY TESTING OF COATING--GENERAL

A. Test linings and coatings with a low-voltage wet sponge holiday detector. Test pipe linings and coatings per AWWA C213, Section 5.3.3. If the number of holidays or pinholes is fewer than one per 20 square feet of coating surface, repair the holidays and pinholes by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and retest. If the number of pinholes and holidays exceeds one per 20 square feet of coating surface, remove the entire lining or coating and recoat the item or pipe.

B. Measure the coating thickness at three locations on each item or piece of equipment or pipe section using a coating thickness gauge calibrated at least once per eight-hour shift. Record each measured thickness value. Where individual measured thickness values are less than the specified minimum thickness, measure the coating thickness at three additional points around the defective area. The average of these measurements shall exceed the specified minimum thickness value, and no individual thickness value shall be more than 2 mils below or 3 mils above the specified minimum value. If a section of the pipe, item, or piece of equipment does not meet these criteria, remove the entire lining or coating and recoat the entire item or piece of equipment.

3.06 FACTORY INSPECTION OF LINING AND COATING OF PIPE—ADDITIONAL REQUIREMENTS

A. Check for coating defects on the weld seam centerlines. There shall be no porous blisters, craters, or pimples lying along the peak of the weld crown.

3.07 SHIPPING, STORAGE, AND HANDLING

A. When loading piping, fittings, couplings, or other coated items for shipment to the project site, use spacers and other protective devices to separate pipes or other coated items to prevent damaging the coated surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the coated surfaces after separation.

Use padded chains or ribbon binders to secure the loaded pipe or other coated items and minimize damage.

B. Do not load or unload pipe, fittings, couplings, or other coated items by inserting forklift tines or lifting chains inside the pipe or item. Use nonmetallic slings, padded chains, or padded forklift tines to lift pipe or other coated items.

C. Cover piping or other coated items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Provide stulls, braces, and supports for piping during shipping and storage such that out-of-roundness or deflection does not exceed 0.5% of the pipe diameter.

E. Handle piping and other coated items with care during the unloading, installation, and erection operations to minimize damage. Do not place or store pipe or other coated items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place pipe or other coated items above the ground upon platforms, skids, or other supports.

F. Store piping or other coated items at the site on pallets to prevent direct contact with ground or floor. Cover pipe or coated items during storage with protective coverings or tarpaulins to prevent deposition of rainwater, salt air, dirt, dust, and other contaminants.

G. Do not allow piping or other coated items to contact metal, concrete, or other surfaces during storage, handling, or installation and erection at the site that could damage or scratch the coating.

3.08 FIELD REPAIRS

A. Patch scratches and damaged areas incurred while installing fusion-bonded epoxy coated items with a two-component, 80% solids (minimum), liquid epoxy resin. Wire brush or sandblast the damaged areas per SSPC SP-10. Lightly abrade or sandblast the coating or lining on the sides of the damaged area before applying the liquid epoxy coating. Apply an epoxy coating to defective linings and coatings to areas smaller than 20 square inches. Patched areas shall overlap the parent or base coating a minimum of 0.5 inch. If a defective area exceeds 20 square inches, remove the entire lining and coating and recoat the entire item or piece of equipment. Apply the liquid epoxy coating to a minimum dry-film thickness of 15 mils. Measure the dry film thickness coating thickness at three locations at each repair site using a coating thickness gauge

calibrated at least once per eight-hour shift. Record each measured thickness value. All measurements shall meet the minimum thickness. If dry film thickness is not observed on any reading, re-patch per the previous direction and re-test.

END OF SECTION

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SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere

A. Work under this Section includes:

1. Safety signs.
2. Engraved plastic laminate signs.
3. Dedication plaque.

B. Related work specified elsewhere includes:

Electrical Identification - Section 16195.

1.02 SUBMITTALS

A. Shop Drawings and Product Data

Submit shop drawings and product data for the products of this Section in compliance with Division 1.

B. Samples

Submit samples of plastic laminate for approval by the Engineer.

PART 2 PRODUCTS

2.01 SAFETY SIGNS

A. Provide safety signs as specified herein and as indicated on the Drawings. Safety signs shall comply with OSHA requirements Section 1910.145. Signs shall be 10" by 14" horizontal signs of minimum 20-gauge steel with a baked-on enamel finish. "Caution" signs shall be yellow and black. "Danger" signs shall be red and black.

B. Floor Load Caution Signs

1. Provide floor load caution signs where indicated and for the loads indicated on the Drawings. Provide a minimum of one floor load caution sign for each area or room on a structural slab.

2. Floor load caution signs shall be lettered as follows:

CAUTION

CAPACITY ____ LBS

FLOOR LOAD

PER SQUARE FOOT

C. Fire Extinguisher Sign

1. Provide location signs for all fire extinguishers both inside or outside the building.

2. Sign shall be lettered as follows:

FIRE EXTINGUISHER

D. Emergency Egress Identification Signs

1. Provide signs at all emergency egress openings and not readily identifiable secondary egress doors.

2. Signs shall be lettered as follows:

EMERGENCY EGRESS

KEEP AREA CLEAR

E. No Combustible Storage Signs

1. Provide signs in all mechanical, electrical and generator/fuel areas, including the exterior fuel tank location.

2. Signs shall be lettered as follows:

COMBUSTIBLE STORAGE

NOT PERMITTED

F. High Voltage Warning Signs

1. Provide signs on all doors leading to the electrical equipment room

2. Signs shall be lettered as follows:

DANGER – HIGH

VOLTAGE

G. No Smoking Signs

1. Provide signs on all doors leading into the building and adjacent to the exterior fuel storage area.

2. Signs to be lettered as follows:

NO SMOKING

H. Hearing Protection Required Signs

1. Provide signs on all doors leading into the building pump/generator area.

2. Signs to be lettered as follows:

HEARING PROTECTION

REQUIRED

I. Eye Wash area signs

1. Provide signs on interior of Chlorine Room indicating the eye wash area is outside and directly adjacent to the exit door from the Chlorine Room.

2. Provide sign directly adjacent to the Eye Wash area.

3. Signs to be lettered as follows:

a. Sign inside Chlorine Room:

EXIT TO EYE WASH AREA

b. Sign above Eye Wash Area:

EYE WASH AREA

KEEP AREA CLEAR

2.02 ROOM IDENTIFICATION SIGNS

A. Provide room identification signs on walls directly adjacent to doors entering specified rooms. Room identification signs shall be minimum 10” by 5” horizontal signs of 316 Stainless Steel.

B. Chlorine Storage Room sign

1. Provide signs on all doors leading to the Chlorine Storage Room.

2. Signs to be lettered as follows:

CHLORINE STORAGE ROOM

C. Electrical Equipment Room sign

1. Provide signs on all doors leading to the Electrical Equipment Room.

2. Signs to be lettered as follows:

ELECTRICAL EQUIPMENT ROOM

D. Pump/Generator Room Sign

1. Provide signs on all doors leading into the Pump/Generator Room.

2. Signs to be lettered as follows:

PUMP/GENERATOR ROOM

2.03 PUMP IDENTIFICATION SIGNS

A. Provide pump identification signs for each pump. The signs shall be numbered to coincide with the controls in the Electrical System and SCADA system. The signs shall be a minimum of 4” by 2” and mounted at the base of each pump.

2.04 ENGRAVED PLASTIC LAMINATE SIGNS

A. Provide engraved plastic laminate signs as follows:

1. Provide _____ signs _____ -inch by _____ -inch with _____ -inch high letters.

2. Provide _____ signs _____ -inch by _____ -inch with _____ -inch high letters.

3. Provide _____ signs _____ -inch by _____ -inch with _____ -_inch high letters.

B. Plastic laminate shall be 1/8" thick with face and core colors as selected by the Engineer. Color selection will be made from the supplier's standard colors. However, the supplier shall provide a minimum of 10 colors for the Engineer's consideration.

C. Engraved letters shall be machine cut evenly into the contrasting color core. Letter style shall be Helvetica Medium.

2.05 DEDICATION PLAQUE – N/A

PART 3 EXECUTION

3.01 INSTALLATION

Install identification devices in a permanent manner as approved by the Engineer.

END OF SECTION

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SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms.

B. Electrically operated paper towel dispensers.

C. Grab bars.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

F. ASTM C1036 - Standard Specification for Flat Glass; 2011.

G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Toilet Accessories:

1. AJW Architectural Products : www.ajw.com.

2. ASI - American Specialties, Inc : www.americanspecialties.com.

3. Bradley Corporation : www.bradleycorp.com.

B. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.

2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide 4 keys for each accessory to Owner ; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666 , Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Type 304 or 316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Adhesive: Two component epoxy type, waterproof.

H. Fasteners, Screws, and Bolts: Hot dip galvanized ; tamper-proof ; security type.

I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 Brushed finish , unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456 , SC 2, satin finish , unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Tork Twin Jumbo Bath Tissue Roll Dispenser, Article 247549A, Color: Black, SCC: 10073286622393. Surface mounted black plastic dispenser with 10” roll capacity .

B. Electric Hand Dryer: The Excel Dryer Inc. Model Xlerator XL-W

1. Cover: Zinc die cast
2. Finish: White painted
3. Mounting: Recess mounted to be ADA compliant with manufacturer’s standard ADA compliant recess kit – 40502.
4. Warranty: 5 years

C. Waste Receptacle: Stainless steel, freestanding style with swing top.

D. Automated Soap Dispenser: GOJO FMX-12 Dispenser – Black – SKU 5155-06 Soap Dispenser.

1. Minimum Capacity: 1250 mL

2. Mounting: Wall

3. Finish: Black Plastic

E. Air Freshener Dispenser: Wall-mounted, battery operated.

1. Products:

a. Georgia-Pacific Professional ; GP ActiveAire Brushed Stainless Powered Whole-Room Freshener Dispenser: www.blue-connect.com.

F. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.

1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.

2. Size: As indicated on drawings.

3. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners , and tamperproof hanging system; No.4 finish.

4. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.

5. Fixed Tilt Mirrors: Minimum 3 inches (75 mm) tilt from top to bottom.

G. Grab Bars: Stainless steel, nonslip grasping surface finish.

1. Standard Duty Grab Bars:

a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.

b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.

c. Length and Configuration: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 44 13

FIRE EXTINGUISHERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association; 2007.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.05 SUBMITTALS

A. Product Data: Provide extinguisher operational features.

B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:

1. JL Industries, Inc: www.jlindustries.com.
2. Larsen's Manufacturing Co: www.larsensmfg.com.
3. Potter-Roemer: www.potterroemer.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.

1. Class 3-A:40-B:C.
2. Size 10.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Semi-recessed type.

1. Sized to accommodate accessories.

C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

D. Door Glazing: Glass, clear, 1/8 inch thick float. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers and accessories in cabinets or mount on brackets as noted on drawings.

END OF SECTION

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SECTION 22 07 19

PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.04 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Aeroflex USA, Inc; www.aeroflexusa.com.

2. Armacell LLC; www.armacell.us.

3. K-Flex USA LLC; www.kflexusa.com.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: -40 degrees F (-40 degrees C).
2. Maximum Service Temperature: 220 degrees F (104 degrees C).
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

1. Manufacturers:
    a. Aeroflex, USA, Inc.
    b. Armacell LLC
    c. K-Flex USA LLC

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Inserts and Shields:

1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07840.

G. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

H. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.03 SCHEDULES

A. Plumbing Systems:

1. Domestic Cold Water: Insulation Thickness 3/4"

2. Plumbing Vents Within 10 Feet (3 Meters) of the Exterior: Insulation Thickness 3/4"

END OF SECTION

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SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.

1. Sanitary sewer.

2. Domestic water.

1.02 RELATED REQUIREMENTS

A. Section 099000 - Painting

1.03 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

F. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 SANITARY SEWER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2729.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.05 CHEMICAL RESISTANT SEWER PIPING

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. PVC Pipe: ASTM D2729 or ASTM D2665.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.06 WATER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

A. PVC Pipe: AWWA C900

2.07 WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Ductile Iron Pipe AWWA C151/A21.51.

1. Fittings: Ductile or gray iron, standard thickenss.

2. Joints: AWWA C111/A21.11, rubber gasket with ¾ inch (19 mm) diameter rods.

2.08 WATER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D1785 or ASTM D2241

1. Fittings: ASTM D2665, PVC.

2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

2.09 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions.

2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch (25 mm):

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, galvanized.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
4. Gasket Material: Nitrile rubber suitable for operating temperature range from minus 20 degrees F to 180 degrees F (minus 29 degrees C to 82 degrees C).
5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
7. Manufacturers:
a. Grinnell Products, a Tyco Business: www.grinnell.com.
b. Shurjoint Piping Products, Inc., a Tyco Business; www.shurjoint.com.
c. Nibco, Inc; www.nibco.com
d. Approved Equal.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.10 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.
5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
    a. Bases: High density polypropylene.
    b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
    c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
    d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
    e. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.

B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
4. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.

5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
4. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.

2.11 BALL VALVES

A. Manufacturers:

1. Conbraco Industries: www.apollovalves.com.
2. Grinnell Products, a Tyco Business: www.grinnell.com.
3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
4. Nibco, Inc; www.nibco.com.
5. Milwaukee Valve Company: www.milwaukeevalve.com.

2.12 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Hammond Valve: www.hammondvalve.com.
2. Crane Co.: www.cranevalve.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Approved Equal.

2.13 WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Amtrol Inc: www.amtrol.com.
2. Cla-Val Co: www.cla-val.com.
3. Watts Regulator Company: www.wattsregulator.com.
4. Approved Equal.

B. Up to 2 Inches (50 mm):

1. ASSE 1003, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches (50 mm):

1. ASSE 1003, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.14 RELIEF VALVES

A. Pressure Relief:

1. Manufacturers:
   a. Cla-Val Co; www.cla-val.com.
   b. Henry Technologies; www.henrytech.com.
   c. Watts Regulator Company; www.wattsregulator.com.
   d. Approved Equal.
2. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

I. Provide support for utility meters in accordance with requirements of utility companies.

J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09900.

K. Install bell and spigot pipe with bell end upstream.

L. Install valves with stems upright or horizontal, not inverted.

M. Install water piping to ASME B31.9.

N. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

O. Sleeve pipes passing through partitions, walls and floors.

P. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

Q. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball valves for throttling, bypass, or manual flow control services.

F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

G. Provide spring loaded check valves on discharge of water pumps.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot (1:50) slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

2. Provide 18 gage (1.20 mm) galvanized sheet metal sleeve around service main to 6 inch (150 mm) above floor and 6 feet (1800 mm) minimum below grade. Size for minimum of 2 inches (50 mm) of loose batt insulation stuffing.

3.08 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:

a. Pipe size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):

1) Maximum hanger spacing: 6.5 ft (2 m).

2) Hanger rod diameter: 3/8 inches (9 mm).

b. Pipe size: 1-1/2 inches (40 mm) to 2 inches (50 mm):

1) Maximum hanger spacing: 10 ft (3 m).

2) Hanger rod diameter: 3/8 inches (9 mm).

c. Pipe size: 2-1/2 inches (65 mm) to 3 inches (75 mm):

1) Maximum hanger spacing: 10 ft (3 m).

2) Hanger rod diameter: 1/2 inches (9 mm).

d. Pipe size: 4 inches (40 mm) to 6 inches (50 mm):

1) Maximum hanger spacing: 10 ft (3 m).

2) Hanger rod diameter: 5/8 inches (15 mm).

e. Pipe size: 8 inches (200 mm) to 12 inches (300 mm):

1) Maximum hanger spacing: 14 ft (4.25 m).

2) Hanger rod diameter: 7/8 inches (22 mm).

f. Pipe size: 14 inches and Over (350 mm and Over):

1) Maximum hanger spacing: 20 ft (3 m).

2) Hanger rod diameter: 1 inches (25 mm).

1. Plastic Piping:

a. All Sizes:

1) Maximum hanger spacing: 6 ft (1.8 m).

2) Hanger rod diameter: 3/8 inches (9 mm).

END OF SECTION

SECTION 22 10 06

PLUMBING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor drains.

B. Cleanouts.

C. Hose bibbs.

D. Hydrants.

E. Backflow preventers.

F. Water hammer arrestors.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

D. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

F. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, None.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. LATICRETE Inernational, Inc.; LATICRETE® HYDRO BAN® Linear Drain: www.laticrete.com.
4. LATICRETE Inernational, Inc.; LATICRETE® HYDRO BAN® Bonding Flange Drain: www.laticrete.com.
5. Noble Company; FreeStyle Linear Drain: www.noblecompany.com.
6. Zurn Industries, Inc: www.zurn.com.
7. Approved Equal.

B. Floor Drain (FD-2):

1. ASME A112.6.3; galvanized cast iron or stainless steel, two piece body with double drainage flange, weep holes, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

2.03 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Josam Company: www.josam.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Approved Equal.

B. Cleanouts at Exterior Surfaced Areas (CO-1):

1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas (CO-2):

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas (CO-3):

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas (CO-4):

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Watts Regulator Company: www.wattsregulator.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Approved Equal.

B. Interior Hose Bibbs:

1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in conformance with ASSE 1011.

C. Interior Mixing Type Hose Bibbs:

1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with handwheels, and vacuum breaker in conformance with ASSE 1011.

2.05 BACKFLOW PREVENTERS

A. Manufacturers:

1. Conbraco Industries: www.apollovalves.com.
2. Watts Regulator Company: www.wattsregulator.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Approved Equal.

B. Reduced Pressure Backflow Preventers:

1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded bent outlet; assembled with two gate valves, strainer, and four test cocks.

2.06 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:

1. Conbraco Industries: www.apollovalves.com.
2. Watts Regulator Company: www.wattsregulator.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Approved Equal.

B. Double Check Valve Assemblies:

1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.07 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Watts Regulator Company: www.wattsregulator.com.
3. Zurn Industries, Inc: www.zurn.com.
4. Approved Equal.

B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories.

H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch (20 mm) minimum, and minimum 18 inches (450 mm) long.

END OF SECTION

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SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Service sinks.

1.02 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 FLUSH VALVE WATER CLOSETS

A. Manufacturers:

1. American Standard, Inc; 3461.001: www.americanstandard-us.com.

B. Water Closets: ASME A112.19.2; floor mounted, siphon jet, vitreous china, 16.5 inches (420 mm) high, bolt caps.

1. Water Consumption: Maximum 1.6 gallon (6 liters) per flush.

D. Flush Valves:

1. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

2. Manufacturers:

a. Sloan Valve Company; 111-1.6: www.sloanvalve.com

C. Seat Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com.

2. Bemis Manufacturing Company: www.bemismfg.com.

3. Church Seat Company: www.churchseats.com.

4. Olsonite: www.olsonite.com.

D. Seat: Solid white plastic, open front, extended back, less cover, complete with self-sustaining hinge.

E. Handle Height: 44 inches (1117 mm) or less.

2.03 LAVATORIES

A. Lavatory Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com.

2. Gerber Plumbing Fixtures LLC; www.gerberonline.com.

3. Kohler Company: www.kohler.com.

4. Zurn Industries, Inc: www.zurn.com.

5. Approved Equal.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, 18 by 20 inch minimum, with 4 inch (100 mm) high back, rectangular basin with splash lip, front overflow, and soap depression.

1. Drilling Centers: 4 inch (100 mm).

C. Supply Faucet Manufacturers:

1. Chicago Faucet; 420-ABCP: www.chicagofaucets.com.

D. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow) (1.9 liters per minute (low-flow)), ceramic cartridge, single lever handle.

E. Accessories:

1. Chrome plated 17 gage (1.3 mm) brass P-trap with clean-out plug and arm with escutcheon.

2. Offset waste with perforated open strainer.

3. Brasscraft ¼ turn ball stop, KT series.

4. Flexible supplies.

5. Carrier:

a. Manufacturers:

1) JOSAM Company: www.josam.com.

2) Zurn Industries, Inc: www.zurn.com.

3) American Standard, Inc: www.americanstandard-us.com.

4) Kohler Company: www.kohler.com

5) Approved Equal.

2.04 SERVICE SINKS

A. Service Sink Manufacturers:

1. American Standard, Inc: www.americanstandard-us.com.

2. Commercial Enameling Company: www.cecosinks.com.

3. Elkay Manufacturing Company: www.elkay.com.

4. Gerber Plumbing Fixtures LLC; www.gerberonline.com.
5. Just Manufacturing Company: www.justmfg.com.
6. Zurn Industries, Inc; www.zurn.com.
7. Approved Equal.

B. Bowl: ASME A112.19.1; 22 by 18 by 12 inch (560 by 460 by 300 mm) deep, porcelain enamelled (inside only) cast iron roll-rim sink, with 12 inch (300 mm) high back, concealed hanger, chrome plated strainer, stainless steel rim guard, cast iron P-trap with adjustable floor flange.

C. Trim: ASME A112.18.1 exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.

D. Accessories:

1. 5 feet (1.5 m) of 1/2 inch (13 mm) diameter plain end reinforced plastic hose.
2. Hose clamp hanger.
3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.

1. Water Closet:

a. Comfort Height: 16.5 inches to top of bowl rim.

b. Accessible: 18 inches (455 mm) to top of seat.

2. Lavatory:

a. Standard: 31 inches (785 mm) to top of basin rim.

b. Accessible: 34 inches (865 mm) to top of basin rim.

B. Fixture Rough-In

1. Water Closet (flushometer):
    a. Cold Water: 1 Inch (25 mm).
    b. Waste: 4 Inch (100 mm).
    c. Vent: 2 Inch (50 mm).
2. Lavatory:
    a. Hot Water: 1/2 Inch (15 mm).
    b. Cold Water: 1/2 Inch (15 mm).
    c. Waste: 1-1/2 Inch (40 mm).
    d. Vent: 2 Inch (50 mm)
3. Service Sink:
    a. Cold Water: 3/4 Inch (19 mm).
    b. Waste: 3 Inch (80 mm).
    c. Vent: 2 Inch (50 mm).

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.04 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.
5. Approved Equal.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 1200 degrees F (649 degrees C).
3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:

F. Tie Wire: Annealed steel, 16 gage (1.5 mm).

2.03 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation: www.knaufusa.com.
2. Johns Manville Corporation: www.jm.com.
3. Owens Corning Corp: www.owenscorning.com.
4. CertainTeed Corporation: www.certainteed.com.
5. Approved Equal.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' ('Ksi') value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.

2. Maximum service temperature: 450 degrees F (232 degrees C).

3. Maximum Water Vapor Sorption: 5.0 percent.

4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.

2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:

a. Compatible with insulation.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square (2.45 kg/sq m).

C. Aluminum Jacket: ASTM B209 (ASTM B209M).

1. Thickness: 0.016 inch (0.40 mm) sheet.

2. Finish: Smooth.

3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.

4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.

2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

G. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. Combustion Air Duct:

1. Flexible Glass Fiber Duct Insulation: 1 inches thick.
2. Rigid Glass Fiber Duct Insulation: 1 inches thick.

B. Evaporative Condenser Intake and Exhaust:

C. Exhaust Ducts Within 10 ft (3 m) of Exterior Openings:

D. Exhaust Ducts Exposed to Outdoor Air:

E. Outside Air Intake Ducts:

F. Plenums:

G. Plenums (Cooling System):

H. Ventilation Equipment Casings:

I. Supply Ducts:

J. Supply Ducts From Fans to Vertical Ducts in Shafts (Cooling System):

K. Supply Ducts in Vertical Shafts (Cooling Systems):

L. Supply ducts After Terminal Boxes:

M. Return and Relief Ducts in Mechanical Rooms:

N. Ducts Exposed to Outdoors:

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:

1. Control system.
2. Major and minor equipment items.
3. Piping systems and equipment.
4. Ductwork and accessories.
5. Sound control devices.
6. Vibration control devices.
7. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process; 2012

1.03 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:

   1. System name.

   2. List of devices.

   3. Step-by-step procedures for testing each controller after installation, including:

      a. Process of verifying proper hardware and wiring installation.

      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.

      c. Process of performing operational checks of each controlled component.

      d. Plan and process for calibrating valve and damper actuators and all sensors.

      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.

   5. Description of the instrumentation required for testing.

   6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.
    g. Heating and/or cooling valve tag ID.
    h. Minimum air flow rate.
    i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.

9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

E. Project Record Documents: See Section 01720 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01820, include:
1. Follow the recommendations of ASHRAE Guideline 1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01820 for additional requirements.

1. Provide one copy of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with the contract documents.

1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.

4. Command valve/damper open; verify position is full open and adjust output signal as required.

5. Command valve/damper to a few intermediate positions.

6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Coil Valve Leak Check:

1. Method 1 - Water Temperature With 2-Way Valve:

a. Calibrate water temperature sensors on each side of coil to be within 0.2 degree F of each other.

b. Turn off air handler fans, close outside air dampers. Keep pump running. Make sure appropriate coil dampers are open.

c. Normally closed valves will close.

d. Override normally open valves to the closed position.

e. After 10 minutes observe water delta T across coil. If it is greater than 2 degrees F, leakage is probably occurring.

f. Reset valve stroke to close tighter.

g. Repeat test until compliance is achieved.

2. Method 2 - Air Temperature With 2 or 3-Way Valve: Water leak-by less than 10 percent will likely not be detected with this method.

a. Calibrate air temperature sensors on each side of coil to be within 0.2 degree F of each other.

b. Air handler fans should be on.

c. Change mixed or discharge air setpoint, override values or bleed or squeeze bulb pneumatic controller to cause the valve to close.

d. After 5 minutes observe air delta T across coil. If it is greater than one degree F, leakage is probably occurring.

e. Reset valve stroke to close tighter.

f. Repeat test until compliance is achieved.

3. Method 3 - Coil Drain Down: Not for 3-way valves.

a. Put systems in normal mode.

b. If cooling coil valve, remove all call for cooling; if heating coil valve, put system in full cooling.

c. Close isolation valve on supply side of coil, open air bleed cap, open drain-down cock and drain water from coil.

d. If water does not stop draining, there may be a leak through the control valve.

e. Return all to normal when done.

F. Isolation Valve or System Valve Leak Check: For valves not by coils.

1. With full pressure in the system, command valve closed.

2. Use an ultra-sonic flow meter to detect flow or leakage.

G. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.

1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.

2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.

1. Setpoint changing features and functions.

2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:

1. That all specified functions and features are set up, debugged and fully operable.

2. That scheduling features are fully functional and setup, including holidays.

3. That all graphic screens and value readouts are completed.

4. Correct date and time setting in central computer.

5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.

6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.

7. Power failure and battery backup and power-up restart functions.

8. Global commands features.

9. Security and access codes.

10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. “After hours” use tracking and billing.
14. Communications to remote sites.
15. Fire alarm interlocks and response.
16. Fire protection and suppression systems interfaces.
17. Security system interlocks.
18. That points that are monitored only, having no control function, are reporting properly to the control system.
19. All control strategies and sequences not tested during controlled equipment testing.
20. Trend logging and graphing features that are specified.
21. Other integrated tests specified in the contract documents
22. That control system features that are included but not specified to be setup are actually installed.

H. Perform and submit trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the control system:

1. Duty cycling, if specified.
2. Demand limiting, including over-ride of limiting.
3. Sequential staging ON of equipment; optionally demonstrate manually.
4. Optimum start-stop functions.
5. Miscellaneous equipment current or status for duty cycling and demand limiting.
6. Equipment or building kW or current for demand limiting.
7. Equipment optimum start/stop functions.

I. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

C. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

1. HVAC Control System: 1 hours.

D. TAB Review: Instruct Owner's personnel for minimum 1 hours, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.

2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

END OF SECTION

SECTION 23 13 23

FUEL PIPING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work of this section includes all labor, materials and equipment required for the installation and testing of the fuel piping systems complete and ready for operation. The system will include a new aboveground fuel storage tank, fuel piping system to a new emergency generator, fuel storage tank monitoring system, and all required accessories.

B. The work of this section shall include installing the tank, fuel piping system, the fuel storage tank monitoring system, and all required accessories.

C. The work of this section shall include installing the fuel piping system and all required accessories.

D. Contractor shall furnish and install a 2,000 gallon fuel tank with stairs and platforms and fuel tank monitoring. Contractor shall furnish and install concrete pads, fuel piping and fuel tank accessories. Contractor shall provide all fuel for testing and then fill the tank to 90% capacity (1,800 gallons) prior to substantial completion.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. All work shall conform to the applicable requirements of the city, county, state and federal codes. Where the requirements of such agencies are more stringent than specified herein, abide by such requirements and consider this specification as supplementary to those requirements.

B. All work shall conform to the applicable requirements of the US Environmental Protection Agency.

C. All work shall conform to the applicable requirements of the following: National Fire Protection Association (NFPA), The Florida Fire Prevention Code; the State of Florida, Department of Environmental Protection (FDEP), and The Florida Building Code.

D. The tank shall meet the current requirements of Underwriters Laboratories (UL) Standard 142 and 2085. All components of the fuel distribution system shall be UL listed, unless otherwise specified, or approved by the Engineer.

E. The tank and fuel systems shall be designed and fabricated according to best practices and methods available to date.

1.03 QUALIFICATIONS

A. Installer shall have had supervisory experience with two similar fuel systems in the past three years and shall hold a valid pollution control contracting license as required by the State of Florida, Department of Environmental Protection. A copy of the license shall be submitted, prior to proceeding with construction.

B. Tank installers shall be certified in writing by the tank manufacturer as being qualified to install the equipment. A copy of the certificate shall be submitted, prior to proceeding with construction.

1.04 SUBMITTALS

A. Complete shop drawings shall be submitted, including certification of shop test to the Engineer for review, according to General Conditions.

1. The shop drawings shall include sufficient information to demonstrate compliance with the tank manufacturer’s recommended tank installation and test procedures.

2. The shop drawings for pipe, fittings, and each item listed in the Specifications shall include manufacturer's catalog data and descriptive literature, fully dimensioned shop layout drawing (1/4" = 1' scale or larger) showing all piping, valves, equipment connections, and installation clearance requirements.

3. Submit all manufacturer's recommended installation and test procedures for all equipment including tanks, piping, etc.

4. Operation and Maintenance Manuals -- Submit two (2) copies for each site plus one additional copy of operation and maintenance manuals, including parts lists and guarantees for each item furnished.

1.05 OPERATING AND MAINTENANCE MANUALS

A. When the installation is completed, submit to the Engineer, as required in Division 1, copies of the following, bound in a hard cover booklet:

1. General operating instructions, including copies of posted specific instructions and automatic control diagrams.

2. Maintenance instructions, followed by tabulated manufacturer's descriptive literature, shop drawings, performance curves and rating data, spare parts lists and manufacturer's maintenance manuals.

3. Names, addresses and telephone numbers of local service representatives of the manufacturers of the installed equipment.

1.06 PRODUCT HANDLING

A. Deliver materials and equipment to project site in manufacturer's original, unopened containers with labels intact and legible. Labels shall indicate manufacturer's name and model number. Store equipment in dry protected area. All damaged items shall be replaced with new at no additional cost to Owner.

B. Piping shall be supplied to the site with sealed end caps which shall remain in place until installation. Tanks shall be delivered to the site with all openings sealed which shall remain in place until installation. The tanks shall be properly supported during transportation to the site and during installation in accordance with the manufacturer's instructions.

PART 2 PRODUCTS

2.01 ABOVEGROUND FUEL OIL STORAGE TANK

A. Storage Tank

1. The aboveground fuel storage tank shall be installed per all the tank manufacturers’ requirements.

2. Provide an emergency vent as required by NFPA 30 with no size reduction allowed for concrete encasement (insulation).

3. Provide a normal vent, independent of the emergency vent as required by NFPA 30.

4. Provide the tank with two (2) ground conductors for lightning protection in accordance with NFPA 78.

5. The tank shall have appropriate warning signs as required by the local jurisdiction.

6. The tank shall be placed on reinforced concrete pad made to manufacturer's specifications, or properly engineering for the weight and conditions.

7. Hurricane Restraints shall be installed per the Building Code.

8. The fuel tank shall be a double containment 2,000 gallon double wall concrete/steel tank or equal.

9. The fuel tank shall be left 90%full at the conclusion of the contract.

B. Tank Accessories

1. A mechanical fuel level gauge shall be provided to indicate the fuel level within the tank. The fuel level gauge shall have a circular gauge indicator mounted to an opening in the top of the tank.

2. Provide custom fabricated stairs with 24” x 24” platform at the top, at a minimum height of 4 feet AFG, to provide access to the top of the tank. Stairs shall have handrails on both sides and at all platform sides. Stairs and stair handrails shall be aluminum construction. Standard steel stairs and/or handrails with a painted or galvanized finish shall not be acceptable

2.02 FUEL OIL TANK ACCESSORIES

A. The following equipment shall be furnished along with the necessary piping and fittings required to provide a complete diesel fuel piping system.

1. Vent piping shall be 2-inches, and shall be provided as with a vent cap constructed of aluminum with removable stainless steel screen, OPW model 23 or equal.

2. An emergency vent shall be provided for the tank, of the size required by code. The emergency vent shall be constructed of an epoxy coated cast iron lid, aluminum body, and a removable stainless steel screen. The emergency vent shall be OPW model 201 or equal.

3. Isolation and ball valves shall be size indicated on the drawings with stainless steel construction, PTFE Teflon seals, lockable handles, and stainless steel trim. The valves shall be Morrison Brothers 691BSS or equal.

4. Overfill protection stop valve, OPW model 61 fstop-3000 or equal, shall be installed on the tank and be capable of stopping diesel fuel flow at 95% tank capacity shall be.

5. A double poppet foot valve, OPW model 86 or equal, shall be installed inside the aboveground tank at the fuel intake line at a location 6" above the bottom of the tank.

6. An anti-syphon valve, aluminum construction, stainless spring, and Nitrile seals, OPW 199ASV or equal, shall be installed in the fuel supply line at the location shown on the fuel piping schematic and on the Drawings. The valve spring shall be sized for the actual rise and run of the installed piping.

7. An emergency shutoff valve, stainless steel construction and Teflon seals, Morrison Brothers 346SS or equal, shall be installed in the fuel supply line at the generator enclosure as shown on the fuel piping schematic and on the Drawings.

8. Provide a Core Engineered Solutions Spill Kit, Model EP-SKL-2, Or equal, including socks, pillows, wipers, at pads, labels, Emergency Response Guidebook, and instruction manual

9. A packaged fire suppression kit including 10 lb. extinguisher with vinyl jacket shall be provided.

10. Provide all piping, valves, unions, filters, strainers, and other accessories as shown on the Drawings and/or as required for a complete system.

2.03 PIPE AND FITTINGS

A. All fuel piping including supply piping, return piping, and vent piping shall be Schedule 40 Type 316 stainless steel in conformance with ASTM A-312 and ANSI B31.3-1980 with 125 lb. butt-welded Type 316 stainless fittings conforming to ANSI B16.3 and ANSI B31.3-1980.

B. Flexible piping at tank and equipment connections shall be constructed of a seamless flexible plastic liner with corrosion resistant type 316 stainless steel wire braid reinforced cover, stainless steel collars, and ductile iron fittings.

C. Provide piping transitions, sleeves, and supports as shown on the Drawings and as required for a rigidly supported and complete installation. Seal all wall penetrations watertight.

D. All supports including hangers, brackets, fasteners, and miscellaneous metals shall be Type 316 stainless steel.

2.04 JOINT COMPOUND

A. Joint compound for steel pipe threaded connections shall be a non-hardening, non-solvent joint sealer compatible with fuel products.

2.05 FUEL LEVEL/LEAK MONITORING EQUIPMENT

A. General

1. Furnish an electrical monitoring equipment including low level alarm, high level alarm, tank level indication, tank interstitial space leak detection, and associated modules for the leak detection system. The system shall have local audio and visual indication for all alarm conditions. The system shall have connections to indicate all alarm and tank level conditions to the plant SCADA system. The system shall be including all required modules, terminals, switches, and transducers and transmitters.

2. One system shall be provided for the new tank.

3. The system shall be mounted to the access stair railing, in an accessible location.

4. The system shall be a Veeder Root model TLS-4C (450 series) with serial to Ethernet TCP/IP interface converter module by Chipkin (FS-QS-1210 Series) approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Equipment shall be installed in accordance with the manufacturer's recommendations.

2. All materials and equipment shall be new and free from defects or damage and shall be installed in accordance with the approved recommendations of the manufacturer to conform to the contract documents. The installation shall be accomplished by workmen skilled in this type of work. Equipment shall be erected in a neat manner, shall be aligned, leveled and adjusted to provide satisfactory operation. Installation shall be such that connection and disconnection of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements to provide proper access may be made.

B. Fuel Piping

1. All pipes shall be cut accurately to measurements established at the site and shall be worked into place without forcing or bending. All pipes shall be installed into place without traps or pockets and pitched 1-inch in 40-foot minimum to drain.

2. Piping shall be installed to minimize the quantity of piping joints. Provide unions and/or flexible connections at all equipment connections.

3. Joints shall be fabricated in accordance with standard industry practices and manufacturer's instructions. All joints shall be liquid tight, screwed joints except where flanged connections to equipment or valves are required. Cut pipe square using pipe cutting tool and carefully ream pipe to remove all burrs. Cut a complete thread, using sharp dies properly set and centered, while applying oil graphite cutting lubricant.

C. Flexible Fuel Piping

1. Provide flexible piping connectors at all day tank connections, all generator connections, all storage tank connections and all equipment connections.

2. Flexible connections shall be a minimum of 12-inches long or as required for equipment removal or maintenance. Protect flexible connectors where physical damage may occur due to adjacent equipment, other piping, wiring, or where subject to possible damage from operating personnel.

D. Leak Sensor Installation

1. Install all level and leak sensing equipment, monitoring panel interface modules and all wiring, conduit, junction boxes, sealing fittings and other material required for a complete operating system.

2. Install all monitoring equipment in accordance with the manufacturer's instructions including compliance with hazardous locations as defined in the National Electrical Code as locally amended and local codes which have jurisdiction.

3. Provide instrument identification (tagging), calibration and manufacturer services.

3.02 TESTING

A. Piping shall be tested in strict accordance with the manufacturer's testing requirements. Piping system shall be tested upon completion of the roughing-in before setting equipment. The entire system shall be pressure tested with fuel at 5 psig and proved tight at this pressure for a period of four (4) hours. Defective work or material shall be replaced and retested. The system shall be test plugged or capped prior to testing to prevent test pressure from reaching any equipment or storage tank.

B. Storage tanks and piping shall be precision tested by a state qualified tester.

C. Storage tanks shall be pressure tested at 2 psi and all fittings soaped for a period of at least 12 hours prior to placing tanks into excavation. Tanks under test pressure shall not be left unattended.

D. Contractor shall provide fuel for any required testing and retesting. If the fuel subsequently becomes contaminated, Contractor shall dispose of the fuel at no cost to the Owner and in accordance with all FDEP regulations. Upon completion of the testing and prior final acceptance of the system, the Contractor shall fill the tank to capacity.

END OF SECTION

SECTION 23 31 00

DUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Casing and plenums.

D. Duct cleaning.

1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

D. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

E. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.03 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.04 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. All Ducts: Galvanized steel, unless otherwise indicated.

B. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

C. Return and Relief: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

D. General Exhaust: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. VOC Content: Not more than 250 g/L, excluding water.

3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

4. For Use With Flexible Ducts: UL labeled.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

6. Other Types: As required.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.

C. Duct systems have been designed for metal duct. At the Contractor's option, fibrous glass duct may be substituted for metal duct.

D. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

E. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

F. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Slab Duct Ventilation System: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS, with G90/Z275 coating designed for installation in cast-in-place concrete floor assemblies.

   1. Fittings: Elbows, End caps, Connecting couplings, Spin-in-collar, Sofit-discharge head, Support Brackets, and Wall discharge head

B. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.

1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
2. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
3. Maximum Velocity: 4000 fpm (20.3 m/sec).
4. Temperature Range: Minus 10 degrees F to 160 degrees F (Minus 23 degrees C to 71 degrees C).

C. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
1. UL labeled.
2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
3. Pressure Rating: 4 inches WG (1000 Pa) positive and 0.5 inches WG (175 Pa) negative.
4. Maximum Velocity: 4000 fpm (20.3 m/sec).
5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).

D. Flexible Ducts: Multiple layers of aluminum laminate supported by helically wound spring steel wire.
1. UL labeled.
2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
3. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
4. Maximum Velocity: 4000 fpm (20.3 m/sec).
5. Temperature Range: Minus 20 degrees F to 210 degrees F (Minus 28 degrees C to 99 degrees C).

E. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
2. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.

3. Maximum Velocity: 4000 fpm (20.3 m/sec).

4. Temperature Range: Minus 20 degrees F to 210 degrees F (Minus 28 degrees C to 99 degrees C).

F. Flexible Ducts: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.

2. Pressure Rating: 8 inches WG (2.0 kPa) positive or negative.

3. Maximum Velocity: 5000 fpm (25.4 m/sec).

4. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 99 degrees C).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with mechanical fastener

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

K. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

SECTION 23 32 12

DIESEL ENGINE DRIVEN GENERATOR

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The generator unit and the automatic transfer switch shall be furnished by the OWNER and installed by the CONTRACTOR. CONTRACTOR shall furnish all labor and incidentals required to install, put into operation, and field test the weatherproof diesel engine driven generator unit, automatic transfer switches and appurtenances as shown on the Drawings and specified herein.

B. CONTRACTOR shall coordinate with the generator manufacturer in order to supply signed and sealed structural drawings for the installation of the required generator concrete support pads. The structural engineer shall be licensed in the State of Florida.

C. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, and delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete units as herein specified, whether specifically mentioned in these specifications or not.

D. For the unit there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. This installation shall incorporate the highest standards for the type of service shown on the Drawings. The CONTRACTOR is responsible for field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.

1.02 DESCRIPTION OF SYSTEMS

A. The generator set shall be mounted as shown on the Drawings and shall be arranged for automatic starting and stopping, and load transfer upon failure of the normal source of power. The unit controls shall provide for automatic exercising on a weekly basis.

1.03 QUALIFICATIONS

A. The generator set shall be the standard product, as modified by these specifications, of a MANUFACTURER regularly engaged in the production of this type of equipment. The unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. To qualify as a MANUFACTURER, the engine must be the principal item manufactured and the completed engine generator set shall be supplied by the MANUFACTURER's authorized distributor only. The distributor shall have a minimum of ten (10) years experience in the field of power generation.

B. It is the intent of this specification to secure an emergency generator system that has been prototype tested, factory built, production tested, site tested and of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the NEC, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the engine/generator and controls, transfer switch, and assembles the emergency generator system as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

C. The unit must be of such physical dimensions as to make a good installation in the opinion of the ENGINEER, in the space provided as indicated on the Drawings.

D. The unit shall be assembled in the U.S. with over 50% of the components such as the engine, generator, auxiliary equipment, etc., manufactured in the U.S. by a MANU-FACTURER currently engaged in the production of such equipment.

E. The unit shall be shipped to the jobsite by an authorized engine distributor having a parts and service facility within a 50 mile radius of the jobsite. In addition, and in order not to penalize the OWNER for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have no less than eighty percent (80%) of all engine replacement parts locally available at all times. Certified proof of this requirement shall be furnished to the ENGINEER upon request.

F. All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these Specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the Specifications set forth herein. Major exceptions to Specifications will be considered sufficient cause for rejection of the machines.

G. The Engine/Generator Unit shall be as manufactured by Caterpillar, Cummins or AKSA-Zabatt. Contractor shall assist with the coordination efforts with the current JEA (Jacksonville Electric Authority) contact.

1.04 SUBMITTALS

A. Submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required for interconnection between the generator set, the transfer switch, and the switchgear panels included elsewhere in these specifications.

B. CONTRACTOR shall submit to the ENGINEER for review in accordance with other sections, complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other Sections, including foundation drawings showing location and size of foundation bolts for the spring type vibration isolators and brochures covering each item of equipment.

C. In the event that it is impossible to conform to certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

D. The submittal data for the generator set and weatherproof enclosure shall include, but not necessarily be limited to, the following:

1. Installation drawings showing plan and elevations of the complete generator unit; foundation plan; exhaust silencer; starting battery; battery charger; and weatherproof enclosure.

2. Engine Data:

    a. MANUFACTURER

    b. MODEL

    c. Number of cylinders

    d. RPM

    e. Bore x stroke

    f. BMEP at full rated load

    g. Piston speed, FPM

    h. Make and model and descriptive literature of electric governor (where required)

    i. Fuel consumption rate curves at various loads

    j. Engine continuous pump drive duty rating (without fan) HP

    k. Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads) HP

3. Generator Data:

    a. MANUFACTURER

    b. Model

    c. Rated KVA

    d. Rated SKVA

    e. Rated kw

    f. Voltage

    g. Temperature rise above 40 degree C ambient

        1) Stator by thermometer

        2) Field by resistance

        3) Class of insulation

h. Generator efficiency including excitation losses and at 80 percent power factor.

1) Full load

2) 3/4 load

3) ½ Load

4. Generator Unit Control Data:

a. Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided. Standard preprinted sheets are not acceptable.

b. Legends for all devices on all diagrams.

c. Sequence of operation explanations for all portions of all schematic wiring diagrams.

5. The Generator Unit: Dimensional data shall be given for the Generator set.

a. Weight of skid mounted unit

b. Overall length

c. Overall width

d. Overall height

e. Exhaust pipe size

f. CFM of air required for combustion and ventilation

g. Heat rejected to jacket water and lubricating oil BTU/hr.

h. Heat rejected to room by engine and generator BTU/hr.

i. Weatherproof enclosure details and certification of manufacturing method per specifications.

j. Venting, fuel connection points and fill cap location.

k. Data on all miscellaneous items supplied.

6. System Service Contract:

a. Equipment Supplier Company

Name

Address

City/State

Phone Number

b. Attach the number of copies required of System Service Contract to submittal.

7. Furnish the number of copies required of the MANUFACTURER'S certified shop test record of the complete engine driven generator unit.

8. Warranty information.

E. Submit to the ENGINEER operating and maintenance data.

F. Submit to the ENGINEER the equipment MANUFACTURER'S Certificate of Installation, Testing, and Instruction.

G. Submit to the ENGINEER the written warranty as required in Paragraph 3.05 below.

1.05 TESTING

To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests and site tests.

A. Design Prototype Tests: Components of the emergency system such as the engine/generator sets, automatic transfer switches, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and pre-production models, which will not be sold, shall have been used for the following tests. Prototype test programs shall include the requirements of NFPA 110 and the following:

1. Maximum power (KW).

2. Maximum motor starting (KVA) instantaneous voltage dip.

3. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-2240 and 16.40.

4. Governor speed regulation under steady-state and transient conditions.

5. Voltage regulation and generator transient response.

6. Fuel consumption at 1/4, 1/2, 3/4, and full load.

7. Harmonic analysis, voltage waveform deviation, and telephone influence factor.

8. Three-phase short circuit tests.

9. Alternator cooling air flow.

10. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.

11. Endurance testing.

B. Final Production Tests: The generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

1. Single-step load pickup.

2. Transient and steady-state governing.

3. Safety shutdown device testing.

4. Voltage regulation.

5. Rated power.

6. Maximum power.

7. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

C. Site Tests: An installation check, start-up and building load test shall be performed by the manufacturer's local representative. The Engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

1. Fuel, lubricating oil, an antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.

3. Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.

4. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate KW rating.

1.06 SPECIAL TOOLS AND SPARE PARTS

A. The MANUFACTURER shall furnish two (2) complete spare replacement sets of all filter elements required for the generator unit.

PART 2 PRODUCTS

2.01 RATINGS

A. The standby rating of the generator set shall not exceed the MANUFACTURER's published prime rating by more than 10%. The gross engine horsepower required to produce the standby rating shall not exceed the MANUFACTURER's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in BS649 or DIN6270 but in no case shall it exceed the MANUFACTURER's published continuous duty rating for the engine as used in continuous rated pump drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan (for fan cooled models) and all accessories necessary to the unit's proper operation while operating at rated load and at a rotative speed not to exceed 1800 rpm.

B. The diesel engine driven generator set shall be capable of producing the specified standby kw rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the MANUFACTURER for the actual unit supplied.

C. The Diesel Engine/Generator Unit at shall be rated for 250KW (277/480 volts, 3-Phase, 60 Hertz) minimum at 0.8 power factor with fan and shall be suitable for starting the following loads:

Step 1-High Service Pump 75HP (VFD) and15KVA of lighting and receptacle load

Step 2-High Service Pump 75HP (VFD)

Step 3-Well Pump 20HP (Across the line)

Step 4-Well Pump 20HP (Across the line)

Step 5-Miscellaneous load 10 HP (Across the line)

- Manufacturer shall submit generator sizing load calculations in writing.

2.02 ENGINES

A. The engine shall be full compression ignition, four cycle, single acting, solid injection engine, either vertical or "V" type. Speed shall not exceed 1800 revolutions per minute at normal full load operation. The engine governor shall be electronic type with a +/- 0.5 percent accuracy. Governor shall be by Woodward, Barber Coleman or Cummins EFC.

B. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM Designation D396). Diesel engines requiring a premium fuel will not be considered.

C. The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.

D. The engine shall be equipped with fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, engine driven water pump, and unit mounted instruments. Unit mounted instruments shall include a fuel pressure gauge, water temperature gauge, and lubrication oil pressure gauge. Each engine shall be provided with low oil pressure, high water temperature, low coolant level and overspeed safety shutdowns of the manual reset type. Additional instruments and safety shutdowns shall be provided as noted herein.

E. Injection pumps and injection valves shall be a type not requiring adjustment in service and shall be of a design allowing quick replacement by ordinary mechanics without special diesel experience. The engine shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be

removed and replaced from parts stock. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.

F. The fuel system shall be equipped with fuel filters having replaceable elements. Filter elements shall be easily removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. The engine shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure.

G. In addition to the standard fuel filters provided by the engine MANUFACTURER, there shall also be installed a primary fuel filter and a water separator in the fuel inlet line to the engine.

H. The engine shall be provided with removable wet-type cylinder liners of close grained alloy iron, heat treated for proper hardness as required for maximum liner life. The cylinder block shall be a one piece stress relieved gray iron casting.

I. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filters shall be accessible, easily removed and cleaned and shall be equipped with a spring-loaded by-pass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water cooled lubricating oil cooler.

J. The engine shall be provided with one or more engine mounted dry type air cleaners of sufficient capacity to protect effectively the working parts of the engine from dust and grit.

K. During each initial start of the engine, a system shall be provided to pre-lube at low idle speed. When the internal oil pressure reaches a predetermined safe value, the engine will then increase to generator set operation speed.

L. Mounting: The unit shall be mounted on a structural steel sub-base and shall be provided with spring type vibration isolators.

M. The engine shall be certified to meet the requirements of U.S. EPA Tier 3 exhaust emission levels.

2.03 COOLING SYSTEMS

A. The engine shall be furnished with a unit mounted radiator-type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature not to exceed 120 degrees F. The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions. Total air restriction from the radiator shall not exceed 0.5 inches of water at both inlet and outlet. A flexible connecting section shall be provided between the radiator and discharge louver frame.

B. Closed circuit jacket water systems shall be treated with a rust inhibitor as recommended by the engine MANUFACTURER.

C. Provide one (1) unit mounted thermal circulation type water heater incorporating a thermostatic switch shall be furnished to maintain engine jacket water at minimum of 70 degrees F. Heater voltage shall be 480-volt, single phase, 60 Hertz, size as required to achieve above noted ambient.

D. The expansion tank of the radiator shall be fitted with a low water level switch and wired into the safety shutdown system of the unit.

E. The generator shall be furnished with a fuel cooler of sufficient capacity to remove heat from fuel before the fuel is returned to the day tank.

2.04 GENERATOR, EXCITER AND ACCESSORIES

A. Rating: The generator shall be rated 0.8 power factor, 1800 RPM, 3 phase, 60 Hertz, 277/480 volts, 12 leads, extended stack, with a maximum temperature rise of 105 degrees C (both armature and field) by resistance at full rated load in ambient air of 40 degrees C. The generator shall conform to NEMA Standard MG-1 and shall be PMG excitation type.

B. Performance: The instantaneous voltage dip shall not exceed 20 percent of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 5 seconds. Steady state modulation shall not exceed +1/2 percent.

C. Construction:

1. The generator and exciter shall be dripproof, with split sleeve, or ball race bearings. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high grade silicon steel laminations precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.

2. The exciter shall be a fast response type, with a rotating 3-phase full-wave bridge. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.

3. Generator stator and exciter stator windings shall be a full Class H insulated system with Class F temp rise, vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air. Generator coils shall be random or machine wound, and precision made, with turn-to-turn and ground insulation of glass yard and mica materials. The average di-electric strength for the form wound coils of the ground and end turn insulation shall not be less than 400 volts per mil. Spacers shall be tightly secured between end turns, and the end turn assembly securely lashed to the support rings.

4. Generator rotor poles shall be built up of individually insulated silicon steel punchings. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Generator windings shall be braced for full line to ground fault currents, with solidly grounded neutral system.

D. Accessories and Attachments

1. Low Voltage Terminal Boxes: The generator shall have separate AC and DC low voltage terminal boxes with suitably numbered terminal strip for required connections.

2. All required P.T.'s, C.T.'s and protective relays shall be supplied by the engine-generator MANUFACTURER as required.

3. Space Heater: Space heater shall be installed on the generator frame to maintain temperature of the entire generator above the dew point while not in use. Power supply shall be 120 volts single phase. Heater will be automatically disconnected when engine starts. The magnetic starter for the heaters shall be mounted in the terminal box. Furnishing and installation of control and starter to be by engine/generator supplier.

E. Generator Associated Controls:

1. Voltage Regulator:

a. The generator MANUFACTURER shall furnish a hermetically sealed, silicon controlled rectifier type voltage regulator employing a zener reference with a +1 percent regulation for the generator. The regulator shall include 3-phase voltage sensing, automatic short circuit protection and shall include automatic under frequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures. Switches and/or fuses shall not be used to provide this protection. An over-voltage sensing module with manual reset shall be furnished with the regulator. A volts per hertz sensing module shall be provided as part of the regulation system.

b. A voltage adjustment rheostat for 5 percent voltage adjustment on the unit shall be provided.

c. High voltage step-down potential transformers shall be provided for the voltage regulator power input and sensing circuits if required.

2. Sustained Short Circuit: A permanent magnetic exciter shall be provided on the unit for sustaining a current of 300 percent during a short circuit, permitting the generator breaker to trip on overload. To prevent possible

overheating of the armature windings, appropriate relaying shall be supplied to limit the fault to ten seconds. All current transformers required shall be supplied by the switchgear MANUFACTURER.

2.05 EXHAUST SYSTEM

A. Exhaust Silencer - A critical type, side inlet, end outlet, Maxim M-51,Nelson, or Silex JB silencer and a flexible stainless steel exhaust fitting properly sized shall be furnished and installed within the generator enclosure to protect siencer from the environment. Externally mounted silencers are acceptable only when constructed of 316 stainless steel. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed the maximum limitations specified by the engine MANUFACTURER. So called "spiral" or truck mufflers are disallowed and will not be considered as equal to the industrial quality silencers specified above.

B. The silencer shall be fitted with a tail pipe extension terminating at a 45^{o} angle to prevent the entrance of rainwater. It shall also be fitted with an expanded metal bird screen.

C. Rain Skirt - At the point where the exhaust pipe flexible tubing penetrates the roof of the enclosure, a suitable "rain skirt" and collar shall be provided by the MANUFACTURER. It shall be designed to prevent the entrance of rain and allow for expansion and vibration of the exhaust piping without chafing or stress to the exhaust system. This detail must appear on the drawings submitted for approval.

2.06 AUTOMATIC STARTING SYSTEM

A. Starting Motor - A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be 24 volts.

B. Automatic Control - Fully automatic engine start-stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, overcrank, and loss of engine coolant. Alarms for approaching high water temperature and impending low oil pressure shall also be included. Controls shall include a 45-second single cranking cycle limit with lockout or a cyclic crank system with lockout and overcrank protection.

C. Batteries - A lead-acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be 12 volts, and the battery set shall be rated no less than 225 ampere hours. Necessary cables and clamps shall be provided.

D. Battery Tray - battery tray shall be provided for the batteries and shall conform to NEC 480-7(b). It shall be constructed of fiberglass and so treated as to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over of battery electrolyte shall be contained within the tray to prevent a direct path to ground.

E. Battery Charger - A current-limiting, automatic 24 volt DC charger shall be furnished to automatically recharge batteries. Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than ten (10) amperes. Charger shall be wall mounting type in NEMA 1 enclosure, and U.L. listed as an industrial control panel. The charger shall be as manufactured by LaMarche, or equal per NFPA 110 and U.L. 508. The charger shall be mounted and wired within the enclosure for the generator set by enclosure manufacturer.

2.07 MAIN LINE CIRCUIT BREAKER AND DISTRIBUTION BREAKERS

A. Type - Main line, molded case circuit breaker mounted upon and sized to the output of the generator shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions. The breaker shall include ground fault sensing that will trip the breaker on ground fault conditions. The three (3) pole main line circuit breaker shall be provided to protect the generator against external faults and provide a positive disconnect device at the generator output terminals. The breaker shall be UL listed with shunt trip device connected to engine / generator safety shutdowns. Facing the control panel, the breaker shall be mounted on the left hand side of generator.

B. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters Laboratories, National Electric Manufacturers Association, and National Electrical Code.

C. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.

D. Circuit breaker shall have battery voltage operated shunt trip wired to safety shutdowns to open the breaker in the event of engine failure.

E. Each circuit breaker shall be equipped with an auxiliary contact for remote annunciation of breaker position.

F. The rating of each circuit breaker shall allow the starting of full generator SKVA.

G. The circuit breaker enclosure, together with all specified circuit breakers, shall be designed for the specific generator set specified and be equipped with an isolated neutral conductor bus, rear copper stabs, or load cable lugs and be finish painted to match the generator set. The generator breaker shall be rated to accept the cable as noted on the electrical drawings.

2.08 GENERATOR CONTROL PANEL

A. Generator set Control. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for each generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

1. Control Switches

a. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

b. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

c. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

d. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

2. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

a. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 0.5%.

b. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

c. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

d. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

e. Digital metering is required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.

3. Generator Set Alarm and Status Display.

a. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

1) The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for function, color, and control action (status, warning, or shutdown).

2) The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

3) The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

4) The control shall include an amber common warning indication lamp.

b. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:

1) low oil pressure (alarm)

2) low oil pressure (shutdown)

3) oil pressure sender failure (alarm)

4) low coolant temperature (alarm)

5) high coolant temperature (alarm)

6) high coolant temperature (shutdown)

7) high oil temperature (warning)

8) engine temperature sender failure (alarm)

9) low coolant level (alarm or shutdown--selectable)

10) fail to crank (shutdown)

11) fail to start/overcrank (shutdown)

12) overspeed (shutdown)

13) low DC voltage (alarm)

14) high DC voltage (alarm)

15) weak battery (alarm)

16) low fuel-daytank (alarm)

17) high AC voltage (shutdown)

18) low AC voltage (shutdown)

19) under frequency (shutdown)

20) over current (warning)

21) over current (shutdown)

22) short circuit (shutdown)

23) over load (alarm)

24) emergency stop (shutdown)

c. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

d. The control shutdown fault conditions shall be configurable for fault bypass.

4. Engine Status Monitoring:

a. The following information shall be available from a digital status panel on the generator set control:

1) engine oil pressure (psi or kPA)

2) engine coolant temperature (degrees F or C)

3) engine oil temperature (degrees F or C)

4) engine speed (rpm)

5) number of hours of operation (hours)

6) number of start attempts

7) battery voltage (DC volts)

b. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of each generator set.

5. Engine Control Functions:

a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed senders or wiring components, and an actual failure conditions.

6. Alternator Control Functions:

a. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

b. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

c. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

d. Controls shall be provided to monitor the KW load on each generator set, and initiate an alarm condition (over load) when total load on each generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when each generator set is overloaded.

e. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

7. Other Control Functions:

a. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of each generator set via the network in both test and emergency modes.

b. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

8. Control Interfaces for Remote Monitoring and control:

   a. The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.

   b. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

   c. A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

   d. Generator control panel shall provided with the following dry contact discrete output signals:

      - Generator Run
      - Generator Fail

2.09 WEATHER-PROTECTIVE ENCLOSURE

A. The generator set shall be provided with a skin tight-non walk in sound-attenuated aluminum construction housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 74 dBA at any location 23 feet from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass.

B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and pad lockable door latches shall be provided for all doors. Door hinges shall be stainless steel.

C. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a raincap and rainshield.

D. The enclosure shall be primed for corrosion protection and finish painted with the manufacturer's standard color. All surfaces of all metal parts shall be primed and painted.

E. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

F. The enclosure, including its installation on the sub base fuel oil tank, shall be certified by a Professional Engineer (P.E.) licensed in the State of Florida to be design rated for a wind load per 2011 Florida Building Code. Provide two (2) original and six (6) copies the P.E. stamped certified wind load calculations report indicating compliance to the Owner's representative. The enclosure wind load rating is to be included on the manufacturer's enclosure drawings.

G. Enclosure shall be Phoenix Products, or JEA pre-approved equal.

2.10 AUTOMATIC TRANSFER SWITCH

A. The automatic transfer switch shall be a standard product of a manufacturer regularly engaged in the manufacture of automatic transfer switches for a period of at least 10 years. ATS shall be solenoid operator type with in-phase monitor designed to transfer in 50 milliseconds or less. The ATS' shall be furnished by the Owner and installed by the Contractor.

B. Subject to compliance with requirements, provide products by one of the following:

1. ASCO 4000 series power Technologies, No Equal.

C. <u>Transfer Switch Construction and General Product Requirements</u>

1. Automatic transfer switches shall be 100% rated for continuous duty and suitable for use in emergency situations. Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp load not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

2. Automatic transfer switches shall be listed under U.L. 1008 for use on emergency systems.

3. A neutral assembly shall be provided on all 3-pole switches when required.

4. Each automatic transfer switch shall be rated to withstand the RMS symmetrical short circuit fault current available at the transfer switch shown on the drawings. The manufacturer shall provide certification of compliance to all U.L. and NEMA Standards referred to above.

5. Automatic transfer switches shall be positively and reliably interlocked to prevent both sources from being simultaneously connected to the load unless intended.

6. Automatic transfer switches shall be mechanically held and electrically operated, energized by the source to which it is being transferred. It shall be double throw, actuated by a single solenoid operator. Connection to each transfer mechanism shall be accomplished by a simple over-center toggle mechanism, which shall mechanically lock the main contacts in place. Main contacts shall be fully rated, self-wiping, and arc quenching. Separate arcing contacts with magnetic blowouts shall be provided.

7. Automatic transfer switches shall be provided with internal manual transfer handle for maintenance purposes.

8. The switches with the same contact-to-contact transfer speed as the electrical operator. Each transfer switch shall be “Load Break” rated when manually operated. The cable entry area of each transfer switch shall be accessible from the top, bottom or front of the enclosure. All control components and wiring shall be front accessible.

D. Automatic Transfer Switch Controls

1. Controls shall be microprocessor based and shall provide all necessary functions of the automatic transfer switch. Each controller shall be equipped with a real time and date clock, battery backup, and non-volatile memory storage.

2. An HMI shall be provided containing a 16 character with automatic scrolling features for necessary data display, LCD display, LED indicating lights as specified herein, and a touch pads to allow access to the system.

3. Controller shall be equipped to accept power quality or condition signals from a variety of external relays or monitors connected to either the normal or emergency sources.

4. Controller shall store all timer and mode settings in non-volatile memory so that upon re-energizing the switch it will return to the previous position without loss of data.

5. Controller shall allow for Automatic, Load Test, and bypass time delay.

6. In the fault mode, the automatic transfer switch shall be locked out and the reason for its failure shall be displayed on the HMI display.

7. Controller shall have complete diagnostic capabilities so that every input and output can be monitored for troubleshooting or maintenance purposes. Specifically, each transfer switch controller shall display 3-phase voltage and frequency values for both power sources. It shall also display timer functions as they execute in normal operation.

8. ATS shall be rated for 50 degrees C.

9. Controller shall meet IEEE C62.41 surge test.

10. Controller shall be able to withstand unlimited power interruptions.

E. Automatic Transfer Switch Features

1. Automatic transfer switch controller shall be equipped with no less than 6 timers as follows:

   a. Time Delay to Engine Start: Adjustable time delay after a failure of the Normal source before initiating an Engine-Start signal to allow for temporary short-duration fluctuations in voltage. Timer shall be field adjustable from 0 to 300 seconds, factory set at three-second increments.

   b. Time Delay to Emergency: Adjustable time delay after the engine has started before transferring the load from the Normal source to the Emergency source. Timer shall be field adjustable from 0 to 300 seconds, in 1-second increments.

   c. Time Delay to Return: Adjustable time delay after the return of Normal power before retransferring the load from the Emergency

source to the Normal source. Timer shall be field adjustable from 30 seconds to 30 minutes (factory set at 5 minutes).

d. Engine Cool Down Timer: Adjustable time delay after retransferring the load from the Emergency source to the Normal source before shutting down the engine. Timer shall be field adjustable from 0.0 to 60 minutes, in 0.1-minute increments.

e. Minimum Run Timer: Adjustable time delay after starting engine before shutting it down. Timer shall be field adjustable from 0.0 to 60 minutes, in 0.1-minute increments.

f. Time Delay in Neutral: Adjustable time delay to provide delay between opening the contacts on one source and closing the contacts on the other course. This shall be the programmable time delay required with the ATS is serving inductive loads. Times shall be field adjustable from 0 to 300 seconds, in 1-second increments.

2. A Digital Plant Exerciser shall be provided to provide for the regular automatic exercising of each Emergency Power System on a pre-selected schedule at field adjustable periods. Each controller shall allow exercising with load or without load. In the event of an engine-generator failure, when operating in the plant exerciser mode, each automatic transfer switch shall immediately return to the normal source, if available.

3. A Close Differential Under Voltage Relay shall be provided to continuously monitor normal voltage. The under voltage relay shall be field adjustable from 70% (seventy percent) to 100% (one hundred percent) of nominal voltage. Factory set at 95% (ninety-five percent) pick-up and 85% (eighty five percent) dropout.

4. To protect against regenerative voltages under a single-phasing condition, each transfer switch controller shall be equipped with a fault output terminal interconnected to a 24Vdc shunt trip, integral to each transfer switch and with built-in time delay that functions to disconnect the utility source from the load, should the emergency power source fail to start. Each transfer switch shall automatically return to utility service when the power problem no longer exists.

5. Transfer switch controller shall include data logging feature to provide troubleshooting aid to field technicians.

6. Transfer switch assembly shall include 2 year parts and labor, 5 year warranty for parts and 10 years main contacts.

7. A single-phase frequency and voltage-sensing relay shall be provided for protection against transferring to each Emergency source until each generator has reached both operating frequency and voltage.

8. A Customer Relay Interface Board shall be provided to allow customer interface to each transfer switch controls. All interfaces shall be voltage free contacts rated 10 amps at 120 Vac. The following interface points shall be made available for each transfer switch.

    a. Engine start contacts consisting of one normally open and one normally closed contact.

    b. Switch Position contacts consisting of two normally open and two normally closed contacts.

9. Light Emitting Diode (LED) pilot lights shall be provided on the HMI panel of each transfer switch to indicate the following conditions:

    a. Normal Source Available

    b. Normal Switch Closed

    c. Emergency Source Available

    d. Emergency Switch Closed

    e. System not in Automatic (Flashing light)

10. A Maintenance Disconnect switch shall be provided for each transfer switch to disconnect control circuitry from line for maintenance purposes.

11. A momentary Load Test Switch shall be mounted inside the enclosure of each transfer switch for ease of servicing. This switch shall cycle each transfer switch through a complete transfer to emergency and retransfer to normal.

12. An Override Pushbutton shall be provided, mounted on the inside of each enclosure to bypass the Time Delay to Return Timer.

13. Integral surge protection devices shall be provided on the load side of the ATS as shown on the electrical drawings. Maximum lead length shall be 6 inches.

14. Auxiliary Contacts Source Available: Dry contacts consisting of two normally open and two normally closed contacts shall be provided for each transfer switch to indicate source available.

F. Enclosures

1. Automatic transfer switch at the well site shall be enclosed in a NEMA 1 steel enclosure with a space heater.

G. Finishes

1. Enclosures: Manufacturer's standard enamel over corrosion-resistant pretreatment and primer.

H. Source Quality Control

1. Factory test components assembled switches and associated equipment to ensure proper operation. Check transfer time and voltage, frequency and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 EXECUTION

3.01 SERVICES

A. Furnish the services of a competent and experienced MANUFACTURER'S field service technician who has complete knowledge of proper operation and maintenance of the equipment for a period of not less than two (2) days in two separate visits to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed.

B. At least one (1) of the two (2) days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least ten days in advance with the OWNER and shall take place during plant start-up and acceptance by the OWNER.

C. Three final copies of operation and maintenance manuals specified must be delivered to the ENGINEER prior to scheduling the instruction period with the OWNER.

3.02 PAINTING

A. The engine generator set and associated equipment shall be shop primed and finish coated in accordance with the MANUFACTURER's standard practice prior to shipment. An adequate supply of touch-up paint shall be supplied by the MANUFACTURER.

3.03 TESTING

A. The engine-generator set shall be given the MANUFACTURER'S standard factory load test prior to shipment.

B. Prior to final acceptance of each generator set, all equipment furnished under this Section shall be field tested per NFPA 110 to show it is free of any defects and the generator set can operate satisfactorily under full load test using resistance type load banks (brine tanks not acceptable). Test shall be for four (4) continuous hours. Any defects which become evident at this time shall be corrected before acceptance.

C. An all-in-place static alignment check of all rotating components shall be made prior to first start-up, after unit is secured in place and all final connections are made.

D. A final alignment check and/or adjustment shall be made after the machine has run four (4) to six (6) hours with its normal connected load.

E. CONTRACTOR shall provide fuel for load bank testing. Contractor to provide a full fuel tank upon completion and acceptance of the load bank test results.

3.04 SYSTEM SERVICE CONTRACT

A. The supplier of the standby power system must provide a copy of and make available to the OWNER his standard service contract which, at the OWNER'S option, may be accepted or refused. This contract will accompany documents, drawings, catalog cuts, specification sheets, wiring or outline drawings, etc., submitted for approval to the designing ENGINEER. The contract shall be for the complete services rendered over a period of one (1) year.

3.05 WARRANTY

A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under terms of the MANUFACTURER'S and dealer's warranty. But, in no event, shall it be for a period of less than five (5) years (comprehensive) from date of initial start-up of the system and shall include labor, parts and travel time for necessary repairs at the job site. Running hours shall not be a limiting factor for the system warranty either by the MANUFACTURER or the supplying dealer.

Submittal data received without written warranties as specified will be rejected in their entirety. Warranties requiring a deductible are not acceptable.

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SECTION 23 81 19

SELF-CONTAINED AIR-CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall hung vertical package unit.

B. Controls.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. AHRI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

1.03 PERFORMANCE REQUIREMENTS

A. Air Cooled Units:

1. Cooling capacity at ANSI 390-2003 test conditions: 72000 Btu/hr (21100 W) with maximum EER of 10 Btu/hr/Watt.

B. Scheduled performance:

1. Cooling capacity: ANSI 390-2003.

3. Unit sound number: AHRI 270.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.

C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

D. Manufacturer's Instructions: Include assembly instructions, support details, connection requirements, and start-up instructions.

E. Operation and Maintenance Data: Provide maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect finished cabinets from physical damage by leaving factory packing cases in place before installation and providing temporary covers after installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bard: www.bardhvac.com.

2.02 AIR CONDITIONING UNITS

A. Description: Packaged, self-contained, through-the-wall air cooled terminal air conditioning units, with wall sleeve, room cabinet, electric refrigeration system, electric heating, remote temperature controls; fully charged with refrigerant and filled with oil.

B. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

C. Electrical Characteristics:

1. 18 rated load amperes.
2. 460 volts, three phase, 60 Hz.
3. 25 amperes maximum overcurrent protection.
4. Disconnect Switch: Factory mount disconnect switch

D. Energy Efficiency:

1. Cooling Capacity: Greater than 1500 Btu/h (4396 W):
    a. Energy Efficiency Ratio: 7.60, minimum.
    b. Seasonal Coefficient of Performance: 3.19.

2.03 CABINET

A. Cabinet: Wall mounted of 18 gage, 0.0478 inch (1.21 mm) galvanized steel with epoxy coated finish, removable front panel with concealed latches, color as selected.

2.04 WALL SLEEVES AND LOUVERS

A. Wall Sleeves: 16 gage, 0.0598 inch (1.52 mm) galvanized steel with protective mastic coating.

B. Louvers: Flush anodized aluminum with enamel finish, color as selected.

2.05 CHASSIS

A. Refrigeration System:

1. Direct expansion cooling coil.
2. Hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection.
3. Accumulator.
4. Condenser coil and fan.

B. Air System: Centrifugal forward curved tangential evaporator fans with two speed permanent split capacitor motor, permanent washable filters, positive pressure ventilation damper with concealed manual operator.

C. Heating Coil: Electric.

D. Condensate Drain: Drain pan to direct condensate to condenser coil for re-evaporation.

E. Condenser Fan: Centrifugal, forward curved type with separate permanent split capacitor motor.

2.06 CONTROLS

A. Control Module: Remote mounted adjustable thermostat with heat anticipator, off-heat-auto-cool switch, fan switch.

B. Low Ambient Lockout Control: Below 35 degrees F (2 degrees C), outdoor thermostat shall prevent compressor operation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate installation of units with architectural, mechanical, and electrical work.

3.02 SCHEDULES

A. Drawing Code

B. Location

C. Manufacturer

D. Model Number

E. Total Cooling Capacity

F. Cooling EER

G. Electric Resistance Heating Capacity

H. Reverse Cycle Heating Capacity

I. Reverse Cycle COP

J. Condenser Water Flow

K. Condenser Water Temperature

END OF SECTION

SECTION 26 05 00

ELECTRICAL - GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required for a complete electrical system at the Otter Run Water Treatment Plant (WTP), for JEA in Jacksonville, Florida as herein and after specified and shown on the Drawings.

B. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter and/or shown on the Drawings. Certain equipment will be furnished as specified in other sections of these Specifications which will require wiring thereto and/or complete installation as indicated. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, lighting, communication systems, instrumentation, wiring and control systems as indicated on the Drawings and/or as specified herein.

C. The Contractor shall furnish and install the necessary cables, transformers, motor control centers, protective devices, conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Drawings and/or as specified hereinafter.

D. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; sub-standard work will be rejected.

E. Mount and wire speed indicators, variable frequency drives and process instruments furnished under other Divisions of these Specifications.

F. Mount and wire isolation transformers, operator's stations, and power conversion equipment for all variable speed drive systems furnished under other Divisions of these specifications.

G. Make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications.

H. For process instrumentation furnish and install all conduit, wire and interconnections between primary elements, transmitters, local indicators and receivers.

I. Furnish necessary devices and make connections to provide power to drinking fountains, kitchen units, shop equipment, and other equipment. This will require appropriate receptacles in some cases and direct wiring in other cases, depending upon equipment furnished.

J. Install and wire all thermostats, aquastats and other devices furnished under other Divisions of this Specification directly controlling heating equipment or fan motors.

K. Mount and wire electric heaters furnished under other Divisions of this Specification.

L. Wire all ventilation equipment furnished under other Divisions of this Specification.

M. Each bidder or his authorized representatives shall, before preparing his proposal, visit all areas of structures in which work under this division is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that he or his representative has visited the area and noted the locations and conditions under which the work will be performed and that he takes full responsibility for a complete knowledge of all factors governing his work.

N. All power interruptions shall be at the Owner's convenience. Each interruption shall have prior approval.

O. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work, which may be reasonably implied as being incidental to the work of this Section, shall be furnished at no extra cost.

1.02 SERVICE AND METERING

A. Coordinate with FPL regarding the new 600-amp, 480-volt, 3-phase electrical service. The FPL contact is Mr. Zachary Marshall at (904) 225-3025.

B. The CONTRACTOR is responsible for all costs of $2,500.00 associated with providing permanent electrical service to the site.

1.03 CODES, INSPECTION AND FEES

A. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes.

B. Pay all fees required for permits and inspections including any charges associated with the service modifications.

1.04 TESTS

A. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

B. The following minimum tests and checks shall be made prior to the energizing of electrical equipment. Test shall be by an independent NETA certified testing firm, and a certified test report shall be submitted stating that the equipment meets and operates in accordance with the Manufacturer's and job specifications, and that equipment and installation conforms to all applicable Standards and Specifications:

1. Testing and setting of protective relays for calibration and proper operation.

2. Mechanical inspection of all circuit breakers 100 amps and larger to assure proper operation.

3. Motors: Megger to ground each motor winding. Record date, motor temperature, terminal, reading and operator and have Owner representative sign off on each reading.

4. Conductors: Megger to ground prior to termination all 600 volt conductors not used for service conductors. Record the date, conductor, reading and operator and have Owner representative sign off on each reading.

5. 480 Volt Power Panels: After installing, with circuit breakers closed, but prior to terminating any conductors or bus to the motor control center, megger each phase to phase and phase to ground. Record the date, test (i.e. A/B or A/G), reading and operator and have Owner representative sign off on each reading.

6. Connections & Terminations:

   a. 480 Volt Panels: Torque to Manufacturer's values in the presence of the Engineer or his representative. Record the date, conductor, torque, and operator and have the Engineer sign off on each reading.

7. Data Base: After equipment suppliers test, calibrations, and inspection, megger all circuits leaving all switchgear and motor control centers. Record the date, conductor, circuit condition (i.e. load connected or unconnected), reading and operator and have Owner representative sign off on each reading.

8. Hot Spot Testing: Perform infrared hot spot inspection of the 480 volt switchgear, motor control centers and associated equipment as soon as determined by the engineer that representative loads are present. Record the date, gear conditions found, operator and have the owner's representative who must be present for the inspection sign off in each instance.

9. Miscellaneous:

   a. Meggering must be done at 1000 VDC for one minute. The ground plane used must be the one established at the main source of energy for conductors, switchboards and control centers. The motor frame may be used for the ground plane for motors.

   b. In the course of construction, it will become necessary to temporarily energize some systems for testing. Confirm that any motor has been meggered prior to connection and testing. Do not leave any motor or system unattended and energized without written authorization.

   c. An unsuccessful test will be one in which any one of the three megger readings differs from another by more than 25%. Engineer shall determine if cables and/or equipment bussing shall be replaced.

1.05 RELATED WORK

A. Division 1: Record Documents

B. Division 2: Sitework

C. Division 3: Concrete

1.06 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

1.07 CUTTING AND PATCHING

A. All cutting and patching shall be done in a thoroughly workmanlike manner.

1.08 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs.

B. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.

C. Unless otherwise approved by the Engineer conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

E. The Contractor shall harmonize the work of the different trades so that interferences between conduits, piping, equipment, architectural, civil, mechanical and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required to accomplish this shall be furnished and installed by the Contractor without additional expense to the Owner. In case interference develops, the Owner's authorized representative is to decide which equipment, piping, etc., must be relocated, regardless which was installed first.

F. Verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

G. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the

Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

H. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

I. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.

J. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as they can determined in advance of the purchase of equipment.

K. All connections to equipment shall be made as shown, specified, and directed and in accordance with the Manufacturer's approved shop drawings, regardless of the number of conductors shown on the Drawings.

1.09 SIZE OF EQUIPMENT

A. Investigate each space in the building where equipment must pass to reach its final location. If necessary, the Manufacturer shall be required to ship his material in sections, sized to permit passing through such restricted areas in the building.

B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

1.10 RECORD DRAWINGS

A. Requirements for record drawings are specified in Division 01: Project Record Documents.

1.11 COMPONENT INTERCONNECTIONS

A. Component equipment furnished under this Specification will not be furnished as integrated systems. Contractor shall field install and wire completely all components.

B. Contractor shall analyze all systems components and their shop drawings, identify all terminals and prepare drawings and wiring tables necessary for component interconnection. Contractor shall provide crimp on wire numbers on both ends of all control wiring installed between all panels furnished under this contract. These numbers shall directly relate to the interconnect wiring drawing furnished by the Contractor and be reflected in the record drawings submitted.

1.12 SHOP DRAWINGS

A. As specified under other sections shop drawings shall be submitted for approval of all materials, equipment, apparatus, and other items as required by the Engineer.

B. Shop drawings shall be submitted for the following equipment:

1. Disconnect Switches
2. Motor Starters
3. Wire and Cable
4. Variable Frequency Drives
5. Conduit Layout Drawings
6. Ground test reports
7. Pumps and Motors
8. Surge Protection Devices
9. Field Instruments
10. HVAC Equipment
11. Generator and ATS
12. 480-volt power panels
13. 120/208-volt distribution panels.

14. Fuel Storage tank, Piping and fuel system monitoring panel

15. Lightning Protection System

16. Fire alarm panel and Fire alarm remote devices

C. The Manufacturer name and product designation and catalog data sheet shall be submitted for the following material:

1. Conduit

2. Receptacles

3. Boxes and fittings

4. Wiring Devices

5. Lamps

6. Control Relays

D. Prior to submittal by the Contractor, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.

E. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the work of this Section.

F. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.

G. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

1.13 MANUFACTURER SERVICES

A. Provide Manufacturer services for testing and start-up of the following equipment:

1. 480 Volt Circuit Breakers

2. Variable Frequency Drives

3. Other items as required by appropriate specification sections.

B. The Manufacturer of the above listed equipment shall provide experienced Field Service Engineer to accomplish the following tasks:

1. The equipment shall be visually inspected upon completion of installation and prior to energization to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "As-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity. The Manufacturer shall provide written approval that equipment supplied is approved for energization.

2. The Field Service Engineers shall provide engineering support during the energization and check out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the Manufacturer's performance specifications.

3. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with Manufacturer's test specifications.

4. Two (2) 4-hour training sessions on operation, and two (2) 4-hour training sessions (one for each system) on maintenance and trouble-shooting procedures shall be provided for the Owner's maintenance personnel. All training shall be conducted at a facility provided by the Owner. The

maintenance and trouble-shooting sessions shall be conducted with record "As-built" electrical drawings sufficient for a class of eight personnel.

5. A final report shall be written and submitted to the Contractor within fourteen days from completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action. The Contractor shall forward a copy of this report to the Engineer for approval.

1.14 MATERIALS

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or Manufacturer's specifications shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be Underwriters Laboratories, Inc. listed.

C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, at the expense of the Contractor, or shall be replaced by the Contractor at his own expense.

1.15 CONDUIT LAYOUT DRAWINGS

A. In addition to the manufacturer's equipment shop drawings, the Contractor shall submit for the approval, electrical installation working drawings for the overall site work, electrical rooms, chemical rooms and all process areas containing the following:

1. Concealed and buried conduit layouts shown on floor plans drawn at not less than 1/4-inch = 1-foot-0-inch scale. The layouts shall include locations of process equipment, motor control centers, transformers, panelboards, control panels and equipment, motors, switches, motor starters, large

junction or pull boxes, instruments, and any other electrical devices connected to concealed or buried conduits.

2. Plans shall be drawn on high quality reproducible, bond size 36-inch x 24-inch, and shall be presented in a neat, professional manner.

3. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

4. Site plan conduit layout drawings shall be at 1" = 20'-0".

Note: ACAD drawing files are available from the Engineer.

1.16 OPERATION AND MAINTENANCE DATA

A. Submit complete operations and maintenance data for all equipment furnished under this Division 00 and 01. The manuals shall be prepared specifically for this installation and shall include all required cuts, Drawings, equipment lists, descriptions, complete part lists, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.17 DEMOLITION

A. Remove all electrical work associated with equipment shown to be removed (TBR) except those portions indicated to remain or be reused. Remove all unused exposed conduit and wiring back to point of concealment. Remove unused wiring in concealed conduits back to source (or nearest point of usage). Electrical work to be removed corresponds to the associated mechanical equipment to be removed.

B. Where electrical systems pass through the demolition areas to serve other portions of the premises, they shall remain or shall be suitably relocated and the system restored to normal operation. Coordinate outages in systems with the Owner. Where duration of proposed outage cannot be allowed by the Owner, provide temporary connections as required to maintain service.

C. All removals and relocations of existing installations cannot be completely detailed on the Drawings. Survey the site before submitting bid proposal.

D. Continuous service is required on all circuits and outlets affected by these changes, except where the Owner will permit outage for a specific time.

Obtain Owner's written consent before removing any circuit from continuous service.

E. Where required to disconnect and/or remove any part of an existing circuit, reconnect that circuit to reestablish service in the remaining portion.

F. Remove exposed conduits, wireways, outlet boxes, pull boxes and hangers made obsolete by the alternations, unless specifically designated to remain. Exposed conduits shall be removed back to point of concealment, where they shall be cut and threaded for a cap. A threaded cap shall then be installed. Conduits may be removed back to first coupling if within 3-inches of point of concealment. Cut back in traffic areas to the floor level and patch.

G. Repair all walls to “Like new” condition and paint to match existing wall color.

1.18 DISPOSITION OF REMOVED MATERIALS AND EQUIPMENT

A. In general, it is intended that all materials and equipment indicated to be removed and disposed of by the CONTRACTOR shall, upon removal, become the CONTRACTOR's property and shall be disposed of off the site by the CONTRACTOR, unless otherwise directed by the Owner.

B. Reuse of wire will not be permitted. An exception is the reuse or relocation when wire is part of an existing lighting branch circuit and reuse or relocation is specifically designated and can be accomplished without removing and re-pulling the wire.

C. All reusable and salvageable disconnect switches, starters, control devices, control panels and instruments, receptacles, light fixtures, etc. shall be sorted and returned to the Owner.

D. All electrical equipment to be salvaged shall be removed and shall be moved by the CONTRACTOR to a location on the site for storage as directed by the Owner.

1.19 WARRANTY

A. Provide a warranty for all the electrical equipment in accordance with the requirements of other sections, but in no case less than 1 year from date of owner acceptance.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

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SECTION 26 05 19

WIRES AND CABLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable, and appurtenances as shown on the Drawings and as hereinafter specified.

1.02 SUBMITTALS

A. Samples of proposed wire and cable shall be submitted to the Engineer for approval. Each sample shall have the size, type of insulation and voltage stenciled on the jacket.

B. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

1.03 APPLICATIONS

A. Wire for lighting and receptacle circuits above grade shall be type THWN-2.

B. Wire for all non VFD service conductors and below grade lighting and receptacle circuits shall be type XHHW-2, stranded.

C. Single conductor wire for control, indication and metering shall be type MTW No. 14 AWG, 19 strand or type XHHW No. 14 AWG stranded.

D. Multi-conductor control cable shall be No. 14 AWG, 19 strand.

E. Wire for process instrumentation or shielded control cable shall be No. 16 AWG, shielded and stranded.

F. VFD rated cable shall provided for a cables between the VFD and the motor. See section 2.03 below for requirements.

1.04 MINIMUM SIZES

A. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. All wires and cables shall be of annealed, 98 percent conductivity, soft drawn stranded copper conductors.

2.02 600 VOLT WIRE AND CABLE

A. Type XHHW shall be cross-linked polyethylene (XLP); as manufactured by the Southwire Co., Collyer Insulated Wire Co., or approved equal.

B. Type THWN shall be as manufactured by the Southwire Co., Collyer Insulated Wire Co., or approved equal.

2.03 VARIABLE FREQUENCY DRIVE (VFD) OUTPUT POWER CABLE

A. Section applies to power cables routed between the output of VFD's and motor terminals.

B. Cable shall be rated for 2000 volts and shall meet the requirements below:

1. Conductors shall be stranded Class B bare copper.

2. All wire shall be brought to the job in unbroken packages and shall bear the data of manufacturing; not older than 12 months.

3. Type of wire shall be XLPE RHH/RHW-2 rated 90 degrees C suitable for wet locations.

4. Provide overall 5 millimeter metallic shield (copper tape shield) overlapped 50%.

5. No wire smaller than No. 12 gauge shall be used unless specifically indicated.

6. Cable construction shall consist of three insulated current-carrying phase conductors and three bare ground conductors, symmetrically placed between the phase conductors, and twisted beneath a continuous overall PVC polymeric jacket.

C. Each ground conductor size (circular mil area) shall be one-third (1/3) of the NEC required size (circular mil area) for a single ground conductor. If one third of the required circular mil area does not correspond to a standard size (circular mil

area) of construction, the next largest size of standard construction shall be used. All conductors shall be megger tested after installation and insulation must be in compliance with the Insulated Power Cable Engineers Association Minimum Values of Insulation Resistance.

D. Manufacturers:

1. Belden

2. O Flex

3. Lutze

2.04 INSTRUMENTATION AND CONTROL CABLE

A. Process instrumentation wire shall be twisted pair, 600V, cross-linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or approved equal. Multi-conductor cables shall be supplied with individually shielded twisted pairs.

B. Multi-conductor control cable shall be stranded, 600V, cross-linked polyethylene insulated with PVC jacket, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or approved equal.

2.05 TERMINATIONS AND SPLICES

A. Power Conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors per termination. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors. Heat shrink boots shall be utilized for all outdoor splices.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): Terminations permitted shall be typical of control conductors. Splices are allowed at instrumentation terminal boxes only.

D. Except where otherwise approved by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at one end only, as directed by supplier of the instrumentation equipment.

F. Wire and cable connections to terminals and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or approved by the Engineer as the manufacturer of the particular item of wire and cable.

H. Steel fish tapes and/or steel pulling cables shall not be used in PVC conduit runs.

I. All control and instrumentation circuits and wiring shall be clearly and permanently numbered and labeled at each end so as to identify the location of the opposite end and the function of the circuit. Individual wires in a multi-wire circuit shall be identified with wire numbers. Labeling shall be in place prior to turnover of any equipment, system or sub-system to Owner.

J. Contractor shall:

1. Measure the attenuation of the fiber optic cable prior to installation and determine the average attenuation per foot.

2. Install the fiber cable runs in accordance with the manufacturer's recommendations and including:

a. Use recommended lubricant.

b. Continuously measure the pull tension during installation and do not exceed the manufacturer's stated maximum tension.

c. Note from the distance markers on the cable the exact length of each installed run.

3. Following installation, measure the attenuation of each run and compare the attenuation per foot readings with those taken prior to installation. Replace any runs whose attenuation per foot reading is more than 10% higher than the pre-installation value.

K. Profibus and Data highway cable shall be supplied and installed by the Contractor.

L. All 600-volt wire insulation shall be tested with a meg-ohmmeter after installation. Tests shall be made at not less than 1,000 VDC. See specification section 26 05 00 for additional testing requirements.

M. All service conductors shall be tested as in paragraph A above. These tests shall be witnessed by the Engineer. A written report shall be submitted to the Engineer for review.

END OF SECTION

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SECTION 26 05 26

GROUNDING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

1.02 RELATED WORK

A. Wire shall be as specified under Section 26 05 19.

B. Conduit shall be as specified under Section 26 05 34.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ground rods: Ground rods shall be copperclad steel 5/8-inch x 20 foot. Ground rods shall be Copperweld or be an approved equal product.

PART 3 EXECUTION

3.01 GENERAL

A. The service entrance equipment ground bus shall be grounded to a 3/4-inch cold water pipe, to the ground grid and to the building steel. The protecting conduits shall be bonded to the grounding conductor at both ends. The Contractor shall not allow the water pipe connections to be painted. If the connections are painted, they shall be disassembled and remade with new fittings.

B. Ground bus in all panelboards and switchboards shall be connected to the service entrance equipment ground bus with a No. 1/0 conductor.

C. All steel building columns shall be bonded together and connected to the building ground grid and to the service entrance ground with a No. 1/0 copper conductor. The bond wire for all high service pumps shall be connected to the well pump casing via Cadweld.

D. Conduits stubbed-up below the panelboard shall be fitted with insulated grounding bushings and connected to the panelboard ground bus. The grounding wire shall, unless otherwise indicated on the drawings, be sized in accordance with Table 250-122 of the National Electrical Code, except that a minimum No. 12 AWG shall be used.

E. Motors shall be grounded as specified in Specification Section 26 26 50, motors.

F. Lighting transformer neutrals shall be grounded to a grounding electrode and the service entrance ground.

G. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

H. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and similar items shall be grounded.

I. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or approved equal. All buried connections shall be made by welding process equal to Cadweld.

J. For reasons of mechanical strength, grounding conductors extending from the grounding grid to the ground buses of control centers and switchboard shall be No. 1/0 AWG.

K. The grounding grid conductors shall be embedded in backfill material around the structures.

L. All underground conductors shall be laid slack and where exposed to mechanical injury shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

M. The Contractor shall exercise care to insure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.02 TESTS

A. The Contractor shall test the ground resistance of the system. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment. The Contractor shall submit all grounding system test results to the Engineer for review.

The CONTRACTOR shall test the ground resistance of the system by 3 point method fall of potential

END OF SECTION

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SECTION 26 05 34

RACEWAYS AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

1.02 APPLICATIONS

A. Except where otherwise shown on the Drawings, or hereinafter specified. The following describes the conduit requirements of the project:

1. All indoor raceways shall be in aluminum conduit unless otherwise noted in 2 through 5 below.

2. Underground power conductors (Non VFD motor units) shall be installed in schedule 80 PVC conduits, unless otherwise noted on the drawings.

3. All Instrumentation circuits installed above or below grade (4-20 mA signal wire) shall be installed in PVC coated GRS conduit.

4. Conduits in chemical areas shall be PVC schedule 80.

B. Where Schedule 80 PVC is used, all below grade elbows and risers to above grade shall be PVC coated GRS. All elbows above grade shall be suitably grounded. Conduit spaces shall be provided for underground conduit installation.

C. PVC schedule 80 conduit shall be used in chemical areas.

D. All conduit of a given type shall be the product of one manufacturer.

E. All switch, outlet and control station boxes and fittings in non-corrosive areas shall be cast aluminum FS boxes with aluminum covers. Plastic/FRP shall be used in all corrosive areas.

F. Concealed switch, outlet and control station boxes in NEMA 1 areas shall be aluminum.

G. Terminal boxes, junction boxes, pull boxes, etc.; installed outdoors shall be NEMA 4X stainless steel. All boxes installed indoors (except in corrosive areas) may be aluminum. Boxes in corrosive areas shall be PVC.

H. Combination expansion-deflection fittings shall be used where exposed or embedded conduits cross structure expansion joints.

PART 2 PRODUCTS

2.01 MATERIALS

A. Rigid Metal Conduit

1. Rigid metal conduit shall be for use under the provisions of NEC Article 346.

2. PVC coated GRS conduit shall have a 1/50-in thick, polyvinyl chloride coating permanently bonded to the aluminum conduit and an internal phenolic coating, and shall be plasti-bond 2" as manufactured by Robroy Industries, Triangle PWC Inc., Perma-Cote Industries, or approved equal.

3. A factory applied clear polyurethane coating must be provided to all PVC coated GRS conduit to protect the ends of the conduit.

B. Rigid Nonmetallic Conduit

1. Rigid nonmetallic conduit shall be for use under the provisions of NEC Article 347.

2. PVC conduit shall be rigid polyvinyl chloride schedule 80 as manufactured by Carlon, An Indian Head Co., Kraloy Products Co., Inc., Highland Plastics Inc., or approved equal.

C. Liquidtight Flexible Conduit, Couplings and Fittings

1. Liquidtight flexible conduit shall be for use under the provisions of NEC Article 351A.

2. Liquidtight flexible conduit shall be Carflex by Carlon, or approved equal.

3. Fittings used with liquidtight flexible conduit shall be nylon.

4. Fittings installed on tanks, filter area, chemical rooms and other outdoor process areas shall be aluminum.

D. Flexible Couplings, Non-metallic

1. Flexible non-metallic couplings shall be as manufactured by the Crouse-Hinds Co., Appleton Electric Co., Killark Electric Manufacturing Co., or approved equal.

E. Boxes and Fittings:

1. PVC, aluminum and stainless steel switch and outlet boxes shall be manufactured by Carlon, Appleton, or approved equal.

2. NEMA 1 terminal boxes, junction boxes, pull boxes etc., may be fiberglass (FRP) or stainless steel. Boxes shall be as manufactured by Hoffman Engineering Co., Stahlin, or approved equal. NEMA 4 boxes located outdoors shall be 316 stainless steel.

3. Cast aluminum boxes and fittings shall be copper-free aluminum with cast aluminum covers and corrosion-proof screws as manufactured by the Killark Electric Co., Crouse-Hinds Co., Appleton Electric Co., or approved equal.

4. Conduit hubs shall be as manufactured by Meyers Electric Products, Inc., Raco Div., Appleton Electric Co., or approved equal. Conduit hubs shall be provided for all outdoor conduit terminations.

5. Conduit wall seals shall be Type WSK as manufactured by the O.Z. Electrical Mfg. Co., or approved equal.

6. Combination expansion-deflection fittings shall be Type XD as manufactured by the Crouse-Hinds Co., or approved equal.

7. Telephone fittings for floor boxes shall have rubber grommeted holes, Walker Catalog No. 501AL or approved equal by Hubbell, Thomas & Betts or approved equal.

8. Conduit wall seals for new concrete walls below grade shall be O.Z./Gedney Co., Type WSK, Spring City Electrical Manufacturing Co., Type WDP, or approved equal.

9. Conduit wall seals for cored holes shall be Type CSML as manufactured by the O.Z./Gedney Co., or approved equal.

10. Conduit wall and floor seals for sleeved openings shall be Type CSMI as manufactured by the O.Z./Gedney Co., or approved equal.

11. Conduit sealing bushings shall be O.Z./Gedney Type CSB or approved equal.

F. Conduit Mounting Equipment:

1. Stainless steel channels and stainless steel hardware shall be used in all areas.

PART 3 EXECUTION

3.01 INSTALLATION

A. No conduit smaller than 3/4-inch electrical trade size shall be used, nor shall any have more than four 90 degree bends in any one run. Pull boxes shall be provided as required or directed. Minimum size in floor slabs shall be 3/4-inch.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. The ends of all conduits shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

D. Conduit supports shall be spaced at intervals as required to obtain rigid construction, but in no case more than as required by the NEC.

E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-inch diameter. Material type shall be as specified in Section 2.

F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

G. All conduits on exposed work shall be run at right angles to and parallel with the surrounding walls and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true. Conduits not installed in this fashion shall be replaced entirely at the Contractor’s expense with no cost to the Owner.

H. No unbroken run shall exceed 300 feet in length. This length shall be reduced by 75 feet for each 90 degree elbow.

I. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

J. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.

K. Conduit wall seals shall be used for all conduits penetrating walls below grade or other locations shown on the Drawings.

L. Liquidtight flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present.

M. Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.

N. Conduit stub outs for future construction shall be provided with threaded PVC end caps at each end.

O. Metallic conduit entering manholes and below grade pull boxes shall be terminated with grounding type bushings and connected to a 5/8" x 20" copperweld rod with a #6 bare copper wire.

P. Underground 120 volt circuits (Schedule 80 PVC) shall be installed directly to the respective motor control centers, lighting panels, etc. Stainless steel pull boxes shall be wall mounted on structures to eliminate excessive bends. With prior approval, below grade pull boxes, equal to Brooks #2424 (minimum), with hot dip galvanized covers and frames may be used. Splices shall not be made in above or below grade pull boxes without prior approval.

Q. A 4-inch concrete conduit housekeeping pad shall be required for all exposed conduit stub-ups. This applies to ALL exposed conduits installed indoors or outdoors.

END OF SECTION

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SECTION 26 05 43

UNDERGROUND ELECTRICAL DUCT SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of ducts, handholes, pull boxes, equipment pads, and related materials for power, control system, and signal system wiring on sites.

1.02 DEFINITION

A. Pull Box: A subsurface enclosure that has a bottom and is used with underground lines, into which personnel can reach but do not enter, for the purpose of installing, operating, or maintaining equipment, cabling, or both. Use pull boxes with 12-inch by 22-inch minimum inside dimensions, unless otherwise indicated or required by the drawings.

B. Handhole: An access opening, provided in equipment or a below-the-surface enclosure without a bottom used with underground lines, into which personnel can reach but do not enter, for the purpose of installing, operating, or maintaining equipment, cabling, or both.

C. Duct: The general term for an electrical conduit or raceway, either metallic or nonmetallic, for use under ground, embedded in earth or in concrete.

D. Duct Bank: A group of two or more ducts in a continuous run between two points.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Division 01 General Requirements, Section 013300, and the General Conditions.

B. Submit product data for the following:

a. Ducts, fittings, and joining cement.

b. Handholes and pull boxes.

C. Submit shop drawings for precast, pull boxes, and equipment pads, showing duct or raceway entry types and sizes, locations and elevations of duct banks and

individual ducts, reinforcement details, cover design, step details, and grounding details. Include dimensioned detailed locations of cable rack inserts, pulling irons, and sumps.

1.04 QUALITY CONTROL

A. UL Compliance and Labeling: Comply with requirements of UL standards. Provide duct products and components listed and labeled by UL or Electrical Testing Laboratory, Inc. (ETL).

B. ANSI Compliance: Comply with requirements of ANSI C2, National Electrical Safety Code, pertaining to construction and installation of underground conduit systems and handholes.

C. Code Compliance: Comply with requirements of NEC.

D. Prefabricators: Provide products of firms regularly engaged in manufacture of factory-fabricated, handholes, and equipment pads of types and sizes required, whose products have been in satisfactory use in similar service for not less than three years.

1.05 DELIVERY, STORAGE, AND HANDLING

Deliver ducts to site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

PART 2 MATERIALS

2.01 CONCRETE MATERIALS

A. Comply with Section 03 30 00 for cast-in-place concrete.

B. Comply with Sections 03 42 10 and 03 42 20 for precast items, frames and covers, sealing compound and gaskets, and grout.

2.02 GROUNDING MATERIALS

Comply with provisions of Section 260526 for ground rods, grounding conductors, and counterpoise conductors.

2.03 IDENTIFICATION

A. Provide bead weld on enclosure covers to indicate usage as follows:

1. "ELECTRIC - LV" (for systems 600 volts or less).

2. "SIGNAL" (for instrumentation, or communications systems).

2.04 RIGID NONMETALLIC CONDUIT (PVC), PVC COATED ALUMINUM CONDUIT AND FITTINGS

As specified in Section 260534.

2.05 RIGID PVC UTILITY DUCT, EB

A. Material: PVC, meeting NEMA TC-6.

B. UL Listing: Listed as meeting UL 651 for concrete encasement in outdoor trenches, rated for 90°C wire and cable.

C. Fittings: UL-listed products of the same manufacturer as the duct. Manufactured fittings shall include 90-, 45-, and 30-degree long-radius ells and sweeps, end bells, plugs, adapters to rigid steel conduit, expansion fittings, and spacers.

D. Joint Cement: As recommended by the manufacturer of duct as suitable for the climate, furnished with instructions to achieve watertight joints.

E. Manufacturers: Carlon, Can-Tex Industries, or equal.

2.06 HANDHOLES AND PULL BOXES

A. Provide handholes and pull boxes, for pulling, splicing, and terminating conductors, in types and sizes indicated.

B. Handholes: Precast concrete, open bottom, with traffic-rated concrete or cast-iron covers.

C. Pull Boxes: Precast concrete, closed bottom with sump and hot-dipped galvanized steel traffic-rated covers, designed to AASHTO HS20-44 loading. Provide with pulling irons and cable racks.

D. Cover Holddowns: Stainless steel, penta-head, flush with cover, bolts.

E. Sump: Cast in bottom of pull boxes with cover and discharge pipe.

F. Handhole and pull boxes shall have identification on covers pertaining to type of service or as indicated in the drawings.

G. Manufacturer: Brooks Products, Associated Concrete Products, or equal.

2.07 CONDUIT SEALANT

As specified in Section 26 05 34.

2.08 ACCESSORIES

A. Cable Racks: Hot-dipped galvanized steel, adjustable brackets with glazed porcelain saddle insulators.

B. Sump Covers: Cast-iron, slotted or perforated, hinged.

2.09 WARNING TAPE

A 6-inch-wide magnetically detectable warning tape with red protective polyethylene jacket resistant to alkalies, acids, and other destructive elements. The polyethylene tape shall be continuously imprinted "CAUTION--ELECTRICAL CONDUIT BELOW" unless otherwise indicated or directed by the Owner's Representative.

2.10 EQUIPMENT PADS

Provide steel-reinforced, precast concrete equipment pads, sizes and details as indicated. Construct with chamfered edges and grounding pigtail.

2.11 CONCRETE

Provide concrete as specified in Section 033000.

PART 3 EXECUTION

3.01 DUCT USAGE SCHEDULE

Install the following types of ducts and fittings in locations listed, unless otherwise noted in the drawings. Definitions and requirements of NEC and the National Electrical Safety Code apply unless specifically modified below. Duct entries into buildings and structures shall comply with Section 26 05 34.

A. Underground, Direct Burial:

a. Material: Rigid nonmetallic conduit (PVC) and fittings. Provide PVC-coated rigid aluminum conduit long-radius elbows or PVC Schedule 80 long-radius elbows for bends exceeding 45 degrees.

b. Minimum Size: 1 inch.

B. Underground, Concrete Encased:

a. Material: Rigid PVC utility duct, EB and manufactured fittings PVC coated aluminum conduit or rigid nonmetallic conduit (PVC) and fittings. For bends exceeding 45 degrees, provide the metal conduit as specified for "Underground, Direct Burial."

b. Minimum Size: 2 inches. For type EB minimum 1 inch for all others.

3.02 TRENCHING AND BACKFILLING

See Section 312316.

3.03 DUCT LAYOUT

A. Underground ducts shall be direct buried unless identified as concrete encased in the drawings. Provide 3-inch-minimum sand above and below direct buried duct banks.

B. Limit the maximum change of direction in any plane between lengths of straight duct without use of bends to 5 degrees.

C. Where other utility piping systems are encountered or are being installed along a duct route, maintain a 12-inch minimum separation between duct and other systems at crossings and when running in parallel.

D. Do not place ducts over valves or couplings in other piping systems.

E. Slope: Pitch ducts to drain towards handholes, and pull boxes and away from buildings and equipment. Minimum slope shall be 4 inches in 100 feet. Ducts may slope from a high point in the run to drain in both directions. Drive stakes in the bottom of the trench at 25-foot intervals maximum, and use to establish slope.

F. Provide continuous rows of concrete warning planks above sand covering direct buried duct banks. Planks shall extend 2 inches minimum on both sides of duct banks.

G. Minimum Cover: 30-inch minimum cover over direct burial underground ducts and top of concrete for concrete-encased ducts.

3.04 DUCT INSTALLATION

A. Comply with the installation provisions of NEMA TC2 and TC6, except as modified below.

B. Power system raceways must be separated, from center to center, at least 7 1/2 inches.

C. Use factory-made conduit spacers to provide 2-inch minimum separation between conduits. Locate spacers not less than 4 feet center-to-center along entire length of ducts. Secure ducts and spacers to prevent movement during placement of concrete or earth backfill.

D. Place duct couplings side-by-side horizontally but staggered at least 6 inches vertically.

E. Make joints in accordance with manufacturer's recommendations. In the absence of specific recommendations, make the joints as follows:

1. Brush a plastic solvent cement on the inside of the coupling and on the outside of the duct ends.

2. Slip duct and fitting together with a quick one-quarter turn to set the joints.

F. Duct Entrances to Handholes, and Pull Boxes: Space end bells approximately 10 inches center-to-center for 5-inch ducts and vary proportionately for other duct sizes. The change from regular spacing to end bell spacing shall start 10 feet from the end bell and shall be made without reducing duct line slope and without forming a low point in the line. Grout end bells into walls from both sides to provide watertight entrances.

G. Install expansion fittings. Expansion fittings are required when the duct is left exposed in trenches for a period of time during which the duct temperature can vary more than 2 degrees. Install expansion fittings near the fixed end of the run and 100 feet on center.

3.05 CONCRETE ENCASEMENT OF CONDUITS

A. Encase duct in Class C concrete with red stain or dye applied to the top surface of the concrete encasement. Make duct construction monolithic. Do not exceed the indicated outside dimensions of the duct by more than 1 inch vertically or 4

inches horizontally. Do not backfill for a period of at least 24 hours after pouring concrete.

B. Power system raceways must be separated, from center to center, at least 7 1/2 inches.

C. Maintain 2-inch minimum separation between conduits and 3-inch minimum concrete encasement around ducts.

D. Extend the concrete encasement under floor slabs or equipment mounting pads to the point of raceway termination.

E. Reinforcing:

1. Place reinforcing bars in accordance with the requirements shown in the drawings and Section 030500.

2. Place No. 4 reinforcing bars 36 inches long, spaced a maximum of 12 inches around the perimeter (with a minimum of four bars total) per duct bank end at the connection at each pullbox.

F. Pour each envelope between pullboxes or other terminations in one continuous operation. Where 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 the concrete on each side of the joint near the corners of the envelope.

3.06 GROUNDING

Install No. 2/0 AWG bare tinned counterpoise conductor over duct bank as indicated and exothermic weld to ground rod every 100 feet and to building or structure ground system at each end.

3.07 HANDHOLES AND PULL BOXES

A. Install handholes and pull boxes where indicated in the drawings.

B. Install accessories and holddowns for the covers where indicated.

C. Provide a 6-inch gravel base for open-bottom handholes.

3.08 CONDUIT SEALING

As specified in Section 260534.

3.09 EQUIPMENT PADS

A. Verify pad-mounted equipment size using reviewed shop drawings before ordering or placing pads. Unless otherwise indicated, pad shall be at least 4 inches larger, all around, than the equipment's footprint.

B. For precast pads, prepare setting bed by excavating an area 6 inches beyond the outside edge of the pad, compact the subgrade, and fill with 6 inches of crushed rock.

C. At Contractor's option, pads may be cast in place on a bed specified for precast units. Install in accordance with Sections 033000 and 030500 using Class A concrete. Set at a 1/8-inch to 1-foot slope to drain, bond reinforcing steel and provide grounding pigtail per Section 260526 and chamfer the edges.

3.10 IDENTIFICATION

A. Bury warning tape approximately 12 inches above all concrete-encased duct banks, direct buried conduit.

B. Align tapes within 3 inches of the centerline of the conduit or duct.

3.11 ACCEPTANCE TEST

A. Pull a mandrel of a diameter approximately 1/4 inch less than the duct inside diameter, through each new duct and through each existing duct in which new conductors will be installed.

B. Pull a bristle brush of a diameter approximately 1/4 inch greater than the duct inside diameter through each duct to remove debris.

C. Provide 200-pound minimum strength nylon pull rope in each spare conduit.

D. Repair or replace any portion of the new duct through which the mandrel and brush will not pass at the Contractor's expense. Notify Owner’s Representative of any problems with existing ducts for resolution.

END OF SECTION

SECTION 26 05 73

SHORT-CIRCUIT, PROTECTIVE DEVICE COORDINATION, AND ARC-FLASH STUDY

PART 1 GENERAL

1.01 DESCRIPTION

This section describes the requirements for furnishing a short-circuit and protective device coordination study and arc-flash hazard analysis. Submit an arc flash study to facilitate compliance with NFPA 70E, Handbook for Electrical Safety in the Workplace. Arc flash study shall be performed using software specifically for the purpose and all calculations shall comply with IEEE 1584.

1.02 SUBMITTALS

Submit shop drawings in accordance with Division 01 General Requirements and the General Conditions.

PART 2 MATERIALS

2.01 ARC FLASH LABEL

A. Arc flash labels shall identify the following as a minimum (distances indicated shall be in inches):

1. Flash Hazard Boundary: Threshold at which burn level exceeds 1.2 cal/cm^2.
2. Calculated incident energy at indicated working distance (18 inches).
3. Hazard risk category and personal protective equipment (PPE) description.
4. Equipment rated voltage.
5. Required electrical glove class.
6. Shock Hazard Boundaries: Limited approach, restricted approach, and prohibited approach (based on equipment rated voltage).
7. Location (name of board).

8. Name of organization that performed the analysis, contact information, and date analysis was performed.

B. Labels shall carry either a “DANGER” or “WARNING” header, depending on whether an accident will or can result in injury or death, as stated in ANSI Z534.4.f. Header shall also include the following: “QUALIFIED WORKERS ONLY – PPE REQUIRED.”

C. Labels shall carry a footer that reads “Warning: Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements.”

D. Labels shall be approximately 6 inches long by 4 inches wide, die-cut and shall come on industrial-quality adhesive-backed vinyl.

E. Provide on the Arc Flash label the calculated available fault current.

2.02 ARC FLASH STUDY

A. Documentation: Provide an Arc Flash analysis summary including as a minimum the following information:

1. Equipment name
2. Equipment Voltage
3. Available fault current (3 phase bolted)
4. Arcing fault current
5. Protective device operating time
6. Arc flash boundary (inches)
7. Working distance (inches)
8. Incident Energy (cal/cm^2)
9. Protective clothing category

B. Provide arc flash warning nameplates for each individual equipment item. Namplates shall include the working “WARNING –Arc Flash Hazard. Protective Equipment Required.” Nameplate shall also include the analysis data as listed above, settings (where applicable) of the equipment main protective device and a description of protective clothing required.

C. Scope: Study shall include all electrical distribution equipment from the service entrance equipment down to and including branch circuit panelboards.

D. Study Data and Submittal Requirements: Fault current and equipment data are as specified above under “Coordination Study”, Arc Flash Study shall be included with or submitted concurrently with the coordination study.

E. Submittal of Digital Data and System Model

1. Following final approval of any of the above mentioned studies, the Contractor shall provide a digital copy of all reports submitted as part of the project. Reports shall not be password protected and shall be freely manipulated by the engineer or owner.

2. Following final approval of any of the above studies, the Contractor shall provide the complete digital system model and system library used to build the model and complete the studies. All files needed to accurately recreate the study completed by the Contractor must be furnished and a backup of the system library used to define all system components must be provided.

PART 3 EXECUTION

3.01 GENERAL

A. Perform study using commercially available computer software, such as Power Tools for Windows by SKM Systems Analysis, Inc.

B. Perform study under the supervision of and signed by a registered professional electrical engineer in the State of Florida.

C. The study shall include scope, results, comments, and suggestions. Evaluation procedures shall follow applicable ANSI, NEMA, IEEE, and UL standards.

D. Obtain referenced or required characteristics and data from pertinent equipment manufacturers and from serving utility company, as applicable.

E. Do not perform study based on assumptions for lack of data.

3.02 SHORT-CIRCUIT STUDY

A. Short-circuit study shall provide calculations for the maximum short-circuit currents produced by balanced 3-phase and unbalanced faults as single-phase to ground

at each bus shown in the single line diagrams. Short-circuit study shall be performed for system connected to utility.

B. Motor contributions to short circuit shall be included, except for those motors controlled by VFDs with no bypass starters. Actual motor subtransient reactances shall be used for motors larger than 50 horsepower. Subtransient reactances of smaller motors may be assumed to be 17%.

C. Evaluation shall include status (pass/fail), calculated short circuit current, short circuit rating of device, ratio of calculated short-circuit current to short-circuit rating of device in percent.

D. Where fuses or current limiting circuit breakers are provided to reduce short-circuit levels at existing equipment that would otherwise have underrated protective devices, study shall include current limiting characteristics superimposed on time-current curves of the existing protective devices to verify compliance with NEC 240.86(A).

3.03 PROTECTIVE DEVICE COORDINATION STUDY

A. Provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size log-log forms. Include with each curve sheet a complete title and single-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pick up, instantaneous, and time delay settings.

B. Provide device coordination studies for both normal and standby source protection devices. Protective device settings shall optimize protection of equipment and, as much as practical, assure that downstream protective devices open prior to upstream protective devices.

C. Include the following on the curve sheets:

1. Utility company relay and fuse characteristics.
2. Motor protection devices for all motors 100 horsepower and larger.
3. Trip device characteristics of low-voltage equipment main protective devices. Exclude systems below 480 volts.

4. Pertinent motor starting and generator characteristics.

5. Characteristics of other system load protective devices.

6. Show transformer full load current and 125%, 250%, 400%, or 600% full load currents as applicable to the selected primary and secondary protective devices. In addition, show transformer magnetizing inrush and ANSI transformer withstand parameters.

7. Include all adjustable setting ground fault protective devices. Terminate device characteristic curves at a point reflecting the maximum symmetrical fault current as shown in the drawings. Ground fault settings of main disconnecting device shall comply with NEC-230.95(A).

8. Include cable damage curves.

D. Highlight protective devices that could not be coordinated and provide recommendation.

E. Identify where cables may not be protected against high short circuits, and make necessary recommendations for correction of problems. Statements such as “Using larger cables or changing the breaker size or type, in most instances, will resolve this problem” are not acceptable.

F. Adjust protective device settings in accordance with values established by the study.

3.04 ARC-FLASH HAZARD ANALYSIS AND EQUIPMENT LABELING

Perform an arc-flash hazard analysis in compliance with the latest edition of NEC 110.16 and NFPA 70E 110.8(B)(1) for the electrical equipment in accordance with Annex D of NFPA 70E and IEEE 1584 to identify:

A. The arc-flash protection boundaries, defined in Article 130.3(A) as "an approach limit at a distance from exposed live parts within which a person could receive a second-degree burn if an electrical arc flash were to occur."

B. The shock hazard boundaries.

C. The PPE and protective clothing necessary, based on the incident energy present at the working distance for the task to be performed, as described in Article 130.3(B) and Article 130.7.

D. Switchboards, panelboards, industrial control panels, stand-alone VFDs, motor control centers, individually mounted starters, and instrument control panels shall be included in the study and shall be provided with arc flash labels. Labels shall be provided for each section of switchboard, VFD, and motor control center. Arc flash study shall not exclude equipment exempted by NFPA 70(E) and IEEE 1585, which allow exclusion of equipment that operates at 240 volts maximum and is fed from a transformer smaller than 125 kVA.

3.05 REEVALUATION OF ANALYSIS

Owner will have the right to request reevaluation of any part of the coordination and arc flash analysis to improve coordination or to reduce arc flash risk category or to eliminate cable protection inadequacy. Owner reserves the right to contact the individual who performed the study or to witness the actual reevaluation at the premises of the organization performing the study and shall be allowed to make suggestions. All of these services shall be provided at no extra cost.

END OF SECTION

SECTION 26 05 90

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as hereinafter specified and as shown on the Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Disconnect Switches:

1. Fusible and non-fusible disconnect switches shall be heavy-duty, NEMA type H, quick-make, quick-break, visible blades, 600 volt, 3 pole with full cover interlock. All current carrying parts shall be copper.

2. Enclosure type shall be NEMA 4X 316 stainless steel with copper lugs except as otherwise shown on the Drawings.

3. Switches shall be horsepower rated as manufactured by the Cutler Hammer, Square D Co. or Allen Bradley.

4. Control wiring shall not pass through any disconnect enclosure. A junction box shall be provided, constructed of the same material as the disconnect, and utilized to separate power and control wiring prior to the disconnect enclosure.

5. Each disconnect shall be provided with a plastic nameplate, affixed to the enclosure without screws, identifying the equipment served.

B. Manual Motor Starters:

1. Manual motor starters shall be furnished and installed for single-phase motors. Manual starters shall be non-reversing, reversing or two speed type as shown on the Drawings. Built-in control stations shall be furnished where shown on the Drawings.

2. Enclosure type shall be NEMA 1 except as shown on the Drawings.

3. NEMA Type 4 enclosures shall be stainless steel.

4. Manual motor starters shall be as manufactured by the Square D. or Equal.

C. Magnetic Motor Starters:

1. Motor starters shall be 2 or 3 pole, 1 or 3-phase as required, 60 Hz, 600 volt, magnetically operated, full voltage nonreversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings.

2. Two speed starters shall be for single or two winding motors as shown on the Drawings.

3. Each motor starter shall have a 120 volt operating coil, and control power transformer. Three phase starters shall have 3 overload relays. Auxiliary contacts shall be provided as shown on the Drawings or required.

4. Overload relays shall be non-adjustable, ambient compensated and manually reset.

5. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.

6. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.

7. Enclosure type shall be NEMA 1 except as shown on the Drawings.

8. NEMA Type 4 enclosures shall be stainless steel.

9. Magnetic motor starter shall be as manufactured by the Square D. or equal.

D. Combination Magnetic Motor Starters:

1. Motor starters shall be a combination motor circuit protector and 3-pole, 60 Hz, 600 volt, magnetically operated, full voltage non-reversing contactor except as otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings.

2. Two speed starters shall be for single or two winding motors as shown on the Drawings.

3. Each motor starter shall have a 120 volt operating coil and control power transformer. Three phase starters shall have 3 overload relays. Auxiliary contacts shall be provided as shown on the Drawings or required.

4. Overload relays shall be non-adjustable, ambient compensated and manually reset.

5. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.

6. Enclosure type shall be NEMA 1 except as shown on the Drawings.

7. NEMA Type 4 enclosures shall be stainless steel.

8. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be furnished with bolt-on current limiting fuses.

9. Combination magnetic motor starters shall be as manufactured by the Square D. or Equal.

E. Control Stations:

1. Control stations shall be NEMA 4X stainless steel heavy-duty type, with full size operators when located outdoors, in "NEMA 4" locations or in "Corrosive" areas.

2. Control stations shall be Class 9001, manufactured by the Square D Company, GE.

3. Pilot lights shall be complete with glass jewels and 150-volt led lamps.

F. Unless otherwise noted, all outdoor enclosures shall be NEMA 4X stainless steel. NEMA 4X push buttons and pilot lights shall be provided in all weatherproof control panels.

G. Alarm Horn and Strobe Light:

1. Strobe light shall be as manufactured by Appleton, Zoller or Leviton. Alarm horn shall be as manufactured by Edwards, Zoller or Federal.

PART 3 EXECUTION (not used)

END OF SECTION

SECTION 26 12 16

DRY-TYPE TRANSFORMERS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of transformers.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Division 01 General Requirements, Section 01 33 00, and the General Conditions.

B. Submit ratings and characteristics including voltage, phases, connections, enclosure type and dimensions, and conduit entry restrictions.

PART 2 MATERIALS

2.01 GENERAL

A. Provide general-purpose, single-phase and three-phase, individually mounted dry-type transformers of the two-winding, self-cooled type. KVA size, voltage, and phase of the transformers are indicated in the drawings.

B. Within panelboards or electric cabinets, provide core and coil, dry-type transformers.

C. Transformers shall have copper windings and shall be UL listed and labeled where listing applies.

D. Transformers shall be rated for continuous operation in a 40°C maximum ambient temperature.

E. Transformers shall comply with the 2010 Department of Energy Efficiency Standards for Distribution Transformers.

2.02 DRY-TYPE TRANSFORMERS (10 KVA AND BELOW)

A. Construct transformers in accordance with ANSI C89.2, NEMA ST-20, and UL listed under the requirements of UL 506.

B. Transformers 5 kva and larger shall have two 5% FCBN taps on the primary side.

C. Encapsulate core and coil in an insulating resin of the class equal to the temperature rise and embed in a resin and filler system to attenuate the sound level.

D. Transformer shall be totally enclosed, nonventilated, suitable for indoor or outdoor installation.

E. Transformers shall be Sorgel Electric Division, Square D Company "Quiet Quality"; General Electric Company "QB," “ML,” or “QMS"; or Cutler-Hammer Type Westinghouse "EP” or “EPT".

2.03 DRY-TYPE TRANSFORMERS (CORE AND COIL TYPE)

A. Transformers shall be constructed in accordance with ANSI C89.1, NEMA ST-1-4 and shall be UL listed.

B. Transformer shall have 115°C rise, 185°C insulation system.

2.04 DRY-TYPE TRANSFORMERS (15 KVA AND ABOVE)

A. Transformer shall be in accordance with ANSI C89.2 NEMA TR-27, NEMA ST-20, and UL listed under the requirements of UL 506.

B. Transformers shall have two 2-1/2% FCAN and FCBN taps on the primary side.

C. Transformers shall have 115°C rise, 150°C insulation system.

D. Transformers shall be energy-efficient type complying with NEMA TP-1.

E. Sound levels shall be within the requirements of ANSI C89.1-2.7.2.

F. Transformers shall be ventilated type.

G. Basic impulse level (BIL) shall be 10 kV for transformers less than 300 kva.

H. Transformers shall be Cutler Hammer, Square D Company or Cutler Hammer.

2.05 FACTORY TESTS

Perform factory tests in accordance with the latest revisions of ANSI C57.12.91 for dry-type transformers.

PART 3 EXECUTION

3.01 GENERAL

A. Set taps under load conditions for correct voltage.

B. Install transformers, 5 kva and larger, on Korfund Series F or H double-deflection mounts selected for the weight of the transformer, to produce the maximum isolation.

C. Install transformers such that no metal-to-metal, concrete, plaster, exists between the transformer and structural members.

D. Make conduit connections to transformers with liquid-tight flexible conduit utilizing neoprene gaskets and isolated grounding bushings at the transformer enclosures, to achieve complete metal-to-metal sound and vibration isolation. Install flexible jumpers for grounding continuity from enclosure to conduits.

3.02 TESTS

Transformers shall have insulation resistance tests made on the windings prior to being connected. The measurements shall be from primary and secondary windings to ground and between primary and secondary windings. The minimum value shall be 10 megohms.

END OF SECTION

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SECTION 26 24 10

PANELBOARDS/MAIN BREAKER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor materials, equipment and incidentals required and install all panelboards as hereinafter specified and as shown on the Drawings.

PART 2 PRODUCTS

2.01 RATING

A. Panelboard and main breaker ratings shall be as shown on the Drawings.

2.02 STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

2.03 CONSTRUCTION (NEMA 1)

A. Interiors:

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the antiturn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A nameplate shall be provided listing panel type, number of circuit breakers and ratings.

B. Buses:

1. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

4. Buses for 480V panelboards shall be rated for 42,000 amperes RMS symmetrical. Buses for 120/208V panelboards shall be rated 10,000 amperes RMS symmetrical.

C. Boxes:

1. Recessed boxes shall be made from galvanized code gauge steel without multiple knockouts. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4-inches on all sides.

2. Surface mounted boxes shall have an internal and external finish as hereinafter specified in paragraph D4.

3. At least four (4) interior mounting studs shall be provided.

4. All conduit entrances shall be field punched.

D. Trim:

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors

over 48-inches in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

3. The trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4-inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

E. Manufacturer:

1. 120/240V, single phase, 3-wire, and 120/208V 3-phase, 4-wire panelboards shall be type NLAB as manufactured by the Cutler Hammer or Square D Co. No equal.

2. 480V, 3-phase, 3-wire panelboards shall be type NF as manufactured by Cutler Hammer or Square D Co. No equal.

2.04 CONSTRUCTION (NEMA 3, 4 & 12)

A. Interiors and Buses:

1. Interiors and buses shall be as herein before specified for NEMA 1 construction.

B. Boxes and Covers:

1. Boxes and covers shall be made from stainless-steel with natural finish.

2. Boxes and covers shall be bolted together and gasketed.

3. Conduit openings shall be tapped.

C. Manufacturer:

1. NEMA 4X panelboards shall be 304 stainless steel as required by voltage application; manufactured by the same as the NEMA 1 panelboards.

2.05 CIRCUIT BREAKERS

A. Main breakers shall be switchboard construction.

B. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

C. Circuit breakers shall be molded case, bolt-in type.

D. Circuit breakers used in 120/240 and 120/208V panelboards shall have an interrupting capacity of not less than 10,000 - amperes, RMS symmetrical.

E. Three pole breakers used in 480V panelboards shall have an interrupting capacity of not less than 35,000 - amperes RMS symmetrical.

F. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Drawings. GFCI units shall be 1 pole, 120 volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity of 10,000 amperes RMS.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2-inch air space between the box and the wall.

B. Unless otherwise noted on the Drawings, top of cabinets shall be mounted 6-feet 0-inch above the floor, properly aligned and adequately supported independently of the connecting raceways.

C. All wiring in panelboards shall be neatly formed, grouped, laced, and identified to provide a neat and orderly appearance. A typewritten directory card identifying all circuits shall be placed in the cardholder inside the front cover.

END OF SECTION

SECTION 26 24 19

480-VOLT MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test the new motor control center as hereinafter specified and as shown on the Drawings. These are the MCCs that are being installed in the Electrical Building.

B. MCC's shall be furnished by the Contractor.

C. All MCCs shall be "smart" and shall communicate to the Plant Instrumentation and Control System (PICS) Profibus.

D. All MCC installed VFDs, Soft Starters, and full voltage non-reversing NEMA starters shall also communicate directly with the PICS over the same network extended as required to applicable MCC buckets. Simocode modules shall be provided in each MCC bucket. See electrical plans for wiring specifics.

E. The PLC shall communicate with remote I/O drops in individual MCC buckets via a serial data link running throughout the MCC. The remote I/O drops interface with the signals as shown in the Contract Documents.

F. Wherever the MCC bucket device is available with direct connection to the serial data link or to the PICS and the necessary data may be transferred over the connection, separate remote I/O drops within the bucket are not required.

G. All MCC communications to the PICS shall be Profibus.

1.02 QUALIFICATIONS

A. The motor control centers shall be the product of a manufacturer who shall be the manufacturer of all the circuit breakers, fused switches, and motor starters included in the motor control centers.

B. All units and sections shall be U.L. labeled when possible. Motor control centers containing service entrance equipment shall be U.L. labeled "Suitable For Use As Service Equipment."

C. The motor control centers shall be Siemens Tiastar or approved equal.

1.03 SUBMITTALS

A. Complete master wiring diagrams and elementary or control schematics, including

coordination with other electrical control devices operating in conjunction with the motor control centers and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable.

B. Submittals shall include a bill-of-material listing conductor material and insulation type as well as other hardware and equipment to be furnished.

C. Where it is not explicitly shown and completely obvious from the outline drawings the following items shall be verified in a written statement accompanying the shop drawings.

1. Type of terminal blocks used and that the removal of plug-in compartments can be performed without disconnecting or removing wires.

2. Silver or tin plating of bus.

3. Insulation and isolation of vertical bus.

4. U.L. approval.

1.04 RELATED WORK

A. Lighting Panels are included in Section 26 24 10.

B. Dry type lighting transformers are included in Section 26 12 16.

PART 2 PRODUCTS

2.01 RATING

A. The motor control centers shall be designed for 480 volt, 3 phase, 3 wire 60 Hz service and shall have short-circuit rating of not less than 65,000 amperes RMS, symmetrical.

2.02 CONSTRUCTION

A. Structure:

1. The motor control centers shall be a standard metal-enclosed, free-standing, deadfront structure, not more than 94.5-inches in height, and fabricated from formed sheet steel of not less than No. 14 gauge thickness. The enclosure shall be NEMA I. The motor control centers shall consist of vertical sections of equal height and 20 inches deep containing individual plug-in compartments. Compartments shall be isolated from each other by separate horizontal steel plates or by steel plates without openings that are a part of the compartment itself.

2. Plug-in compartments shall totally isolate enclosed equipment. All unused openings to the adjacent vertical wiring space shall be plugged. All openings used for wiring shall have insulating grommets.

3. Vertical sections shall be mounted on steel channel sills continuous on four sides, or with steel channel sills on two sides and end cover plates. Each compartment shall be provided with a hinged door of pan construction on the front and a door opening of sufficient size to permit ready removal of any of the equipment in the compartment. Interlocks shall be provided to prevent opening the compartment door when the disconnect device in the compartment is in the closed position. An interlock bypass device shall be furnished. Means of locking the disconnect device in the "Off" position shall be provided. Disconnect device operating mechanism shall not be attached to the compartment door.

4. All sections shall have the same structural features with provisions for the addition of similar sections at either end. Each compartment shall meet NEMA Standards for the control equipment installed and units of similar size shall be interchangeable.

5. Each section shall be provided with a horizontal wiring space which shall line up with a similar space in the adjacent section or sections, with openings between so that wires may be pulled the entire length of the control centers. There shall also be provided in each section a vertical wiring space with separate full height door.

6. The motor control centers shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.

7. The motor control centers shall have engraved laminated nameplates screwed to the doors of each individual compartment and wiring diagrams pasted inside each door. Compartments containing panel boards shall have a card holder on the inside of the door. Compartments containing motor starters shall each have an overload heater selection table pasted inside the door.

8. The motor control centers shall provide equipment of type, capacity, trip ratings for the loads shown on the Drawings or otherwise specified.

9. Construction shall be NEMA Class II, Type B or C. In so far as possible all devices and components used shall be of one manufacturer. The motor control centers shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit.

10. The motor control centers shall be finished with ANSI Z55.1, No. 61 light gray enamel over a rust resistant primer.

11. The insulation level of the complete motor control assembly shall be such

that it will meet the field tests required under Paragraph 3.02.

12. ALL wires shall be numbered and referenced to the approved control drawings.

B. BUSES:

1. All buses shall be silver on tin-plated copper. A continuous main horizontal bus shall be furnished. Main buses shall be rated as shown on the Drawings, but shall be not less than 600 amperes.

2. Each vertical section shall have a full height vertical bus rated not less than 300 amperes. Vertical buses shall be insulated and isolated with glass polyester or equivalent continuous insulation. Taped buses will not be acceptable. Unused stab openings shall be plugged. Lower ends of vertical buses shall be insulated.

3. A 1/1-inch x 2-inch ground bus shall be furnished the entire length of the motor control centers.

4. Buses shall be braced for 100,000 amperes RMS, symmetrical, short circuit current.

5. All buses except neutral and ground buses shall be completely isolated by steel plates or insulating material.

6. The buses shall be sized for a maximum current density of 1200 amperes per square inch.

C. Wiring:

1. All wiring shall be copper.

2. Compartment wiring shall be to compartment mounted, plug-in terminal blocks that allow compartments to be withdrawn without having to remove wires from fixed terminal blocks.

3. Power wiring shall be black, control wiring shall be red, wiring energized from sources other than the starter control power transformer shall be yellow.

D. Signage:

1. Each motor control center shall be furnished with a sign marked "DANGER - HIGH VOLTAGE." Letters shall be not less than 1-inch high, 1/4-inch stroke. Signs shall be laminated plastic, engraved red letters with a white background.

2. All compartments with voltages from sources outside of the compartment, not disconnected by the motor circuit protector, shall have a sign on the

compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM A SOURCE OUTSIDE OF THIS UNIT." Letters shall be black on a high visibility yellow background. Background shall be laminated plastic approximately 3 inches x 5 inches.

2.03 COMPONENTS

A. Combination Motor Starters:

1. All motor starters shall be a combination motor circuit protector and contactor, 3-pole, 60-Hz, 600-volt, magnetically operated, of the types shown on the drawings. NEMA sizes shall be as required for the horsepower shown on the Drawings, but shall be not less than NEMA Size 1.

2. All motor starters shall have a 120-volt operating coil, overload relay in each phase and control power transformer.

3. All motor starters shall have 1-N.O. and 1-N.C. auxiliary contacts. Additional auxiliary contacts shall be furnished where shown on the Drawings or as required by the control scheme.

4. Full voltage, non-reversing starters, NEMA size 4 and smaller shall be of plug-in design with stab-on connectors engaging the vertical buses. Larger units shall be of fixed design.

5. Reduced Voltage Starters (Solid State):

   a. Reduced voltage starters shall be combination solid state motor controller with circuit breaker. Starters shall be Heavy Duty type.
   b. Starters shall be provided with isolation and bypass contactors. All starters shall be rated for 150% of the full load rating of the motor. AIC rating shall be 65,000 amps.
   c. Motor starters shall have a 120-volt operating coil, overload relay in each phase and control power transformer.
   d. Motor starters shall have 1-N.O. and 1-N.C. auxiliary contacts. Additional auxiliary contacts shall be furnished where shown on the Drawings or as required by the control scheme.
   e. Overload relays shall be adjustable and manually reset by push button in compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.
   f. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.
   g. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with solid state reduced voltage starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits. AIC rating shall be 65,000 amps.
   h. The following options shall be required:

1) Soft start
2) Soft stop
3) Protective module - line side of each starter.
4) Door mounted devices shall be as shown on the starter elementary diagrams.

i. Overload relays shall be adjustable and manually reset by push button in compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.

j. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.

k. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits.

l. Each Starter unit shall have a door mounted display. The display unit shall replace all pilot lights and pushbuttons and shall include an LCD display, extended temperature range, backlit display. A real-time clock shall be included in the display rated for Ten years @ 25°C without external power. The display shall be provided with keylock functionality to prevent tampering of setpoints.

6. Overload relays shall be adjustable and manually reset by push button in compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.

7. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.

8. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits.

B. Circuit Breakers:

1. Circuit breakers shall be thermal-magnetic, molded case, 480 volt, with not less than 65,000 amperes, RMS interrupting capacity. All circuit breakers with 225 amperes frames and larger shall have interchangeable trips. Circuit breakers shall have auxiliary disconnect contacts when used with starters having external control circuits.

C. Control Stations:

1. Control stations shall be standard size, heavy-duty, oil-tight.

D. Indicating Lights:

1. Indicating lights shall be standard size, heavy duty, oil tight, low voltage transformer operated.

E. Instrumentation and Metering:

1. Power Meters: All MCCs shall be equipped with a digital-metering device capable of communication on over the Profibus. Meters shall be Siemens PAC 4200".

F. Instrument Transformers:

1. Instrument transformers shall be indoor, 600-volt, butyl-rubber molded, metering class designed in accordance with ANSI and NEMA standards.

G. Surge Protection:

1. Surge protection devices shall be provided as shown on the drawings.

H. Nameplates:

1. Unit nameplates shall be black and white laminated plastic having engraved letters approximately 3/16-inch high extending through the black face into the white layer. Nameplates shall identify equipment controlled or circuit designation as applicable.

2.04 SPARE PARTS

A. The following spare parts shall be furnished:

1. One (1) box of power fuses of each size furnished.
2. One (1) starter for each NEMA size installed.
3. One (1) starter coil for each NEMA size installed.
4. One (1) box of pilot lights.
5. One spare VFD for each size provided suitable for MCC integral mounting

3. EXECUTION

3.01 INSTALLATION

A. The motor control center housings shall be bolted to angle iron sills imbedded in the concrete on the two longest sides. The sills shall be the full length of the motor control center housing and shall be installed level in all directions.

B. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit terminations are not stressed.

C. The motor control centers shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angle.

D. The motor control centers shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by motor control centers manufacturer.

3.02 TESTS AND CHECKS

A. The following minimum tests and checks shall be made after the assembly of the motor control centers, but prior to the termination of any field wiring.

1. Megger terminals and buses after disconnecting devices sensitive to megger voltage.
2. A 1,000 VDC megger shall be used for these tests.
3. The first test shall be made with main circuit breaker closed and all remaining breakers open. A second test shall be made with all circuit breakers closed.
4. The test results shall be recorded and forwarded to the Engineer for his review. Minimum megger readings shall be 100 megohms in both tests.

B. The following shall be done before energizing the motor control centers.

1. Remove all current transformer shunts after completing the secondary circuit.
2. Install and set overloads based on actual motor nameplate current. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.
3. Check all mechanical interlocks for proper operation.
4. Vacuum clean all interior equipment.

END OF SECTION

SECTION 26 26 50

MOTORS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

B. Refer to the following items listed below for related sections:

1. 43 21 10 Horizontal Split-Case Centrifugal Pumps
2. 26 29 23 Variable Frequency Drives (VFD)
3. 40 95 00 Process Instrumentation and Control Systems (PICS)

1.02 QUALIFICATIONS

A. Motor shall be sufficient size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.

1.03 SUBMITTALS

A. The motor manufacturer shall submit to the Engineer certified dimension prints showing nameplate data and outline dimensions within three weeks of the date they receive the order.

B. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and improper installation for a period of one year from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the Contractor at no expense to the Owner.

C. Provide equipment warranty in accordance with Division 01.

PART 2 PRODUCTS

2.01 RATING

A. Unless otherwise noted, all motors shall be of the low voltage type. All motors 1/2

through 100 horsepower shall be rated 230/460 volt, 3 phase, 60 Hertz A.C.; motors 125 horsepower through 500 horsepower shall be rated 460 volt, 3-phase, 60 Hertz, and motors below 1/2 horsepower shall be rated 115/230 volt, 1 phase, 60 Hertz A.C.

2.02 THREE PHASE INDUCTION MOTORS

A. Motors 20 HP and larger shall have a 120-volt space heater for moisture control.

B. Unless specifically noted in other sections of these Specifications, all motors shall have a minimum as indicated in the table below. All motors shall be "premium efficiency" type.

C. Motors operating with variable frequency drives shall state that they are suitable for their intended applications. Refer to specification section 26 29 23 for VFD requirements. Motor nameplate shall read "Inverter Duty Rated".

In addition, Motors operating with Variable Frequency Drives (VFDs) shall meet the requirements of NEMA MG1 Part 31.

TABLE 1

Motor HP	Min. Eff.	Max. dba	Motor HP	Min. Eff.	Max. dba
1-2	84.0%	74	25-30	92.0%	92
3-5	86.5%	79	40-50	93.0%	97
7.5-10	90.2%	84	60-75	94.0%	100
15-20	91.0%	89	100	94.1%	102
			200	94.3%	105

D. All motors shall have imbedded a winding temperature switch.

2.03 CONSTRUCTION

A. General:

1. All drip-proof and weather protected Type I motors shall have epoxy encapsulated windings. Totally enclosed motors shall not be

encapsulated. Motors not readily available with encapsulated windings may be standard type. Service Pump Motors shall be totally enclosed fan cooled (TEFC) unless otherwise specified.

2. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.

B. Low Voltage, Three Phase Motors:

1. Motors shall be of the squirrel-cage or wound rotor induction type as noted. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as specified herein. All motors shall be built in accordance with current NEMA, IEEE, ANSI and AFBMA standards where applicable. Motors shall be of the type and quality described by these Specifications, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.

2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.

3. Motors shall be totally enclosed fan-cooled construction with 1.15 service factor unless otherwise noted. Indoor motors shall be WPI unless otherwise noted.

4. Motors shall be suitable for operation in moist air with hydrogen sulphide gas present.

5. The output shaft shall be suitable for direct connection or belt drive as required.

6. Motors shall have a Class B nonhygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.

7. All motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.

8. All fittings, bolts, nuts, and screws shall be 316 stainless steel. Bolts and nuts shall have hex heads.

9. All machine surfaces shall be coated with rust inhibiter for easy disassembly.

10. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.

11. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.

12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

13. Low voltage, three phase motors shall be manufactured by General Electric, U.S. Motors, Westinghouse or Reliance.

14. Fractional Horsepower:

    a. Fractional horsepower motors shall be rigid, welded-steel, designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.

    b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.

    c. For light to moderate loading, bearings shall be quiet all-angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.

d. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large reservoir providing 10 years' normal operation without relubrication.

15. Integral Horsepower:

a. Motor frames and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.

b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

d. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings may be cast-aluminum or bar-type construction with brazed end rings.

e. Motors shall be equipped with vacuum-degassed antifriction bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

f. Bearings of high thrust motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum

B10 life rating of 100,000 hours in accordance with AFBMA life and thrust values.

g. Vertical hollow-shaft motors will have nonreverse ratchets to prevent backspin.

C. Low Voltage, Single Phase Motors:

1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm called for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open drip-proof, or totally enclosed fan cooled as called for on the Drawings, with temperature rise in accordance with NEMA Standards for Class B insulation.

2. Totally enclosed fan cooled motors shall be designed for severe-duty.

3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have a corrosion protective plating.

4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Motor Connections: All motors shall be connected to the conduit system by means of a short section 18-inch minimum of flexible conduit unless otherwise indicated. For all motor connections, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

3.02 TESTS AND CHECKS

A. The following tests shall be performed on all motors after installation but before putting motors into service.

1. The Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor. The following table gives

minimum acceptable insulation resistance in megohms at various temperatures and for various voltages with readings being taken after one minute of megger test run.

TABLE 2

Degree Winding Temperature		**Voltage**			
^{0}F	**^{0}C**	**115V**	**230V**	**460V**	**4,160V**
37	3.9	60	108	210	1,700
50	10	32	60	120	1,000
68	20	13	26	50	460
86	30	5.6	11	21	195
104	45	2.4	4.5	8.8	84
122	50	1	2	3.7	35
140	60	.5	.85	1.6	15

2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication, and shall lubricate if required in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

B. The following tests shall apply to the medium voltage motors:

1. All motors shall be given the standard short commercial test prior to shipment. This shall consist of no load current, check current balance, winding resistance, air gap measurement, high potential tests, and bearing inspection. Six (6) copies of the certified short commercial test shall be mailed to the Engineer prior to shipment.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

This section describes materials and installation of light switches, telephone outlets, data, coax and receptacles devices.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Division 01 General Requirements and the General Conditions.

B. Submit material list for each type of wiring device and cover plate. Indicate type, ratings, material, color, and manufacturer.

1.03 REFERENCES

A. NEMA WD 1, General Purpose Wiring Devices.

B. NEMA WD 6, Wiring Device Configurations.

PART 2 MATERIALS

2.01 GENERAL

A. Provide wiring devices that are UL listed.

2.02 RECEPTACLES

A. Duplex Receptacles: Provide NEMA WD 1, molded composition, ivory, specification grade receptacles. Duplex receptacles for 120-volt, single-phase, 3-wire circuit to be rated 20 amperes, 125 volts, NEMA Type 5-20R.

B. Double Duplex Receptacles: Double duplex receptacles for 120-volt, single-phase service to be same as duplex receptacles with the two duplex receptacles installed in one 4-inch by 4-inch outlet box with one two-gang faceplate.

C. Ground Fault Interrupter (GFI) Duplex Receptacles: Receptacles shall be rated 20 amperes and comply with UL 943, Class A. Provide Leviton 6398-HGI, 3M GFI-2701, or equal.

D. Corrosion-Resistant Receptacles: Provide corrosion-resistant receptacles for areas identified as "Corrosive Area" in the drawings. Provide gray melamine, duplex receptacle, Hubbell 53CM62GY or equal.

E. Isolated ground Duplex Receptacles: Provide NEMA WD 1, molded composition, orange, specification grade receptacles. Duplex receptacles for 120-volt, single-phase, 4-wire circuit to be rated 20 amperes, 125 volts, NEMA Type 5-20R.

2.03 SWITCHES

A. Switches shall be NEMA WD 1, molded composition, ivory, specification grade, single pole, three way and four way as shown in the drawings.

B. 120- or 277-Volt Lighting: Provide switches rated 20 amperes, 120/277-volt ac. Provide quiet operation, toggle-type switches.

2.04 COAX OUTLETS

A. Provide RG-6 modular jack.

2.05 COMMUNICATIONS OUTLET

A. Provide insulation displacement type, Category 5, eight-pin, eight-position, modular jack.

2.06 COVER PLATES

A. Provide galvanized steel plates in electrical and mechanical equipment rooms, utility rooms, unfinished areas, and on all indoor surface-mounted boxes, fittings, and exposed extension rings. Plates to be hot-dipped galvanized.

B. In wet areas, areas subject to hosing down, areas identified as "Corrosive Area," or where indicated, use individually gasketed weatherproof cover plates. Plates shall be gray polycarbonate lift-cover type. Provide outdoor receptacles with covers that provide weatherproof protection while outlet is in use. Provide Tay Mac Industrial Outlet Covers or equal.

C. Provide ivory lexon plates in all remaining locations. Plates to be smooth style, noncombustible, mar-resistant thermosetting plastic.

PART 3 EXECUTION

3.01 GROUNDING

A. Provide a bonding jumper between the grounded outlet box and the receptacle ground terminal.

3.02 TESTING

A. Operate each switch and verify that the load is turned on and off.

B. Test each receptacle with a circuit tester that checks voltage, polarity, and grounded conditions. Repair or replace defective receptacles and repeat the test.

C. GFI receptacles shall be tested with the circuits energized. Devices shall be tested with a portable GFI receptacle tester capable of circulating 7.5 mA of current, when plugged in, between the "hot" line and "ground" to produce tripping of the receptacle. Resetting and tripping shall be checked at least twice at each GFI receptacle.

END OF SECTION

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SECTION 26 29 23

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to furnish and install variable frequency drives (VFDs) as shown on the Drawings and as specified herein.

B. Refer to the following items listed below for related sections:

1. 43 21 10 Horizontal Split-Case Centrifugal Pumps
2. 26 26 50 Electric Motors
3. 40 95 00 Process Instrumentation and Control Systems (PICS)

C. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, the shop testing, delivery and complete installation and field testing, of all materials, equipment and appurtenances for the variable frequency drives herein specified.

D. All VFDs furnished for this project shall be the responsibility of the System Supplier defined in Specification section 40 95 00. The System Supplier shall be responsible for complete system operation and all required coordination with all disciplines. The System Supplier shall be responsible for coordinating the sizing of all VFDs.

E. The System Supplier shall provide the services of a competent and experienced equipment manufacturer's factory field engineer to supervise start-up and provide training to the Owner's personnel.

F. VFDs shall be furnished by Cutler Hammer no equal.

1.02 DESCRIPTION OF SYSTEM

A. The variable frequency drives will operate motors as specified in other Divisions and Division 26. The drives furnished hereunder shall be totally compatible and adequately sized with the Motors to be supplied.

B. Variable speed drives shall be sized as shown on the electrical drawings.

C. Installation of the VFDs in the power equipment center shall be provided where indicated on the drawings.

D. The variable frequency control shall operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10% total harmonic voltage distortion and commutation notches up to 36,500 volt microseconds, or when other variable frequency drives are operated from the same bus.

1.03 QUALIFICATIONS

A. The drives covered by these Specifications are intended to be equipment of proven ability as manufactured by reputable manufacturers having long experience in the production of identical units. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

B. The variable frequency drive manufacturer shall maintain and staff engineering service and repair shops through the United States, including the State of Florida, trained to do start up service, emergency service calls, repair work, service contracts and training of customer personnel.

1.04 SUBMITTALS

A. Copies of all materials required to establish compliance with the specifications shall be submitted. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. Data on the characteristics and performance of the variable frequency drives. Data shall include certification that the variable frequency drives

are warranted for use with the motors specified in other Divisions and Division 26.

4. Complete drawings shall be furnished for approval before proceeding with manufacture and shall consist of master wiring diagrams, elementary or control schematics including coordination with other electrical control devices operating in conjunction with the variable frequency drive, and suitable outline drawings with sufficient details for locating conduit stub-ups and field wiring. Generic schematics not specific to this project shall not be acceptable.

5. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's numbers only.

1.05 OPERATING INSTRUCTIONS

A. See Division 1 for Operating and Maintenance Data requirements.

1.06 PRODUCT HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and spare parts must be properly protected against any damage during a prolonged period at the site.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.07 WARRANTY

A. 5-year on-site warranty shall be provided such that the owner is not responsible for any warranty costs including travel, labor, parts, or other costs for a full 5 years from the date of manufacture of the Drive. The warranty shall cover all Drive failures including line anomalies – load anomalies, accidental exposure to moisture or corrosives and accidental collision of other physical damage; product

misapplications, vandalism and chronic problems due to the misapplication are not covered. The cost of the warranty shall be included in the bid.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall be responsible for the erection and installation of all equipment defined in this section of the contract documents.

B. The System Supplier shall furnish complete variable frequency drive systems for installation by the Contractor. The System Supplier is responsible for the start up of all VFD drives furnished on this project.

C. The variable frequency drive shall be furnished by an approved manufacturer who has actively been manufacturing variable frequency drives for a period of at least five (5) years.

D. The variable frequency drive shall be complying with the latest applicable standards of ANSI, NEMA, IEEE, and the National Electric Code.

E. Variable frequency drive shall operate as specified on standby generators or normal power sources.

F. Passive harmonic filters shall be provided for each VFD. The System Supplier is responsible for confirming their size. The passive filters shall be designed as required to limit voltage and current distortion levels to acceptable limits as determined by IEEE-519. Refer to section 2.03 below for additional requirements.

G. The System Supplier shall provide a listing of all programmable parameters that are different from the factory default values. For each indicate:

The factory default and meaning.

The revised value and meaning.

H. The VFD Supplier shall provide a copy of PC compatible remote programming/ diagnostic software and any required cables to the Owner. The software shall permit communications to the VFDs via an Ethernet/IP network connection.

2.02 CONSTRUCTION

A. Each variable frequency drive shall consist of a 460V, 3-phase rectifier, DC link and variable frequency inverter with features, functions and options as specified. The inverter shall be voltage source design using pulse width modulation (PWM) techniques. VFD-1, VFD-2, VFD-3 and VFD-4 shall be limited to maximum dimensions shown on the drawings.

B. The variable frequency drives shall be rated for continuously operating at the full load current as specified on the electrical drawings per the single line diagram. The variable frequency drives shall be designed to provide continuous speed adjustment of three-phase motors. The variable frequency output voltage shall provide constant volts-per-Hertz excitation to the motor terminals up to 60 Hertz.

C. Inverters shall be capable of converting incoming three phase, 460V (+10 to -5%) and 60 Hertz (+/-2) Hertz power to DC bus levels. The DC voltage shall be inverted to a variable frequency output.

D. Controllers shall be rated for an ambient temperature of 0^{o}C to 40^{o}C and humidity of 0 to 95% non-condensing.

E. All openings in the VFD shall be filtered.

F. VFDs shall have complete front accessibility.

G. All variable frequency drives shall:

1. Be furnished with integral DC link reactor.
2. Have frequency stability of 2% for 24 hours with voltage regulation of +2% of maximum rated output voltage.
3. Be phase insensitive to input power.

H. The following standard basic control features shall be provided on the inverter:

1. Unidirectional operation, coast to rest upon stop.
2. Variable linear independent timed acceleration.
3. Variable torque performance from 4 to 60 Hertz.
4. LED status indication for Power On, Run, Inverter Enable, over frequency, instantaneous overcurrent, DC over voltage, AC

undervoltage/loss-of-phase, emergency stop, overload, over temperature, inverter pole trip and standby modes.

5. 115V AC control power for operator devices.

6. Automatic restart upon return of power following a utility outage. Drive shall require manual reset after three (3) attempts in a 60 second period.

I. The following protective features shall be provided on the drive:

1. Input AC circuit breaker with an interlocked, pad lockable handle mechanism and AC input line current limiting fuses for fault current protection of AC to DC converter section and circuit breaker. Minimum short circuit rating of 100,000 AIC shall be provided.

2. Electronic overcurrent trip for instantaneous overload protection.

3. Undervoltage and phase loss protection of output.

4. Over-frequency protection.

5. Over-temperature protection.

6. Electrical isolation between the power and logic circuits, as well as between the 115V AC control power and the static digital sequencing.

7. Drive to be capable of withstanding output terminal line short or open circuits without component failure.

J. The following standard independent adjustments shall be provided on the inverter:

1. Minimum speed (12 to 54 HZ).

2. Maximum speed (40 to 60 HZ).

3. Acceleration time 6 to 60 Sec. (minimum).

4. Deceleration time 6 to 60 Sec. (minimum).

5. Volts per Hertz.

6. Stability adjustment, if required.

7. Voltage boost (100 to 600 percent of nominal V/HZ ratio at 1 HZ tapering to 100 percent at 20 HZ).

K. All VFDs shall have a door-mounted key-pad display that allows:

1. Display of electrical values, parameters and faults.

2. Adjustment and configuration of the drive controller.

3. Local control.

4. Storage of up to four different, downloadable controller configurations.

L. The key-pad display shall comprise:

1. LCD display that displays alphanumeric codes and numerical values.

2. LCD display that displays plain English messages.

3. Illuminated indication of local/remote status, direction of rotation and programming/run mode.

4. A pushbutton keypad supporting local control, display, and configuration of the drive.

M. The Variable Frequency Drive shall be provided with a Profibus D9 communications module for a remote connection to the existing PCP.

N. All wiring shall have permanently affixed wire numbers.

O. The variable frequency drives shall be as manufactured by Cutler Hammer SVX9000, no equal.

2.03 INTEGRAL PASSIVE HARMONIC FILTER

A. The passive harmonic filter (hereafter called the filter) shall be designed to filter all characteristic low frequency harmonics (5th, 7th, 11th, 13th, etc.), generated from three phase diode rectifier loads such as variable frequency drives (VFD), while improving the system power factor.

B. The filter shall consist of inductive element(s) in series with the load and an inductive-capacitive network in parallel with the load (shunt).

C. The filter shall not adversely react with or resonate with the power system or attract harmonics from other sources. The filter shall be provided with a normally closed contact which shall open and isolate the VFD connection from the filter when the VFD is not running.

D. The filter shall be UL- and cUL-Listed under UL 508A.

E. The harmonic filter shall be warranted free from defects both in materials and in workmanship for a period of three years from the date of shipment, when applied in accordance with the manufacturer's recommended procedures.

F. The filter shall be manufacturers shall be as follows:

1. TCI, Jacksonville, Florida

2. Approved Equal

G. The filter described in this specification shall be used on a 480-Volt, 3-phase, 60 Hertz system. The filter horsepower ratings shall be determined in accordance with the VFD Schedule.

H. Submittals shall include the following information:

1. Outline dimensions, conduit entry locations and weight.

2. Customer connection and power wiring diagrams.

3. Complete technical product description.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Field wiring shall be in accordance with manufacturer's recommendations. Anchor bolts shall be stainless steel and set in accordance with manufacturer's recommendations.

3.02 SHOP PAINTING

A. Prior to shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill/scale, rust, grease, dirt, and other foreign matter.

B. Drives shall be shop painted.

3.03 TESTS AND CHECKS

A. The drive manufacturer shall test the drive controller with a motor load prior to shipment. The motor shall have equal or greater full load current than the specified motor.

B. Perform start-up demonstration and field testing as specified in Section 017825.

C. A certified copy of all tests and checks performed in the field, complete with meter readings and recordings, where applicable, shall be submitted to the Owner.

3.04 TRAINING

A. The training and instruction shall be directly related to the System being supplied and be accomplished.

B. Training of the Owner's personnel will only be considered valid for approval by the Engineer if it takes place after the successful start-up and demonstration test.

C. The Supplier shall provide classroom training detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

D. The Supplier shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, such materials shall be delivered to Owner.

E. The training program shall represent a comprehensive program covering all aspects of the variable frequency drive and maintenance of the system.

F. All training schedules shall be coordinated with, and at the convenience of the Owner. Shift training may be required to correspond to the Owner's working schedule.

G. On-site Training: On-site (field) training shall be conducted at the Owner's Plant Site over a total of one (1) - eight (8) hour day. It shall provide detailed hands-on instruction to Owner's personnel covering:

1. System operation
2. Program modification
3. Trouble-shooting
4. Maintenance procedures
5. Calibration procedures.

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26 41 00

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. A Lightning Protection System shall be provided and installed for the High Service Pump Building, ground storage tank, stairs, wells and well pumps and as well as for all structures greater than five (5) feet above grade level. They system shall be provided and installed in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Lightning Protection Institute. All equipment to that result shall be included whether or not specifically called for herein. Installers shall be LPI (Lightning Protection Institute) certified, master and Journeyman in accordance with LPI standards or of equal qualifications as approved by Engineer. A LPI label for the system shall be required.

B. Material shall comply in weight, size and composition with the requirements of the Lightning Protection Institute and the National Fire Protection Code relating to this type of installation, and shall be LPI labeled.

1. All materials, where available by any one manufacturer, shall be cast. All bolts shall have hexagonal heads, no screw heads will be permitted.

2. Lightning protection cable shall be Class I copper. Grounding counterpoise shall be as shown. Fittings and straps shall be cast copper.

1.02 SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted before work is done. Drawings shall include full layout of cabling and points, and connections.

B. Product Data: Product Data shall be submitted on all equipment to show compliance with this section of the specifications and shall include manufacturer's written recommendations for installation.

PART 2 PRODUCTS

2.01 AIR TERMINALS

A. Air terminals shall be copper and shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface. Terminals shall project a minimum of 10" above top of object to which attached.

2.02 CONDUCTORS

A. Roof conductors shall consist of copper complying with the weight and construction requirements of the Code, and shall be coursed to interconnect with air terminals, and in general, provide a two-way minimum path to ground. The angle of any turn shall not exceed 90 degrees, and shall provide an approximately horizontal or downward course. Down conductors shall be copper, concealed within the structure. Radius of bends shall not be less than 8 inches. Roof conductors material shall match and/or be compatible with roof flashing material.

2.03 FASTENER

A. Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.

2.04 GROUND CONNECTIONS

A. Ground connections shall be made in accordance with requirements of all applicable codes. Ground rods shall be placed in a minimum of two (2) feet from building foundations. In addition to above artificial grounds, one down conductor of each two-path system shall be connected to water piping system with approved water pipe type strap connector. All ground rods shall be 5/8" diameter, with a minimum length of 20' copperweld type. Each installed ground rod shall be checked for resistance to ground. If a 0 to 5 ohm reading is not obtained, extend 10’ rod lengths and continue driving rods until the required reading is obtained. No rod can be connected to the bonding cable without the required ohm reading. The system must also be tied into the existing plant system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed within structure, and shall be run in 1" PVC conduit. All metallic equipment within 6 feet of any lightning conductor shall be bonded to conductor. System shall also be tied to the main service electrical ground.

3.02 EQUIPMENT

A. Equipment shall be as manufactured by Thompson Lightning Protection, Inc., Robbins Lightning Inc., National Lightning Protection, Inc., Lightning Masters Corp., or Heary Bros Lightning Protection (premium lines).

END OF SECTION

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SECTION 26 43 13

SURGE PROTECTION DEVICES (SPD'S)

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of SPD's for the protection of electrical and electronic circuits and equipment. All feeders to a structure to be protected by a SPD. Coordinate SPD requirements with the lightning protection system.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Division 01 General Requirements and the General Conditions.

B. Submit product data on each suppressor type, indicating component values, part numbers, and conductor sizes. Include dimensional drawing for each, showing mounting arrangements.

C. Submit manufacturer's UL 3rd Edition certified test data and nameplate data for each SPD.

D. Submit electrical single-line diagram showing location of each SPD.

E. Provide copy of extended warranty.

1.03 QUALITY ASSURANCE

A. UL Compliance and Labeling:

1. For power and signal circuits, SPD devices shall comply with UL 1449 3rd Edition and UL 1283 as an electromagnetic interference filter. Provide units that are listed and labeled by UL. Products that have been "Tested to UL Standards" by a Nationally Recognized Testing Laboratory (NRTL) will not be accepted.

2. For telephone circuit protection, SPD devices shall comply with UL 497A.

B. ANSI Compliance: Use SPD devices that comply with ANSI/IEEE C62.41 and ANSI/IEEE C62.33.

C. NEC Compliance: Use SPD devices that comply with NEC Article 285.

1.04 EXTENDED WARRANTY

A. Provide written warranty, signed by the manufacturer, agreeing to replace any surge suppressor which fails in service within five years following the guarantee period specified in the General Conditions.

PART 2 MATERIALS

2.01 GENERAL

A. SPD's for power circuits shall be the product of a single manufacturer and shall be of modular construction designed for field replacement.

B. SPD's shall be capable of performance at ambient temperatures between 40°C and 60°C, at relative humidity ranging from 0% to 95%, and at elevations ranging from sea level to 12,000 feet.

C. SPD's shall be fused to disconnect the suppressor from the electrical source should the suppressor fail. The fusing shall allow full surge handling capabilities and afford safety protection from thermal overloads and short circuits.

D. Design SPD's for the specific type and voltage of the electrical service. Single-phase and 3-phase wye-configured systems shall have L-N, L-G, and N-G protection. Grounded delta-configured systems shall have L-L and L-G protection.

E. Power Filter: The SPD's shall include a high-frequency extended range power filter and shall be UL 1283 listed as an electromagnetic interference filter. The filter shall provide minimum noise attenuation as follows:

F. Provide SPD's devices at the end of all exterior (external to building) power branch circuits.

G. Provide SPD's devices at each exterior (external to building) analog and control device.

Attenuation Frequency	100 KHz	1 MHz	10 MHz	100 MHz
Insertion loss (ratio)	50:1	350:1	500:1	250:1
Insertion loss (dB)	34	51	54	48

2.02 MANUFACTURER

A. SPD's shall be products of one of the following manufacturers:

1. APT (Advanced Protection Technologies).

2. Leviton Surge Suppression.

2.03 MAIN DISTRIBUTION SPD'S

A. Provide SPD's meeting ANSI/IEEE C62.41 Location Category C High (20kV/10kA)

B. Maximum single impulse surge current rating shall be not less than the following:

1. L-L Capacity: 200 kA.

2. L-N Capacity: 100 kA.

3. L-G Capacity: 100 kA.

4. N-G Capacity: 150 kA.

C. Suppressor housing shall be in an enclosure that has the same NEMA rating as the panel it protects and painted to match.

D. UL 1449 3rd Edition Voltage Protection Rating (VPR) shall not be more than:

System Voltage	Phase	L-L or L-N UL 3rd Ed. VPR
120	1	900
208Y/120	3	900
480Y/277	3	1,200

2.04 PANELBOARD SPD'S

A. Provide SPD's meeting ANSI/IEEE C62.41 Location Category B (6kV/3kA)

B. Maximum single impulse surge current rating shall be not less than the following:

1. L-L Capacity: 100 kA.

2. L-N Capacity: 50 kA.

3. L-G Capacity: 50 kA.

4. N-G Capacity: 50 kA.

C. Suppressor shall be in an enclosure that has the same NEMA rating as the panel it protects.

D. UL 1449 3rd Edition Voltage Protection Ratings (VPR) shall not be more than:

System Voltage	Phase	L-L or L-N UL 3rd Ed. VPR
120	1	600
208Y/120	3	600
480Y/277	3	1,200

2.05 SHORT-CIRCUIT RATING

A. Provide SPD's with short-circuiting rating permanently marked on the enclosure.

B. Provide SPD's with the same or greater short-circuit rating as the switchboards and/or panelboards with which they are installed.

2.06 ANNUNCIATION

A. Provide unit with LED (Green/Red) indication lights to show the normal (Green=Power on/Protection present) and failed (Red) status of each module. Provide one normally open and one normally closed contacts which operate when the unit fails or loss of AC power.

2.07 SURGE COUNTER

A. Provide each SPD's rated above 100kA with a counter displaying the number of voltage transients that have occurred on the unit input. The counter shall have battery backup and retain the count through system power outages.

2.08 PAIRED CABLE DATA LINE INTERIOR SUPPRESSORS

A. Provide units meeting ANSI/IEEE C62.41, Location Category A.

B. Use bipolar 1,500-watt silicon avalanche diodes between the protected conductor and earth ground.

C. Provide units with a maximum single impulse current rating of 80 amperes (10 x 1,000 microsecond--waveform).

D. Breakdown voltage shall not exceed 36 volts.

E. Manufacturers: Advanced Protection Technologies Model TE/RS2321.5kw or Atlantic Scientific series devices.

2.09 PAIRED CABLE DATA LINE EXTERIOR SUPPRESSORS

A. Provide units meeting ANSI/IEEE C62.41, Location Category A.

B. Suppressors shall be a hybrid design with a minimum of three stages, utilizing solid-state components and operating bi-directionally.

C. Suppressors shall meet or exceed the following criteria:

1. Maximum single impulse current rating of 10,000 amperes (8x20 microsecond--waveform).

2. Pulse Life Rating: 3,000 amperes (8x20 microsecond--waveform); 2,000 occurrences.

3. Maximum clamping voltage at 10,000 amperes (8x20 microsecond current waveform) shall not exceed the peak of the normal applied signal voltage by 200%.

D. Manufacturers: Advanced Protection Technologies Series CEP, Atlantic Scientific Corporation, Square D Surgelogic, or equal.

PART 3 EXECUTION

3.01 APPLICATION REQUIREMENTS

A. Install SPD's as indicated and:

1. On each building service entrance panel.

2. On each motor control center.

3. On each distribution panel, subpanel, and branch panel.

4. On 120-volt power connections at each signal system panel, including telephone power supplies, and similar panels and dedicated circuits.

5. On each Power supply to instrumentation and control system cabinets.

6. Install SPD’s for circuits sensing, powering, and controlling devices located or mounted external to a building.

B. Only one SPD is required to be installed within 50 linear feet of power circuit.

C. Electronic Equipment Paired Cable Conductors: Install data line suppressors at the low-voltage input and output of each piece of equipment.

1. Use secondary protectors on lines that do not exit the structure.

2. Use primary protectors on lines that exit and enter the structure.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install SPDs according to manufacturer's recommendations.

B. Install suppressors directly to the cabinet which houses the circuit to be protected so that the suppressor leads are straight and short, with all conductors laced, running directly to the point of connection within the panel, without loops or bends. If bends are unavoidable, no bend may exceed 90 degrees and bending radius may not be less than 6 inches.

C. Provide at least 3 inches of separation between line-side and load-side connecting wires. Do not bundle line-side and load-side conductors together or run them in the same raceway.

D. Field installed conductors shall be the same as specified for building wire, not smaller than No. 8 AWG and not larger than No. 4 AWG. Device leads shall not be longer than the length recommended by the manufacturer, unless specifically reviewed and approved by the manufacturer.

E. Provide dedicated disconnecting means for SPD devices installed at main service entrance location, in switchboards, and in motor control centers. Provide dedicated 30-ampere circuit breakers, number of poles as required, as disconnecting means for SPD’s installed in panelboards. The interrupting capacity of the circuit breakers shall be that specified for the other breakers at that location.

3.03 SPARE PARTS

A. Provide spare SPD components as follows:

1. Provide one spare module of each different type needed.

END OF SECTION

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SECTION 26 50 00

LIGHTING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contactors, clocks and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

1.02 STANDARDS

A. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be Underwriters Laboratories labeled.

1.03 RELATED WORK

A. Panelboards shall be as specified under Section 26 05 90.

B. Conduit shall be as specified under Section 26 05 34.

C. Wire shall be as specified under Section 26 05 19.

D. Transformers shall be specified under Section 26 12 16.

PART 2 PRODUCTS

2.01 MATERIALS

A. Switches:

1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type. All switches shall conform to Federal Specification W-S-896-D.

2. Wall switches shall be of the following types and manufacturer or approved equal.

a. Single pole - Arrow-Hart or Leviton.

b. Double pole - Arrow-Hart or Leviton.

c. Three way - Arrow -Hart or Leviton.

d. Four way - Arrow-Hart or Leviton.

e. Single pole, key operated - Arrow-Hart or Leviton.

f. Momentary contact, 2 circuit, center off - Arrow-Hart or Leviton.

B. Receptacles:

1. Wall receptacles shall be of the following types and manufacturer or approved equal.

a. Single, 20A, 125V, 1P, 3W; Arrow-Hart or Leviton.

b. Duplex, 20A, 125V, 2P, 3W; Arrow-Hart or Leviton.

c. Weatherproof, 20A, 125V, 2P, 3W; Arrow-Hart or Leviton and Crouse-Hinds cover or Leviton.

d. Corrosion-resistant, duplex, 20A, 125V, 2P, 3W; Arrow-Hart or Leviton and Crouse-Hinds cover.

e. Ground fault interrupter, duplex, 20A, 125V, 3P, 2W; Arrow-Hart or Leviton.

f. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart.

g. Weatherproof cover for G.F.I. receptacle in FS box; Arrow-Hart or Leviton.

h. Single, 20A, 250V, 2P, 3W; Arrow-Hart or Leviton.

i. Single, 30A, 125V, 2P, 3W; Arrow-Hart; cap: Arrow-Hart or Leviton.

2. Special wiring devices shall be provided as noted of the drawings.

a. Tamper resistant duplex receptacle Leviton or approved equal.

C. Device Plates:

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

2. Plates for surface mounted device boxes shall be of the same material as the box.

D. Lighting Fixtures:

1. Lighting fixture types shall be LED type as shown on the "Lighting Fixture Schedule" on the Drawings. The catalog numbers listed are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be reviewed. Photometric evaluation shall be submitted in order for Engineer to consider equivalency.

PART 3 EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Flexible fixture hangers shall be used for all pendant mounted fixtures.

D. Receptacles shall be mounted 36 inches above the floor unless otherwise noted on the Drawings.

3.02 SPARE LAMPS

A. Spare LEDs shall be provide for all fixture types supplied. Quantity shall be 5 for each type fixture used on project.

3.03 CLEANING UP

A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

SECTION 27 13 33

FIBER OPTIC SUB-SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Work includes furnishing, installing, and testing all fiber optic cable links described under Specification Section 40 95 00. Final connection of the fiber optic cables shall be performed by, or under the supervision of, the SYSTEM SUPPLIER defined under that Specification Section.

B. All work covered by this specification shall be performed by a SUB-CONTRACTOR experienced in fiber optic cable installation.

C. The SUB-CONTRACTOR shall furnish all labor, materials, equipment, services and incidentals required to install the fiber optic network as shown on the Contract Drawings, and as specified herein.

D. The SUB-CONTRACTOR shall meet all of the requirements of these specifications, and, unless specifically stated otherwise, no prior acceptance of any subsystem, equipment, or materials has been made.

E. It is the ultimate responsibility of the Contractor to furnish a complete and fully operable system that supports the required functions specified elsewhere. The Contractor is to assume full responsibility for additional costs which may result from unauthorized deviations from the specifications.

F. Equipment found to be defective prior to system acceptance shall be replaced and installed at no additional cost to the OWNER.

1.02 RELATED WORK

A. Specification Section 36 05 43 “Underground Electrical Duct Systems” defines requirements associated with the duct bank within which the fiber optic sub-system is to be installed.

B. Specification Section 40 95 00 “Process Instrumentation and Control Systems (PICS)” defines the equipment to be interconnected by the fiber optic sub-system.

1.03 SUBMITTALS

A. Shop Drawings: Submit, in a single package, catalog information, descriptive literature and drawings for all components of the fiber optic system.

B. Test Procedure: Submit the procedure proposed to be followed during duct bank cable pulls. The procedure shall include data sheets to be used to record cable pull lengths and the attenuation readings before and after installation as defined in Part 3 herein.

1.04 FINAL DOCUMENTATION

A. Provide a complete wiring diagram of the entire fiber optic system including termination numbers at all fiber patch panels.

B. Distances and installed attenuation of all fiber runs within the duct bank system.

C. Provide a hard copy of all final documentation and also in electronic format on a Compact Disk.

1.05 STANDARDS

A. The design, testing, assembly, and methods of installation of the fiber optic system shall conform to the National Electrical Code and to applicable state and local requirements.

B. Any additional work needed resulting from any deviation from codes or local requirements shall be at no additional cost to the OWNER.

PART 2 PRODUCTS

2.01 FIBER OPTIC CABLE

A. Provide fiber optic cable for implementing the fiber links required within the system. The cable shall meet the following requirements:

1. 62.5/125 micron multimode fiber.

2. Certified for use in underground duct banks.

3. 12-count fibers.

4. Manufacturer: Corning or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance. Coordinate the work with the OWNER and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the existing plant during construction.

B. Install suitably sized innerduct in all duct bank conduits. Exposed innerduct shall be labeled with fiber optic warning labels where they enter the duct bank and every three feet in between.

C. All cables shall be clearly labeled at each end with source and destination.

D. Install all duct bank fiber cable runs in accordance with the manufacturer's recommendations and including:

1. Use manufacturer approved cable lubricant.

2. Use a pulling winch that continuously monitors and records the pull tension.

3. Note from the distance markers on the cable the exact length of each installed run and record the information.

E. All pulling equipment and hardware that will contact the cable shall be sized to maintain the cable's minimum bend radius.

F. Do not utilize a figure-of-eight machine for installation without prior written confirmation of compatibility from both the machine and cable manufacturer.

3.02 TESTING

A. Measure the attenuation of the fiber optic cable prior to installation and determine the average attenuation per foot.

B. Following installation, measure the attenuation of each run and compare the attenuation per foot readings with those taken prior to installation. Replace any runs whose attenuation per foot reading is more than 10% higher than the pre-installation value.

C. Provide all special testing materials and equipment.

D. Coordinate all testing with the CONTRACTOR, the ENGINEER, all affected suppliers, and the OWNER.

E. The ENGINEER reserves the right to test or retest any and all specified functions whether or not explicitly stated in the approved test procedures. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.

END OF SECTION

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. The work covered under this section of the specification includes the provision of all labor, materials, and supervision necessary to install and test a Fire Alarm System. This shall include but not be limited to provision of the following:

Pull Stations	Strobe Lights
Audible/Strobe Combinations	System Start-up, Test
Duct Detectors	Area Smoke Sensors

1.02 DESCRIPTION

A. The new Fire Alarm System shall be an electronically supervised, intelligent (Analog) system. All components of the system must be listed by Underwriters Laboratories (U.L.). The system must be installed with the necessary hardware to accommodate connection to a U.L. Certified Central Station Alarm monitoring. The system must be U.L. Certificated prior to acceptance.

B. Intelligent (Analog) systems are defined as those where the Fire Alarm Control Panel communicates with its sensing devices (heat/smoke) in order to receive measured information in analog form (e.g., measured level of obscuration, measured level of dirt/dust particles, measured level of temperature) and report this information to the panel. Further, the panel will be programmed such that dirt accumulation or variations in obscuration, and temperature can be quantified to produce warnings in advance of the device going into alarm.

C. The System will provide a three-pulse temporal signal to the horns. A switch shall be provided on the control panel for silencing the alarm devices. Any additional incoming alarm shall operate normally. Each alarm shall be represented on the control panel by an audio and visual indication.

D. All visual indicating circuits will be wired on a separate circuit independent of horn/speaker circuits. All strobe circuits, during an alarm condition, will have the

option of remaining active after a signal silence and only turn off on a panel reset or turning off after the signal silence is activated.

E. All duct detectors will be equipped with a test switch and annunciator light located in immediate proximity to the duct detector and be readily accessible. All of the duct detectors will be programmed to cause a supervisory signal rather than a full alarm signal to the Central Station.

F. All systems containing two or more fire alarm control panels which are linked together will be linked with fiber optic cabling.

G. If there is a generator feeding the building the fire alarm must be on the generator circuit.

H. Conduit fill will not exceed 60%.

I. County will provide dedicated phone numbers for the fire alarm dialer. The Contractor awarded the installation of the Fire Alarm System will be responsible for wiring the phone lines to the Fire Alarm panel's Digital Communicator (DAC).

J. All conduit junction boxes and couplings will be painted RED and marked FA in white.

K. The fire alarm system will be designed and sized to have a minimum of 10% expansion capability to add additional devices. This expansion capability will necessitate that the system be equipped with the appropriate power supplies and connections to handle a minimum of 10% additional signaling devices.

L. All wiring entering and leaving the panel and junction boxes will be permanently labeled in such a manner as to indicate the type of device and its location. All wires that leave or enter the panel from outside the building must have surge and transient protection at the panel with devices that will limit the voltage to no more than 10% above the peak operating voltage of the devices connected to the wires.

M. See attached list of acceptable and pre-approved bench marked equipment.

1.03 QUALITY ASSURANCE AND WARRANTY

A. Perform all work in accordance with the following codes and standards:

1. Federal, state and local codes, regulations and ordinances.

2. National Electrical Code (NEC), latest edition.

3. Occupational Safety and Health Act (OSHA).

4. All authorities having jurisdiction

5. Factory Mutual System (FM) requirements

6. EIA, Electronics Institute of America.

7. UL, Underwriters Laboratories.

8. American Disability Act (ADA).

9. National Fire Alarm Code NFPA 72 1996 Edition.

10. Life Safety Code (NFPA 101).

B. System Warranty: All components, parts, assemblies and software shall be guaranteed against defects in materials and workmanship for a period of a least 24 months, beginning on the date of acceptance by the local Fire Marshal and ELECTRONIC SERVICES & SECURITY= designated representative. Warranty service shall be provided by a manufacturer=s authorized representative 24 hours per day, 7 days per week. The representative shall be based in a fully staffed branch office located within one (1) hour travel time of the installation site and respond within this time. All repairs performed during the warranty period must be non-chargeable for labor, material, and travel time. All repairs performed during the warranty period shall be completed within the time limitations imposed by NFPA rules. The initial fire alarm call will be handled by ELECTRONIC SERVICES & SECURITY who will assess the problem, and notify the vendor of corrective action required. Failure of the vendor to respond and perform accordingly will result in disqualification of future bids on similar projects for the COUNTY.

1.04 SUBMITTALS

A. Shop drawings and catalog data submittals shall be made in accordance with the Section 01 33 00-Contractor Submittals and shall include the following:

1. Manufacturer’s installation diagrams, written product specifications, and instructions for installation, operation and maintenance.

2. Completer riser diagram.

3. Manufacturer’s published product warranties and warranty instructions.

4. Data sheets on each item of equipment.

5. List of device location indicating specific zone designation.

6. List of all programming and access codes associated with the panel.

B. At completion of project, prior to final payment vendor must provide to ELECTRONIC SERVICES & SECURITY the following:

1. Manufacturer’s installation diagrams, written product specifications, and instructions for installation, operation and maintenance.

2. Manufacturer’s published product warranties and warranty instructions.

3. 2 sets of As-Built drawings.

4. Data sheets on each item of equipment.

5. List of device location indicating specific zone designation. Two (2) sets.

6. List of all programming and access codes associated with the panel. Two (2) sets.

7. Supply all software required to program/re-program fire alarm panel/components, dialers and any other device required for operation of the system.

8. Special equipment required to program/re-program the panel/dialer and associated equipment not to include a laptop computer.

C. At the Fire Alarm Panel, install the following:

1. Plan drawings (1/16" = 1' - 0" or larger as required for clarity), modified to include new equipment, showing location of automatic detectors and manual pull stations. Drawings shall be professionally drawn on suitable drafting medium 8.5" x 11" and shall reflect the system as installed. Devices shall be numbered in a manner that reflects the ZONE/DEVICE location.

2. A Certificate of Completion as required by N.F.P.A.

3. A Certificate of Inspection, showing a completed 100% test, as required by N.F.P.A.

1.05 SYSTEM OPERATION

A. Initiation Circuits: The occurrence of an open circuit in the initiation circuit shall cause a trouble indication. The occurrence of a ground condition in the initiation circuit shall cause a trouble and a panel ground fault indication.

B. Signal Circuits: The occurrence of an open circuit in a signal circuit shall cause a signal zone trouble indication. The occurrence of a ground condition in a signal circuit shall cause a signal zone trouble indication and a panel ground fault indication. A single ground in a signal circuit shall not inhibit the signals from working properly.

C. Remote Annunciation: Shall be supervised as required for signal circuits and be of the LCD design.

D. The system shall detect the following conditions:

1. Loss of primary and/or secondary operating power.

2. A single ground, open, or short on any installation wiring to supervisory or alarm initiating devices.

3. A single ground, open or short on any installation wiring to the system speaker, remote supervised annunciator and remote telephone station.

4. Failure of a tone generator, pre-amplifier, or power amplifier in the audio subsystem.

E. Alarm Initiating Devices: If an alarm initiating device is activated, the following responses shall automatically occur:

1. Visual indication shall identify the specific device in alarm, and common audible and visual alarm signals shall be generated by the Fire Alarm Control Panel.

2. An audio indication shall produce a message to the audible devices sufficient to produce an audio signal 15db over ambient noise.

3. Auxiliary relays shall be installed to accommodate accessories such as: Air-handler shutdown, vent fans etcetera), to match the design of the system , as required by NFPA standards and rules.

4. The device shall be a measured device having the capability to send

measured and intelligent signals back to the panel stating the condition of the device (e.g., measured level of obscuration, measured particles of dirt/dust and measured temperature levels).

F. Control Panel: The Fire Alarm Control Panel shall detect the operation of any signal initiating device, operate all alarm and auxiliary devices, and in addition shall function as follows:

1. A pilot lamp shall be normally on, indicating that the system is receiving power from the building service supply.

2. A visual and audio trouble indication, operating together, shall signal any trouble condition. Failure of the building service power supply, disarrangement in system wiring, or alarm condition shall activate the visual and audio trouble indication. A silencing switch shall be provided to silence the trouble audio indicator, which shall be so arranged that the visual trouble indication will remain illuminated until the system is restored to a normal operating condition.

3. The system shall have the capability to shut down the air handlers in the area of the alarm.

4. The system shall have AUTO PROGRAMMING. Auto Programming is a feature which allows the panel to Alearn@ what devices are physically connected and automatically load them in the program with default values for all parameters.

5. The DAC shall have the capability to call the monitoring station, provided by the County, sending individual point annunciation using Point Contact I.D. format.

1.06 SYSTEM TESTING & ACCEPTANCE

A. It is the responsibility of the vendor to meet with the appropriate ELECTRONIC SERVICES & SECURITY representative to compare the placement and installation of proper devices with the drawings and specifications (as-built prints must be furnished to ELECTRONIC SERVICES & SECURITY). A 100% device by device test to be conducted by the vendor under the supervision of ELECTRONIC SERVICES & SECURITY. Further, the vendor will be required to demonstrate that the installed interface modem is functioning properly by remotely accessing the fire

alarm panel(s) for appropriate history information. Punch lists will be developed at this time by ELECTRONIC SERVICES & SECURITY and furnished to the vendor. All punch list items must be corrected and verified as such by ELECTRONIC SERVICES & SECURITY prior to acceptance of the system.

1.07 TRAINING

A. The contractor and/or manufacturer's representative shall instruct the ELECTRONIC SERVICES & SECURITY representative in the operation, maintenance, and repair of the system to the sub-assembly level, including familiarization with the operation, maintenance, and parts manual.

1.08 SPARE PARTS

A. A spare parts inventory of 5 smoke Sensors, Pull Stations, Heat Sensors and Audible/Visual Signaling Devices will be supplied to ELECTRONIC SERVICES & SECURITY prior to acceptance.

1.09 LIST OF PRE-APPROVED EQUIPMENT

A. This specification delineates various manufacturers with respective equipment model numbers that meet County requirements. These manufacturers have been listed as a benchmark reference simply to assist vendors. Vendors are under no obligation to propose the equipment models listed. Equivalents that meet the salient features of the pre-approved benchmark equipment will be considered.

FIRE ALARM PANELS

FCI	7200 SERIES
GRINNELL	TFX SERIES
NOTIFIER	400, 640 & 3030 SERIES
SIMPLEX	4010, 4020 & 4100 SERIES

SMOKE SENSORS

FCI	ASP - PL
GRINNELL	900 SERIES
NOTIFIER	FSP 851
SIMPLEX	4098-9701, 4098-9710

THERMAL DETECTORS

FCI	ATD - R
GRINNELL	912 SERIES
NOTIFIER	FST 851
SIMPLEX	4098 -9732

DUCT DETECTORS

FCI	DH 500 SERIES
GRINNELL	900 SERIES
NOTIFIER	FSD 751RP
SIMPLEX	4098 -9752

EMERGENCY AUDIBLE AND STROBE DEVICES

FCI	HA/VA 4W
GENTEX	HS 24 & ST 24 SERIES
NOTIFIER	P1224 MC
SIMPLEX	4903-9146, 4903-9219

PULL STATIONS

FCI	MS - 7A
GRINNELL	IXA - RMS
NOTIFIER	NBG12LX
SIMPLEX	4099-9003, 2099-9761

DIGITAL COMMUNICATOR

FCI	411
GRINNELL	5128

NOTIFIER	UDACT
SIMPLEX	4010-9816, 4020-0155, 4100-0155

PART 2 - PRODUCTS

2.01 SYSTEM DESIGN

A. Alarm System

1. Furnish and install a fully field programmable/analog addressable fire detection system. The System shall be of the type that automatically programs itself upon initiation. The System shall determine the number of installed analog addressable loops and all installed devices. It shall determine the type of device, the device number, and record the device's analog reading and sensitivity setting. The System shall use Style 4 signaling line circuits and Style Z indicating appliance circuits with individual device supervision and annunciation, primary and secondary supervision. The System shall include:

   a. control panels

   b. addressable manual pull stations

   c. addressable smoke sensors

   d. addressable thermal sensors

   e. duct detectors

   f. addressable Conventional Zone Interface modules

   g. addressable Point Identification Devices

   h. addressable Relay Control Elements

   i. addressable Signal Control Elements

   j. isolation devices

   k. analog/addressable loop modules

   l. audio/visual devices

   m. visual devices

   n. wiring

o. connections to devices

p. outlet boxes

q. junction boxes

2. In addition, include other necessary material for a complete operating system. System shall allow for loading or editing special instructions and operation sequences as required. System shall be site programmable to accommodate and facilitate expansion or changes. System shall be capable of generating the programming necessary to establish a fully functional general alarm system upon initialization. Software operations are to be stored in a non-volatile programmable memory. Loss of primary and secondary power shall not erase the instructions stored in memory. Selective input/output control functions based on ANDing, ORing, NOTing, timing and special coded operations shall be incorporated in the resident software programming of the system.

B. Job Site Changes

1. To accommodate and facilitate job site changes, initiating and indicating circuits shall be individually configurable on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or an alarm verification circuit.

2.02 OPERATIONS

A. Display

1. Under normal condition, front panel shall display a “SYSTEM NORMAL” or equivalent message and the current time and date.

B. Sequence of Operation

1. Operational manual stations or activation of area smoke sensors and thermal sensors as follows unless noted otherwise:

a. Annunciate device type, location by building, floor, circuit and time on FACP mounted alphanumeric annunciator.

b. Trip existing master box code transmitter to alert Fire Department. (Response will be required to reset FACP.)

c. Building audio/visual devices to sound, except activation of a single smoke detector shall not sound devices until a second device of any type is activated.

d. Operate prioritized outputs to release egress doors throughout the building and as indicated on the contract drawings.

e. Operate prioritized outputs to signal shut-down of ventilation equipment.

C. Abnormal Conditions

1. Panel shall display the following information relative to the abnormal condition of a point in the system:

a. Alphanumeric custom location label (minimum of 30 alphanumeric characters)

b. Type of device

c. Point status

D. Alarm or Trouble Condition

1. Pressing the appropriate FACP acknowledge button shall acknowledge the alarm or trouble condition. After the points have been acknowledged, the LED's shall glow steady and the panels audible signal will be silenced. Total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. End of the list shall be indicated.

E. System Reset

1. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The display shall step the user through the reset process.

2. Should an alarm condition continue to exist, system will remain in an abnormal state. System control relays shall not reset. The panel audible signal and the alarm LED shall be on. The display will indicate the total number of alarms and troubles present in the system along with a prompting to review the points.

F. History Logging

1. The control panel shall have the ability to store a minimum of one thousand (1000) events in a log. These events shall be stored in a battery-protected memory.

2.03 PRIMARY POWER

A. Obtain primary power 208/120 VAC 50/60hz, at the electrical room location as indicated on the Contract Documents. Primary power source shall be identified FIRE ALARM SYSTEM with a red and white engraved plastic sign permanently affixed to the face of the panel adjacent to the circuit breaker. Install lock clips on circuit breakers in the “ON” position.

2.04 AUXILIARY POWER (SECONDARY POWER)

A. Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

B. Batteries

Provide rechargeable lead acid type with sufficient ampere-hour rating to operate the system under supervisory and trouble conditions, including audible trouble signal devices for 24 hours and audible and visual signal devices under alarm conditions for an additional 5 minutes. House batteries either within the control panel or in a separate substantial steel cabinet, and finish on inside and outside with enamel paint; equip with a non corrosive base and cylinder lock keyed to match FACP. Separate cells to prevent contact between terminals of adjacent cells and between terminals and other metal parts. Locate cabinet to allow convenient viewing and servicing of the batteries. The battery cabinet, if provided, shall be identified FIRE ALARM SYSTEM BATTERY CABINET with a red and white engraved plastic sign permanently affixed to the face of the panel.

C. Battery Charger

Provide solid state automatic float type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less. Locate charger within the control panel or within the battery cabinet. Provide voltmeter and ammeter to indicate battery voltage and charging current.

2.05 WIRING

A. Conductors

1. Provide in accordance with NFPA 70 and NFPA 72. Conductors shall be copper. Identify conductors within each enclosure where a tap, splice, or termination is made. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Wire the alarm initiating and notification signal devices so that removal will cause the system trouble device to sound.

B. Terminations

1. Connections, junctions and conductor terminations shall be made with screw terminals at risers only. Wire nuts are permitted in places where “T” tapping occurs. Terminate strips everywhere except in control panels. Termination’s with operating voltage of 50 volts or more shall be provided with protective cover and shall be labeled with the voltage.

2.06 COMPONENT DESIGN

A. Colors - Provide finish colors under this section in accordance with FED-STD-595.

2.07 FIRE ALARM CONTROL PANEL (FACP)

A. Requirements

1. FACP shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with cylinder lock. The door can be either hinged or completely removable to allow access for service. Control panel shall be a neat, compact assembly containing components and equipment required to provide the specified operating and supervisory functions of the system. Each initiating circuit shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones. Loss of power, including any batteries, shall not require the reloading of a program from any source. Upon restoration of power, start-up shall be immediate, automatic and shall not require manual operation. Loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Enclosures shall be provided with ample gutter space to

allow proper clearance between the enclosure and live parts of the panel equipment.

B. FACP shall be intelligent, with its own microprocessor and memory. FACP shall be UL listed independently as a fire alarm control unit. FACP shall be capable of automatically programming itself upon initialization and of creating the System Program. FACP shall be capable of automatically updating the initial System Program to accommodate added or deleted devices on any analog circuit. FACP shall be capable of identifying and programming a General Alarm condition for all installed devices. The system shall be capable of identifying the number of analog addressable circuits, the number of devices on all circuits, the device type and location.

2.08 CONTROL FUNCTIONS

A. Control functions shall be assigned on the basis of system initiation patterns of devices such as “anding” circuits, counting circuits, counting devices, “anding” groups and “anding” types of devices.

2.09 SUPERVISION

A. FACP shall supervise each individual device on an initiating circuit such that trouble supervisory, normal, pre-alarm and alarm thresholds are individually annunciated. Each device on an addressable initiating circuit shall be checked to include the following: sensitivity, response, opens, shorts, ground faults, functionality and status.

2.10 REPORTING A FAILURE

A. FACP shall report the failure of a device’s transmitting component’s, open or shorted, on an addressable initiating circuit. Device shall be recognized and identified by location within the circuit to the specific devices, and other devices on the circuit shall continue to function properly.

2.11 DEVICES

A. FACP shall report by specific device and address, any device which has been removed from an addressable initiating circuit, and shall not disrupt the operation of the remaining devices to function. The system shall be capable of sounding a Trouble if the device replaced is a different device type than the device removed.

2.12 ACCESSORIES

A. FACP shall be completely equipped and be provided with 25 percent spare initiating and indicating circuits, including modules, enclosure space, terminal strips, internal electronic memory and other necessary accessories complete and ready to accept future circuits. The FACP shall be capable of automatically updating the System Program to adjust for such changes.

2.13 POWER

A. FACP shall provide power necessary for the devices connected to it, including relays. Provide a green LED to indicate normal system power is functioning.

2.14 HARDWARE AND SOFTWARE

A. Hardware and software, which define system configuration and operation, shall be provided. Memory data and operating system software shall be contained in a non-volatile memory.

2.15 SMOKE SENSORS

A. Smoke sensors shall be provided with alarm verification with field-adjustable time from 0 to 60 seconds. System shall initially set up with a 30-second verification period.

2.16 DETECTOR SENSITIVITY

A. FACP shall be capable of measuring and adjusting the sensitivity of sensors. Provide alphanumeric display-to-display custom messages and give readings of sensor sensitivity, sensor by sensor. It shall be possible to change the sensor sensitivity from the FACP within maximum and minimum values as defined by the UL listing of the sensors. System shall be capable of listing sensor sensitivity settings on the printer for permanent record.

2.17 SMOKE OBSCURATION SENSITIVITY

A. Control panel shall maintain a moving average of the sensors' smoke chamber value to automatically compensate (move the threshold) for dust and dirty conditions that could affect detection operations. System shall automatically maintain a constant smoke obscuration sensitivity for each sensor (via the floating threshold) by compensating for environmental factors. The smoke obscuration sensitivity shall be

adjustable within the UL 268 window (0.5 percent to 4.0 percent) to compensate for any environment.

2.18 DIRTY SENSOR INDICATION

A. System shall automatically indicate when an individual sensor needs cleaning. When a sensor's percentage of compensation reaches a predetermined value, a "DIRTY SENSOR" or equivalent trouble condition shall be audibly and visually indicated at the control panel for the individual sensor. To prevent false alarms, these "DIRTY" conditions shall in no way decrease the amount of smoke obscuration necessary for system activation.

2.19 SELF-TEST ROUTINE

A. Control panel shall continuously perform an automatic self-test routine on each sensor, which will functionally check sensor sensitivity and ensure the accuracy of the values being transmitted to the control panel. Any sensor that fails this test shall indicate a trouble condition with the sensor location at the control panel.

2.20 RESETTING AND TESTING THE SYSTEM

A. It shall be possible to test, reset and alarm silence from the FACP. New unacknowledged alarms and troubles shall be distinctively displayed on both the visual display and the printer and differentiated from previous alarm and troubles. System shall automatically indicate the total quantity of alarms and of trouble which have occurred prior to reset at the control unit. No alarm or trouble indication shall be re-setable until it has been acknowledged. It shall not be possible to reset the system until alarms have been acknowledged.

2.21 FACP SWITCHES

A. FACP switches shall allow authorized personnel to accomplish the following, independent of the main operating console:

1. Trouble silencing switch, which transfers trouble signals to an indicating lamp.

2. Evacuation alarm silencing switch which, when activated during alarm, silences alarm devices and, upon clearing the alarm, causes operation of the system trouble signals until the switch is returned to the normal position. Upon activation of a second alarm while silenced, causes the evacuation

alarm to re-sound. Operation of the switch when there is no evacuation alarm causes operation of the system trouble signals.

3. Transmitter disconnect switch which, when activated, disconnects the transmitting device and causes operation of the system trouble signals.

4. Reset zones after initiating devices have been returned to normal.

5. Perform a complete operation test of the microprocessor with a visual indication of satisfactory communications with each board.

6. Test panel LED's for proper operation without causing a change in the condition on any zone.

2.22 FIELD PROGRAMMING EQUIPMENT

A. Provide field programming equipment, software devices, software, computers and other equipment necessary, including interconnection cables to accommodate field software programming changes to be made by the Government to change device descriptions, sensitivity setting, control, device type and addition or deletion of devices.

2.23 LOCKABLE EQUIPMENT

A. Lockable equipment shall have CAT 60 locks and keys. All devices and cabinets shall be keyed alike.

2.24 MANUAL STATIONS

A. Provide an addressable non-coded double action type with mechanical reset features. Locate stations as indicated. Stations shall be die cast aluminum semi-flush or surface-mounted. Surface-mounted boxes shall be painted the same color as alarm station. Mount stations with the base at 4 feet above finished floor and no more than 5 feet from any door, measured horizontally, as shown. Provide each station with screw-type terminals of proper number and type to perform functions required. Break-glass-front stations will not be permitted; however, a pull-lever, break-glass-rod type is acceptable. The manual alarm station shall require a key to reset or test.

2.25 SMOKE SENSORS

A. Provide analog addressable smoke sensors of the photoelectric and ionization type, which shall communicate actual smoke chamber values to the system fire alarm control panel. Detectors shall be uniquely identifiable to FACP.

B. Sensors shall be listed to UL 268 and shall be documented compatible with the control equipment to which they are connected. Sensors shall be listed for both ceiling and wall-mount applications.

C. Each sensor base shall contain a LED that, when the control panel determines that a sensor is in the alarm or trouble condition, the control panel shall command the LED on that sensor's base to turn on steady, indicating the abnormal condition.

D. Sensor's electronics shall be immune from false alarms caused by electromagnetic interference and radio frequency interference.

E. Detectors shall be nominal 24 Vdc powered by initiating circuit.

F. All sensor addressing information shall be stored in the fixed base. Addressing information that is stored in the removable sensor is not acceptable.

2.26 DUCT SMOKE DETECTORS

A. Detectors in duct shall be analog addressable photoelectric type and listed by UL or FM for duct installation. Duct detectors shall be provided with approved duct housing, mounted exterior to the duct, and shall be provided with perforated sampling cubes extending across the width of the duct. Activation of duct detectors shall cause actuation of the fire alarm control panel in the same manner as other alarm initiating devices and in addition, cause all air-handling units to be deactivated. Detector head shall contain amplifier-switching circuitry. The amplifier switching circuit shall be entirely solid-state and operate with a nominal detector line voltage of 24 volts dc. Detectors to be equipped with screw terminals. Detector to be provided with indicating lamp and test switch and in test position bypass fan shutdown feature.

2.27 ADDRESSABLE POINT IDENTIFICATION DEVICE

A. The Point Identification Device shall be provided to connect single supervised conventional initiating contact type device such as water flow switches, tamper switches, single detectors, and other such devices to any of the two-wire intelligent analog loop cards. The Point Identification Device shall mount in a 4 inch square, 2

1/8 inch deep electrical box and shall be capable of (Class “A”) supervised wiring to the initiating device. The Point Identification Device shall contain an integral LED that annunciates module activation. The Point Identification Device shall provide address setting means switches and store an internal identifying code, which the control panel shall use to identify the type of device.

2.28 ADDRESSABLE CONTROL ELEMENT

A. The Addressable Control Element shall be provided to connect and supervise, conventional indicating device or zone of indicating devices that required an external power supply, such as horns, strobes to any of the (2) wire intelligent analog loop cards. The Control Element shall be capable of operating as a relay (dry contact form C,) to control door holders, air-handlers, and other such devices. Control Elements shall mount in a 4 11/16 inch square, 3 inch deep electrical box and shall be capable of (Class “A”) supervised wiring to the indicating or control device. Control Element shall contain an integral LED that annunciates module activation. Control Element shall provide address setting means switches and store an internal identifying code in which the control panel shall use to identify the type of device. The Addressable Control Element shall be capable of providing feedback to the FACP for positive confirmation of the controlled devices activity.

2.29 AUDIO/VISUAL ALARMS

A. Provide recessed and surface-mounted approved combination audio/visual alarm devices consisting of a grill electronic type alarm horn suitable for use in an electrically-supervised circuit and top-mounted integral flashing strobe light. Horn shall have a sound rating of at least 96 decibels at 10 feet. Provide lamps of the flashing stroboscopic type, powered from the control panel alarm circuit. Lamps shall produce a minimum of 100 candela and be designed for one flash per second. Lamps shall be protected by a translucent white polycarbonate lens and shall be labeled FIRE.

2.30 VISUAL ALARMS

A. Provide flush and surface-mounted lamp assembly suitable for use in an electrically-supervised circuit. Provide lamps of the flashing stroboscopic type, powered from the control panel alarm circuit. Lamps shall produce a minimum of

100 candela and be designed for one flash per second. Lamps shall be protected by a translucent white polycarbonate lens and shall be labeled FIRE.

2.31 NAMEPLATES

A. Major Components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment.

2.32 WIRING

A. Provide wiring materials under this section as specified in Section 16120, with the additions and modifications specified herein.

2.33 FIELD PROGRAMMER

A. The manufacturer must provide for initial installation a UL listed programmer/tester.

B. The programmer shall be portable with internal rechargeable battery and charging supply sufficient for four hours of use before requiring recharging.

C. The programmer shall set and verify the device address and perform a device test to assure operation within the UL defined detection window. This programming and testing shall be done independent of the control panel and system wiring.

D. The programmer shall be menu driven with an integral keypad and LCD display.

E. The programmer shall contain an integral detector base and non-polar leads to program and test intelligent modules with screw terminals.

F. The programmer tester shall dynamically display in real time, the detector chamber analog voltage.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. All systems shall be installed in a workmanlike manner.

2. Install work in accordance with manufacturer's approved product installation instructions, drawings and herein specified.

3. All interfaces with external devices must be coordinated with the

manufacturers of those devices to ensure compatibility. Ensure that control relays are properly rated for its function.

B. Conductors

1. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

2. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

3. Wiring for analog loop circuits shall be 18 AWG twisted. Wiring for strobe circuits shall be a minimum 14 AWG.

4. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturers' recommendations.

5. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

6. Permanently label or mark each conductor at both ends with permanent alpha-numeric wire markers.

7. A consistent color code for fire alarm system conductors throughout the installation.

C. Conduit

1. All wiring must be in conduit.

2. All conduit must be installed using standard electrical practice and to meet all applicable codes and standards.

D. Smoke detector installation

1. To avoid voiding warranties, smoke detectors must remain protected with a plastic wrapper to keep out dust until all other trades are complete and the building cleaned.

2. Detectors must be programmed and tested by the electrical contractors before installation.

END OF SECTION

SECTION 31 11 00

SITE PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Layout of work and protection of bench marks.

B. Protection of structures, trees, or vegetation to remain.

C. Clearing and grubbing.

D. Stripping and storing topsoil.

1.02 RELATED SECTIONS

A. Section 31 23 33 - Trenching, Bedding and Backfilling

B. Section 31 25 00 - Erosion and Sedimentation Control

1.03 COORDINATION

A. Refer to Drawing G-1 for a list of utility companies that may have facilities in the project area and coordinate with them to avoid service interruptions and/or safety hazards:

B. Contact "Sunshine State, One-Call" 1-800-432-4770, to determine if there are other utilities in the area, and their location.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 BENCH MARKS AND MONUMENTS

Maintain all existing benchmarks, monuments and other reference points; if destroyed, replacement costs will be deducted from payments due the Contractor.

3.02 LAYING OUT WORK

A. Base lines, property lines, and easement lines, are shown on the Drawings. Benchmarks utilized are also shown on the drawings. If the bench marks are disturbed as a result of construction activities, reestablish such items by utilizing a Florida licensed surveyor.

B. Stake out the construction, establish lines and levels, temporary bench marks, batter boards, centerlines and reference points for the work, and verify all dimensions relating to interconnection with existing features.

C. Report any inconsistencies in the proposed grades, lines and levels, dimensions and locations to the Engineer before commencing work.

3.03 BURNING

Burning is not allowed.

3.04 PROTECTION OF TREES AND SHRUBS

Existing trees and shrubs within the right-of-way and easements along the work zones shall remain unless specifically required to be removed as indicated on the Drawings. Protect branches, trunks, and roots of trees and shrubs that are to remain. Trees to remain in the construction area shall be boxed, fenced or otherwise protected before any work is started; remove boxing when directed by the Engineer. Do not permit heavy equipment or stockpiles within branch spread. Remove interfering branches without injury to trunks and cover scars with tree paint.

3.05 RELOCATION OF UTILITIES

A. Active utilities which do not interfere with the work shall be supported and protected from damage. After obtaining the Engineer's approval, relocate or remove active utilities which will interfere with work as indicated. Pay for all damage to active utilities and for relocation or removal of all interfering utilities which are ascertainable from Drawings, surveys, site inspection or encountered during construction.

B. Inactive or abandoned utilities and appurtenant structures encountered shall be removed to avoid interference as directed by the Engineer. Exposed ends of abandoned lines shall be plugged or capped in a water-tight manner.

3.06 CLEARING AND GRUBBING

A. Areas to receive clearing and grubbing shall include all areas to be occupied by the proposed improvements, areas for fill and site grading, and borrow sites. Remove trees outside of these areas only as indicated on the Drawings or as approved in writing by the Engineer

B. Clearing shall consist of removing trees and brush and disposal of other materials that encroach upon or otherwise obstruct the work.

C. Exercise extreme care during the clearing and grubbing operations to not damage existing structures, pipes or utilities.

D. Grubbing shall consist of removing and disposing of stumps, roots larger than 2" in diameter, and matted roots. Remove to a depth of not less than 18" below the original surface level of the ground.

E. All combustible debris and refuse from site preparation operations shall be removed to legal off-site disposal areas.

3.07 TOPSOIL REMOVAL

A. All areas to be occupied by proposed improvements, and borrow sites shall be stripped of all brush, weeds, grass, roots and other material.

B. Remove all loamy, organic topsoil suitable for seeding and planting to whatever depth encountered and store separately from other excavated material. Stockpile in designated areas and provide for proper drainage. Cover storage piles as required to prevent windblown dust.

C. In the event that inadequate space within the site or work area is available for stock-piling topsoil without interfering with other construction operations, contact Owner for determination of another storage location.

D. Dispose of unsuitable topsoil as specified under disposal of debris. Excess topsoil shall be removed from site unless specifically noted on Contract Drawings.

3.08 DISPOSAL OF DEBRIS

A. All combustible debris and refuse from site preparation operations shall be burned if allowable and properly permitted, or removed to legal off-site disposal areas.

B. All non-combustible debris (not including acceptable fill material, fences, or other structures), resulting from site preparation operations shall become the property of the CONTRACTOR and shall be removed to legal off-site disposal areas.

END OF SECTION

SECTION 31 22 00

FINISH GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

Topsoil placement, grading of site

PART 2 PRODUCTS

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural topsoil typical of the area, free from subsoil, stones, plants, roots or other extraneous material and shall not be used while muddy or frozen.

B. Topsoil shall contain not less than 8% organic matter (AASHTO T194). The topsoil shall consist of either natural topsoils typical of the locality and free from coarse stone aggregate or surface soils stripped from the site and enriched with humus at a rate of 8% by volume. The soil mixture prepared by mixing surface soils and humus shall be free of oil, cinders, coarse stone, and woody root material.

PART 3 EXECUTION

3.01 GENERAL

Provide all topsoil placement and finish grading and filling to achieve the lines and grades indicated on the Drawings. All earthwork shall be done in a manner that provides drainage.

3.02 TOPSOIL PLACEMENT

Place topsoil in all areas of new grading. The compacted subgrade to receive topsoil shall be scarified to a depth of 3 inches. Topsoil shall be spread evenly and compacted to a thickness of not less than 4 inches, 8 inches in areas to be grassed and planted, and to the proposed elevations and grades. Grade flush with walks, curbs, and paving.

3.03 FINISH GRADING

A. All areas of the project including all previously grassed areas that have been disturbed, borrow sites, excavated and filled sections and adjacent transition areas shall be uniformly smooth-graded. Depressions from settlement shall be filled and compacted. Tops of embankments and breaks in grade shall be rounded. All surfaces shall be finished to provide adequate drainage. Finished surfaces shall be reasonably smooth, compacted, free from irregular surface changes and comparable to the smoothness obtained by blade-grader operations.

B. Slope grades to drain away from structures at a minimum of 3-inch per foot for 10 feet.

C. Finished surfaces adjacent to paved or surfaced areas and within 10 feet of structures shall be within 1 inch of the proposed grade. All other areas shall be within 3 inches of the proposed grade.

D. Newly graded areas shall be protected from traffic and erosion. All settlement or washing away that may occur from any cause prior to seeding or acceptance shall be repaired and grades re-established to the required elevations and slopes at no additional cost to the Owner.

E. Unless otherwise indicated, all surplus material shall be disposed of by the Contractor.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation and fill for roads, ponds, general site work

B. Sheeting, shoring and bracing

C. Compaction

1.02 RELATED SECTIONS

A. Section 31 11 00 - Site Preparation

B. Section 31 22 00 - Finish Grading

C. Section 31 23 19 - Dewatering

D. Section 31 23 33 - Trenching, Bedding, and Backfilling

E. Section 31 25 00 - Erosion and Sedimentation Control

F. Meskel & Associates Engineering, PLLC's Soils Report (Attached)

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:

AASHTO M145 - Classification of Soils

AASHTO T180 - Moisture-Density Soil Sampling and Testing

B. American Society for Testing and Materials (ASTM) latest edition:

1. ASTM D1557 - Moisture-Density Soil Sampling and Testing
2. ASTM D2487 - Classification of Soils

C. Occupational Safety and Health Administration (OSHA) Regulations, including:

1. Part 1926 Subpart P - Excavations

1.04 DEFINITIONS

A. Backfill - material placed in newly excavated areas the topsoil, paving sub-grade, or foundation level.

B. Influence Area - the area within lines sloped downward at 45 degrees from the outer edges of paving, foundations, and utility lines.

1.05 QUALITY ASSURANCE

A. Field density testing frequencies:

1. One test for each 10,000 square feet or fraction thereof per lift of general backfilling, minimum 2 tests each layer.

2. One test for each 100 square feet or fraction thereof of backfill around and under structures.

3. One test per lift per each change in type of fill.

4. One test per 1000 square feet of pavement subgrade, minimum of 2 tests.

1.06 PRECONSTRUCTION REQUIREMENTS

Precondition surveys and vibration monitoring are required for those areas where residential structures are within 100 feet of the proposed construction.

PART 2 PRODUCTS

2.01 GENERAL

It is intended that previously excavated materials conforming to the following requirements be utilized wherever possible.

2.02 MATERIALS

A. Acceptable materials: AASHTO M145 classification A-1, A-3, A-2-4, A-2-6; ASTM D2487 classification GW, GP, GM, SM, SW, SP; unless otherwise disapproved within the Soil and Subsurface investigation reports. No more than 12% of acceptable materials shall pass the number 200 sieve.

B. Unacceptable materials: AASHTO M145 classification A-2-5, A-2-7, A-4, A-5, A-6, A-7, A-8; ASTM D2487 classification GC, SC, ML, MH, CL, CH, OL, OH, PT; unless otherwise approved within the Soil and Subsurface investigation reports.

C. Controlled low strength material ("excavatable flowable fill") shall meet the requirements of FDOT specification section 121, with a 28-day compressive strength of 80-100 psi.

2.03 SHEETING, SHORING, AND BRACING

A. The structural strength and safety of all sheeting, shoring and bracing shall be the sole responsibility of the Contractor. Repair any damage resulting from failure to provide adequate supports.

B. Provide timber work, shoring, bracing, sheeting, and sheet piling where necessary to retain banks of excavations, prevent cave-in of adjacent ground, prevent displacement of utilities and structures, and to protect public safety.

C. Contractor is solely responsible for the design, installation, and operation of dewatering systems and their safety and conformity with local codes and regulations.

PART 3 EXECUTION

3.01 GENERAL CONSTRUCTION REQUIREMENTS

A. Provide suitable temporary drainage channels for any water that may flow along or across the work as specified hereafter.

B. Provide barriers, warning lights and other protective devices at all excavations.

C. Sidewalks, roads, streets, and pavements shall not be blocked or obstructed by excavated materials, except as authorized by the Engineer, in which case adequate temporary provisions must be made for satisfactory temporary passage of pedestrians, and vehicles. Minimize inconvenience to public travel or to tenants occupying adjoining property.

D. Where necessary to place excavated material adjacent to buildings, erect barriers to keep earth at least 4' from such buildings. Earth deposited on lawns shall be promptly and carefully removed to preserve the turf. All trees, shrubs,

and landscaping shall be protected. Boring and jacking shall be used, if necessary, except where written permission is granted to remove trees and shrubs.

E. If open excavations cross existing rigid surfacing, the surfacing shall be removed for a width one foot beyond the anticipated edge of the excavation. The pavement break shall be sawed to insure a straight joint. Surface replacement shall match existing surfacing except as otherwise indicated on the Drawings. Where open excavation is allowed along or across public roadways, excavation, backfill, and surface replacement shall conform to the requirements of all permits applicable thereto. In no case shall surface replacement edges bear on less than 12" of undisturbed soil.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Locate and identify existing utilities that are to remain and protect from damage.

C. Notify utility companies to remove or relocate utilities that are in conflict with proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

F. Prior to placing fill in low areas, such as previously existing ditches, ponds, or lakes, perform following procedures:

1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.

2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.

3. If proposed for fill, muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation by Engineer. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building or pavement subgrade or within 10'-0" of perimeter of building subgrade or paving subgrade. If, after observation by Engineer, material is found to be unsuitable, unsuitable material shall be removed from site.

3.03 SHEETING, SHORING, AND BRACING

A. Furnish, install, and maintain, without additional compensation, sheeting, bracing, and shoring support required to keep excavations within the easement provided, to support the sides of the excavation, and to prevent any movement which may damage adjacent pavements or structures, damage or delay the work, or endanger life and health. Voids outside the supports shall be immediately filled and compacted.

B. Sheeting, where required, shall be driven below the bottom of excavation so the lowest set of wales and struts are above the bottom of the excavation to allow necessary working room.

C. The Engineer may direct in writing that supports in trenches be cut off at any specified elevation, in which case Contractor shall be paid for the supports left in place.

D. Contractor may leave in place, to be embedded in the backfill of the excavation, any or all supports for the purpose of preventing injury to persons or property, whether public or private. However, no supports that are within 4’ of the ground or pavement surface may be left in place without written permission of the Engineer. No extra payment will be made for supports left in place at the Contractor's option.

E. All supports not left in place shall be removed in such manner as to avoid endangering the piping, structures, utilities or property, whether public or private. All voids left by the withdrawal of sheeting shall be immediately filled and compacted.

F. The right of the Engineer to order supports left in place shall not be construed as creating an obligation on his part to issue such orders. Failure by the Engineer to exercise this right shall not relieve the Contractor from total liability for damages to persons or property resulting from the failure of the Contractor to leave in place sufficient supports to prevent any caving or moving of the ground adjacent to the excavation.

3.04 EXCAVATION

A. Do not excavate for any structure until that structure is scheduled for construction. Excavate only to the depth and dimensions necessary for the construction. Slope sides of excavations in accordance with OSHA requirements and the recommendations contained within the project geotechnical report.

B. The bottom of all excavations shall be undisturbed earth unless otherwise indicated, and shall be approved by the Engineer before any subsequent work is started. Over excavate a minimum of 2 feet where excavations occur within unsuitable soils, and replace over excavated material with suitable soils.

C. Excavations carried below depths indicated on the Drawings without the previous approval of the Engineer shall be filled with 2500 psi concrete or flowable fill to the correct level at the expense of the Contractor.

D. Maintain excavations in good order. If the bearing capacity of the foundation soils is reduced because the excavation is allowed to remain open prior to commencing work, the weathered soil shall be removed and replaced with 2500 psi concrete or flowable fill at the Owner's discretion at the expense of the Contractor.

E. All suitable materials removed from excavation areas shall be used for the project. Excess excavated suitable material shall be stockpiled on site at a location of the Owner's choosing, and shall become the property of the Owner, unless otherwise indicated on the Drawings.

F. Suitable onsite excavated materials containing silty or slightly clayey to clayey fine sands shall be sufficiently dried by surface spreading and discing if necessary, or by mixing with cleaner fine sands prior to placement in fill areas.

G. Unsuitable materials within the influence area of construction shall be excavated,

removed from the site, and disposed, unless otherwise indicated on the Drawings.

H. Excavations shall be kept dry, compacted, and stable to a depth two feet below the bottom of the excavation.

I. If portions of the bottom of excavations consist of material unstable to such a degree that, in the opinion of the Engineer, it cannot adequately support the construction, the bottom shall be over excavated and stabilized with approved coarse granular stabilization material. Depth of stabilization shall be as directed by the Engineer. The initial 50 tons of stabilization shall be incidental to the Contract. Compensation will be allowed only for such additional quantities as the Engineer shall direct in writing to be placed.

3.05 FILLING

A. All fill material shall be suitable soils or flowable fill. Fill placed within 1 foot of structures shall not contain rock or stone larger than 2 inch diameter. If a sufficient quantity of suitable material is not available from other excavations within the site, provide additional suitable material or flowable fill.

B. Fill within the influence area of roadways, structures, foundations, or slabs, shall be placed in layers of 8 inch loose depth. In all other areas, place fill in layers of 12 inch loose depth.

C. Take necessary precautions not to cause settlement or damage to adjacent slabs, walls, structures, or foundations. Place fill materials evenly adjacent to structures, without wedging against structures.

D. Where filling is required on both sides of structures, fill and compact simultaneously on opposite sides in even layers.

3.06 COMPACTION

A. Unless otherwise indicated, the type of equipment and number of passes required to obtain the specified degree of compaction shall be determined at the site, subject to the approval of the Engineer.

B. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the Engineer. Vibratory compaction is not allowed within 100 feet of existing structures. In these areas,

compaction shall be accomplished by static means only. If compaction difficulties arise, the Engineer shall be consulted to review and possibly modify compaction procedures.

C. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated.

D. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.07 TESTING AND CLEANUP

A. Provide for testing and cleanup as soon as practicable, so these operations do not lag far behind pipe installation. Perform preliminary cleanup and grading operations immediately after backfilling.

B. All unsuitable surplus excavated material shall be disposed of by the Contractor.

3.08 FIELD QUALITY CONTROL

A. Minimum Density Requirement (ASTM D1557 or AASHTO T180)

Fill under and within the influence area of roadways, structures, slabs, foundations = 98%

Pond and road embankment fill = 95%

Landscape areas = 85%

All other areas = 90%

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.01 SECTION INCLUDES

Dewatering design and operation requirements

1.02 RELATED SECTIONS

A. Section 31 25 00 - Erosion and Sedimentation Control

1.03 GENERAL REQUIREMENTS

A. Obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work. Contractor shall be solely responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

B. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom and/or sides. Design system to prevent differential hydrostatic head which would result in floating out soil particles in a manner termed as a “quick” or “boiling” condition. System shall not be dependent solely upon sumps and/or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation’s stability.

C. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow all Work to be installed in a dry condition.

D. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

E. Contractor shall be responsible for and shall repair without cost to the Owner any damage to work in place, or other contractor’s equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation,

including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.

F. All dewatering shall be contained onsite and discharged into the percolation ponds. If the Contractor determines a more feasible option and discharges offsite, the Contractor shall be required to permit the dewatering system with the St. Johns River Water Management District or may operate under a current General Dewatering Permit issued from the District and shall schedule, coordinate, and pay for any groundwater testing required to obtain and operate under an approved permit. Contractor shall provide a copy the Permit and an operation plan showing compliance with the permit, including one turbidity test at a minimum. If an FDEP General Dewatering permit is used, the Contractor shall dispose of ground water in accordance with permit conditions. All required groundwater testing shall be performed by a firm specializing in testing groundwater at the expense of the Contractor.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Control by acceptable means all water regardless of source and be fully responsible for disposal of the water.

B. Confine discharge piping and/or ditches to available JEA property or easements or to additional easement obtained by Contractor.

C. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary for these purposes, lower water level in advance of excavation, utilizing wells, wellpoints, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.

D. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.

E. Open pumping with sumps and ditches shall be allowed, provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.

F. Install wells and/or wellpoints, if required, with suitable screens and filters, so that continuous pumping of fines does not occur. During normal pumping, and upon development of well(s), levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.

G. Control grading around excavations to prevent surface water from flowing into excavation areas.

H. Remove subgrade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

I. Walls shall not be exposed to water pressure before structural work at the next higher level has properly cured and the cantilever action of walls is eliminated.

3.02 MAINTAINING EXCAVATION IN DEWATERING CONDITION

A. Dewatering shall be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted.

B. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.

C. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.

D. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition.

3.03 SYSTEM REMOVAL

A. Remove dewatering equipment from the site, including related temporary electrical service.

B. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

END OF SECTION

SECTION 31 23 20

COMPACTION CONTROL AND TESTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Specified Herein and Elsewhere

1. Work under this Section includes:

a. Placement, compaction controls, and fields density testing requirements for all earthwork, including pavement subgrade.

1.02 TESTING

A. Tests will be performed by an approved independent soils laboratory to insure adequate density is being obtained. The ENGINEER shall approve soils laboratory and designate where and when samples shall be taken, in accordance with soils report provided in the appendix. The Contractor will pay initial costs to make tests. The laboratory shall submit test reports to the ENGINEER and the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials and products are specified elsewhere in Division 31.

PART 3 EXECUTION

3.01 FILL PLACEMENT

A. Compacted material that has been flooded and no longer meets the density specified shall be removed, replaced and recompacted.

B. If the in-place surface has dried, sprinkle with water before placing the next lift. The surface of smooth lifts shall be scarified before the next lift is placed.

C. Where fill is required on both sides of structures, fill and compact simultaneously on opposite sides in even layers. Other filling sequences shall be as specifically indicated on the Drawings.

D. Fill shall be spread in uniform horizontal lifts. The material shall be thoroughly mixed to insure a uniform moisture content slightly wetter than optimum but not greater than 5 percent above optimum water content as determined by the Modified Proctor Test, ASTM D1557.

E. Where cohesive structural fill is used, the moisture content when compacted shall be within 3 percent of the optimum moisture content. If the fill does not have natural water content, which falls within the acceptable range, the Contractor shall mix, dry, or moisten as necessary.

F. Place and compact each lift over an entire area prior to placing successive lifts, unless otherwise approved by the ENGINEER.

G. All materials shall be placed in loose lift thicknesses indicated hereafter.

3.02 COMPACTION

A. General

1. Unless otherwise indicated, the type of equipment and number of passes required to obtain the specified degree of compaction shall be in accordance with the soils report and/or determined at the site, subject to the approval of the ENGINEER.

2. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the ENGINEER.

B. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated.

3.03 FILL LIFT THICKNESSES AND COMPACTION DENSITIES

A. Unless otherwise indicated or approved by the ENGINEER, place fills in the loose lift thicknesses indicated hereafter, except when water jetting, and compact to a dry density not less than the following percentage of maximum dry density, determined by the Modified Proctor Test, ASTM D1557, unless otherwise noted.

3.04 TESTING

A. The Contractor shall assist in providing samples for the following field density tests to insure required densities are being obtained:

1. One test for each 3,000 lineal feet or fraction thereof per lift of general backfilling.

2. Two tests for each 10,000 square feet or fraction thereof per lift of structural fill under slabs, foundations, and pavements.

3. One test per lift for each other type of fill, if so directed by the ENGINEER.

B. Tests shall be in accordance with ASTM D1557 or other tests suitable for the materials being tested.

C. The Contractor will pay for initial field density tests. Subsequent tests and associated costs necessitated as a result of the initial tests failing to meet specified requirements will be at the expense of the Contractor.

TYPE OF FILL	USAGE	THICKNESS	REQ'D % OF LIFT MODIFIED PROCTOR TEST
Trenched Pipe Bedding	Beneath piping	6"	95 D1557
Trenched Pipe Cover	Over and/or around piping	6"	95 D1557
Utilities Trench Backfill	"Influence area" beneath other piping or utility lines	8"	95 D1557

	"Influence area" beneath rigid paving and rail-road tracks.	6"	95 D1557
	"Influence area" beneath non-rigid paving	9"	95 D1557
	Adjacent to or under structures	9"	98 D1557
	Croplands, plant site, lawns and landscaped areas.	12"	85 D1557
Preloading	Soil stabilization	12"	85 D1557
Structural Fill	All locations under major structures and all lagoon structures.	6"	98 D1557
	All locations under minor structures (manholes, etc.)	6"	95 D1557

Impermeable Fill	All locations	6"	98 D1557
Granular Fill	Below concrete slab bedding, foundations, rigid paving, and excavated areas adjacent to structures	8"	98 D1557
	All other uses	12"	85 D1557
Granular Bedding	Beneath concrete slabs	6"	95 D1557
Granular Drainage Blanket	Below concrete slabs, paving, or piping	9"	95 D2049
	All other uses	12"	85 D2049
Granular Filter	Around open joint or perforated drain pipes and at pressure relief valves	9"	95 D1557
Structural Backfill	See Trench Backfill		

General Site Grading	Lagoon Embankment	8"	95 D1557
	Lagoon bentonite - soil mixtures	--	95 D1557
	Fill for abandoned or demolished structures	12"	85 D1557
	Fill in other locations not covered herein	12"	85 D1557
	Topsoil placement	12"	85 D1557

"Influence area" shall be considered the area within lines sloped downward at 45 degrees from the outer edges of paving, foundations, and utility lines.

END OF SECTION

SECTION 31 23 33

TRENCHING, BEDDING, AND BACKFILLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Trenching for piping and electrical work.

B. Excavation for manholes, junction boxes, meter vaults, and appurtenances.

C. Sheeting, shoring and bracing

D. Bedding, backfilling, and compaction.

1.02 RELATED SECTIONS

A. Section 31 11 00 - Site Preparation

B Section 31 23 20 - Compaction Control and Testing

C. Section 31 22 00 - Finish Grading

D. Section 31 25 00 - Erosion and Sedimentation Control

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition:

1. AASHTO M145 - Classification of Soils

2. AASHTO T180 - Moisture-Density Soil Sampling and Testing

American Society for Testing and Materials (ASTM) latest edition:

1. ASTM D1557 - Moisture-Density Soil Sampling and Testing

2. ASTM D2487 - Classification of Soils

1.04 DEFINITIONS

A. Bedding = Area from bottom of trench to centerline of pipe

B. Backfill = material above the top of pipe to the topsoil, paving sub-grade, or foundation level.

Influence Area = the area within lines sloped downward at 45 degrees from the outer edges of paving, foundations, and utility lines.

1.05 QUALITY ASSURANCE

A. Field density testing frequencies:

1. One test for each 300 lineal feet or fraction thereof per lift of general backfilling in the pipeline trench.

2. One test for each 100 square feet or fraction thereof of backfill around and under structures.

3. One test per lift per each change in type of fill.

1.06 PRECONSTRUCTION REQUIREMENTS

Precondition surveys and vibration monitoring are required for those areas where residential structures are within 100 feet of the proposed construction.

PART 2 PRODUCTS

2.01 GENERAL

It is intended that previously excavated materials conforming to the following requirements be utilized wherever possible.

2.02 MATERIALS

A. Suitable materials: AASHTO M145 classification A-1, A-3, A-2-4; ASTM D2487 classification GW, GP, SW, SP, SP-SM; unless otherwise disapproved within the Soil and Subsurface investigation reports. No more than 12% of acceptable materials shall pass the number 200 sieve.

B. Unsuitable materials: All materials other than those listed above.

C. Controlled low strength material ("flowable fill") shall meet the requirements of FDOT specification sections 121-1, 121-2, 121-3, 121-4, 121-5, and 121-6, except the range of acceptable 28-day compressive strength (as defined in 121-3) shall be revised to 75-100 psi.

2.03 SHEETING, SHORING, AND BRACING

A. The structural strength and safety of all sheeting, shoring and bracing shall be the sole responsibility of the Contractor. Repair any damage resulting from failure to provide adequate supports.

B. Provide timber work, shoring, bracing, sheeting, and sheet piling where necessary to retain banks of excavations, prevent cave-in of adjacent ground, prevent displacement of utilities and structures, and to protect public safety.

C. Contractor is solely responsible for the design, installation, and operation of dewatering systems and their safety and conformity with local codes and regulations.

PART 3 EXECUTION

3.01 GENERAL CONSTRUCTION REQUIREMENTS

A. Provide suitable temporary drainage channels for any water that may flow along or across the work.

B. Provide barriers, warning lights and other protective devices at all excavations.

C. Sidewalks, roads, streets, and pavements shall not be blocked or obstructed by excavated materials, except as authorized by the Engineer, in which case adequate temporary provisions must be made for satisfactory temporary passage of pedestrians, and vehicles. Minimize inconvenience to public travel or to tenants occupying adjoining property.

D. Where necessary to place excavated material adjacent to buildings, erect barriers to keep earth at least 4 feet from such buildings. Earth deposited on lawns shall be promptly and carefully removed to preserve the turf. All trees, shrubs, etc., shall be protected. Boring and jacking shall be used, if necessary, except where ENGINEER permission is granted to remove trees and shrubs.

E. If open excavations cross existing rigid surfacing, the surfacing shall be removed for a width one foot beyond the anticipated edge of the excavation. The pavement break shall be sawed to insure a straight joint. Surface replacement shall match existing surfacing except as otherwise indicated on the Drawings. Where open excavation is allowed along or across public roadways, excavation, backfill, and surface replacement shall conform to the requirements of all permits

applicable thereto. In no case shall surface replacement edges bear on less than 12 inches of undisturbed soil.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Locate and identify existing utilities that are to remain and protect from damage.

C. Notify utility companies to remove or relocate utilities that are in conflict with proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced as necessary by same.

3.03 SHEETING, SHORING, AND BRACING

A. Furnish, install, and maintain, without additional compensation, sheeting, bracing, and shoring support required to keep excavations within the easement provided, to support the sides of the excavation, and to prevent any movement which may damage adjacent pavements or structures, damage or delay the work, or endanger life and health. Voids outside the supports shall be immediately filled and compacted.

B. Sheeting, where required, shall be driven below the bottom of excavation so the lowest set of wales and struts are above the bottom of the excavation to allow necessary working room.

C. The Engineer may direct in writing that supports in trenches be cut off at any specified elevation, in which case Contractor shall be paid for the supports left in place.

D. Contractor may leave in place, to be embedded in the backfill of the excavation, any or all supports for the purpose of preventing injury to persons or property, whether public or private. However, no supports which are within 4' of the ground or pavement surface may be left in place without written permission of the Engineer. No extra payment will be made for supports left in place at the Contractor's option.

E. All supports not left in place shall be removed in such manner as to avoid endangering the piping, structures, utilities or property, whether public or private. All voids left by the withdrawal of sheeting shall be immediately filled and compacted.

F. The right of the Engineer to order supports left in place shall not be construed as creating an obligation on his part to issue such orders. Failure by the Engineer to exercise this right shall not relieve the Contractor from total liability for damages to persons or property resulting from the failure of the Contractor to leave in place sufficient supports to prevent any caving or moving of the ground adjacent to the excavation.

3.04 TRENCHING

A. All excavations shall be made by open cut unless otherwise indicated. Sides of trenches shall be kept as nearly vertical as possible from the trench bottom to a level of one foot above the top of the pipe.

B. Excavation of trenches shall not advance more than 50 feet ahead of completed pipe installation except as approved by the ENGINEER.

C. Excavate trenches to depth indicated or required for indicated flow lines and invert elevations.

D. Where rock is encountered, carry excavation 6 inches below scheduled elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.

E. For pipes or conduit 5 inches or less, excavate to indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

F. For pipes or conduit 6 inches or larger, and other work indicated to receive subbase, excavate to subbase depth indicated, or, if not otherwise indicated, to 6 inches below bottom of work to be supported.

G. Except as otherwise indicated, excavate for pressure piping so top of piping is minimum 3 feet below finished grade.

H. Unsuitable excavated materials shall be removed from the site and disposed, unless otherwise indicated on the Drawings.

I. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

J. Trench bottoms shall be kept dry, compacted, and stable to a depth two feet below the bottom of the trench.

K. Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 9 -12 inch clearance on each side of pipe or conduit.

L. If more than one pipe is to be installed in a trench, the pipes shall be spaced a minimum of one foot apart for pipes 4 inches and larger.

M. If portions of the bottom of trenches consist of material unstable to such a degree that, in the opinion of the Engineer, it cannot adequately support the pipe or structure, the bottom shall be over excavated and stabilized with approved coarse granular stabilization material. Depth of stabilization shall be as directed by the Engineer. The initial 10 tons of stabilization shall be incidental to the Contract. Compensation will be allowed only for such additional quantities as the Engineer shall direct in writing to be placed.

N. Do not backfill trenches until tests and inspections have been made.

3.05 TRENCH BACKFILLING

A. Following placement of pipe and inspection of joints, install tamped bedding material. Place bedding fill materials in layers of 6-inch loose depth.

B. All bedding and backfill material shall be suitable soils or flowable fill. Backfill material within 1 foot of pipe and appurtenances shall not contain rock or stone larger than 2-inch diameter. If a sufficient quantity of suitable material is not available from the trench or other excavations within the site, provide additional suitable material or flowable fill.

C. After completion of bedding and preliminary approval of piping and testing, the pipe shall be covered to a point one foot above the top of the pipe for the full trench width, placed in layers of 6-inch loose depth.

D. Place backfill over pipe. Where trench is within the influence area of roadways, structures, foundations, or slabs, place backfill in layers of 6-inch loose depth. In all other areas, place backfill in layers of 8-inch loose depth.

E. Take necessary precautions not to cause settlement or damage to adjacent slabs, walls, structures, or foundations. Place backfill and fill materials evenly adjacent to structures, without wedging against structures or displacement of piping or conduit.

3.06 MINOR STRUCTURAL EXCAVATION AND BACKFILLING

A. Minor structures are defined as manholes, junction boxes, inlets, valve vaults, and meter vaults. Do not excavate for any structure until that structure is scheduled for construction. Excavate only to the depth and dimensions necessary for the construction.

B. The bottom of all excavations shall be undisturbed earth unless otherwise indicated, and shall be approved by the Engineer before any subsequent work is started.

C. Excavations carried below depths indicated on the Drawings without the previous approval of the Engineer shall be filled with 2500-psi concrete or flowable fill to the correct level at the expense of the Contractor.

D. Maintain excavations in good order. If the bearing capacity of the foundation soils is reduced because the excavation is allowed to remain open prior to commencing work, the weathered soil shall be removed and replaced with 2500 psi concrete or flowable fill at the expense of the Contractor.

E. Do not backfill until new concrete has properly cured, coatings have been approved, and any required tests have been accepted.

F. Exercise care during backfilling operations to avoid any puncture, break or other damage to waterproofing systems, if any. Backfill adjacent to waterproofing in the presence of the Engineer.

G. Where backfilling is required on both sides of structures, backfill and compact simultaneously on opposite sides in even layers. Other backfilling sequences shall be as specifically noted.

3.07 COMPACTION

A. Unless otherwise indicated, the type of equipment and number of passes required to obtain the specified degree of compaction shall be determined at the site, subject to the approval of the Engineer.

B. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials, unless otherwise approved by the Engineer. Vibratory compaction is not allowed within 100 feet of existing structures. In these areas, compaction shall be accomplished by static means only. If compaction difficulties arise, the Engineer shall be consulted to review and possibly modify compaction procedures.

C. Noncohesive soils shall be compacted with vibrating roller or equivalent; cohesive soils shall be compacted with sheeps-foot roller, pneumatic tamping, or approved equivalent, unless otherwise indicated.

D. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3.08 TESTING AND CLEANUP

A. Provide for testing and cleanup as soon as practicable, so these operations do not lag far behind pipe installation. Perform preliminary cleanup and grading operations immediately after backfilling.

B. All surplus excavated material shall be disposed of by the Contractor.

3.09 FIELD QUALITY CONTROL

A. Minimum Density Requirement (ASTM D1557 or AASHTO T180)

1. Fill under and within the influence area of roadways, structures, slabs, foundations = 98%
2. Pond and road embankment fill = 95%
3. Landscape areas = 85%
4. All other areas = 90%

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

Designing, providing, maintaining, removing temporary erosion and sedimentation controls.

1.02 REFERENCES

A. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction and Roadway and Traffic Design Standards, latest editions:

Index No. 102 - Baled Hay or Straw Barriers and Silt Fences

Index No. 103 - Turbidity Barriers

Specification 300 - Prime and Tack Coats for Base Courses

1.03 SUBMITTALS

Provide erosion control plan. Show types of erosion and sedimentation control, locations, inspection and maintenance plan.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Seeding and Mulching

B. Sodding

C. Hydro-seeding

D. Coarse Aggregate

E. Prime Coat - Per FDOT Specification 300

2.02 SEDIMENTATION CONTROL

A. Silt Fence - Per FDOT Index No. 102

B. Floating Turbidity Barriers - Per FDOT Index No. 103

a. Hay Bales - Per FDOT Index No. 102

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Establish erosion control measures within 48 hours of the completion of any clearing and grading activities.

B. Erosion control of areas to be paved shall meet the following:

1. Install subgrade and base course materials within 48 hours of the completion of grading activities.

2. Areas to receive asphalt shall receive erosion control measures no later than 48 hours after acceptance of base course. Temporary erosion control consists of placement of a bituminous prime coat and sanding the surface. Permanent erosion control consists of placement of the structural course.

3. Areas to receive concrete paving shall be either protected with a layer of FDOT coarse aggregate material or shall be paved within 48 hours of acceptance of the subgrade.

3.02 SEDIMENTATION CONTROL

A. Install prior to construction.

B. Inspect every two weeks during construction.

C. Remove any sediment build-up.

D. Repair and reinstall any damaged or missing sediment control measures. Install additional measures if inspection reveals additional sedimentation control is necessary.

E. Rough excavate and grade any proposed stormwater ponds at the start of site grading activities. Direct site runoff to the ponds to minimize runoff to offsite areas.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 1947 (Revised 2001).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirements .

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

G. Record moisture content of soil before application.

H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work.

1. Having minimum of 5 documented experience.

2. Approved by manufacturer of treatment materials.

3. Licensed in the State in which the Project is located.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.

1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:

1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management.

2. FMC Professional Solutions: www.fmcprosolutions.com.

3. Syngenta Professional Products: www.syngentaprofessionalproducts.com.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Toxicant Chemical: EPA (Title 7, United States Code, 136 through 136y) approved; synthetically color dyed to permit visual identification of treated soil.

C. Diluent: Recommended by toxicant manufacturer.

2.02 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:

   1. Under Slabs-on-Grade.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

F. Re-treat disturbed treated soil with same toxicant as original treatment.

G. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

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SECTION 32 92 10

GRASSING AND SODDING

PART 1 GENERAL

1.01 SECTION INCLUDES

Soil preparation, sodding, seeding, mulching, fertilizing, watering, and maintenance of grassed areas

1.03 WARRANTY

All seeding shall be warranteed by the General Contractor to be true to name and in a vigorous growing condition through one growing cycle including one summer and one winter season.

1.04 MAINTENANCE

Maintenance for lawns shall begin immediately after seeding or sodding. Provide watering, mowing and replanting and continue as necessary until a close healthy stand of specified grasses is established.

PART 2 PRODUCTS

2.01 LIME

Lime shall be agricultural grade dolomitic limestone, ground sufficiently fine so that at least 80 percent will pass through a No. 8 sieve, and it shall contain not less than 80 percent calcium carbonate equivalent. Moisture content at time of delivery shall not exceed 8 percent.

2.02 FERTILIZER

Fertilizer shall be a composition recommended by a local County Agricultural Agent or State Agricultural Extension Service or a pre-formulated 10-6-4 mixture.

2.03 WATER

Water shall be free from oil, acid, alkali, salts, and other harmful substances.

2.04 SOD

A. Sod shall be either field or nursery grown sod that is native to the locality of the Project. The Contractor shall obtain Engineer's approval of the source of the sod prior to cutting the sod.

B. Sod grown on soil high in organic matter, such as peat, will not be acceptable. The consistency of sod shall be such that it will not break, crumble or tear during handling and placing. Sod shall be reasonably free of stones, crab grass, noxious weeds, and other objectionable plants or substances injurious to plant growth.

C. Sod shall have at least 1-inch of soil adhering firmly to the roots and cut in rectangular pieces with the shortest side not less than 12-inches. At the time of cutting sod the grass shall be mowed to a height not less than 2-inches nor more than 4-inches.

D. Sod cut for more than 48 hours shall not be used without the approval of the ENGINEER.

E. Bermuda Sodding - 419 Tifway Bermuda

F. Bahia Sodding - Argentine Bahia Sod

2.05 SEEDING AND MULCHING

A. Permanent grass seed shall be Argentine Bahia, in accordance with FDOT specification 981.

B. Temporary grass seed shall be annual rye grass in accordance with FDOT specification 981.

C. Mulch shall be dry mulch in accordance with FDOT specification 981.

PART 3 EXECUTION

3.01 REGRADING OF TOPSOIL

Topsoil shall be graded reasonably smooth and level after final settlement. All humps shall be removed and depressions or eroded areas filled in with additional topsoil before proceeding with seeding or sodding.

3.02 PREPARATION FOR SODDING OR SEEDING

A. Preparation shall not be started until all other site and utility work and finished grading within the areas to be seeded have been completed.

B. Loosen topsoil by tilling it to a depth of at least 3 inches and smooth out all surface irregularities resulting therefrom. Leave area free of rocks or hard soil clods, which will not pass through the tines of a standard garden rake.

C. At least 7 days before applying fertilizer, spread lime uniformly in sufficient quantity to produce in the soil a pH of 6.5. Work lime thoroughly into topsoil to a depth of 3-inches.

D. Apply fertilizer uniformly at a rate of 20 pounds per 1000 square feet. Work fertilizer into soil prior to seeding or sodding.

3.03 SODDING

A. Sodding shall also be used in ditches and drainage swales and on all embankment slopes unless protection is provided against erosion of seeding.

B. Place sod with the edges in close contact and alternate courses staggered. Lightly tamp or roll to eliminate air pockets. On slopes 2 to 1 or steeper, stake sod with not less than 4 stakes per square yard and with at least one stake for each piece of sod. Stakes shall be driven with the flat side parallel to the slope. Do not place sod when the ground surface is frozen or when air temperature may exceed 90 degrees. Water the sod thoroughly within 8 hours after placement and as often as necessary to become well established.

C. In ditches, the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground.

D. All exposed edges of sod shall be buried flush with the adjacent turf.

3.04 SEEDING AND MULCHING

A. Scatter seed uniformly over the grassing area while the soil is still loose and moist at the rate of 100 pounds per acre.

B. Seed of quick growing species of grass, such as rye, Italian rye, millet or other cereal grass, shall be spread in conjunction with the permanent-type seed mixture. The type of quick-growth 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 30 pounds per acre, unless otherwise specified.

C. Apply approximately 2 inches, loose thickness, of the mulch material uniformly over the seeded area, and cut into the soil so as to provide an early ground cover during the particular season when planting is done. The rate of spread shall be 30 pounds per acre, unless otherwise specified.

D. Rolling: Roll thoroughly the entire seeded area immediately after completion of the seeding.

3.05 WATERING

Immediately after placing erosion control or mulch, water seeded areas thoroughly with a fine mist spray. Keep soil thoroughly moist until seeds have sprouted and achieved a growth of 1 inch. For sod, immediately begin watering and continually keep moist until the sod has firmly knit itself to the topsoil.

3.06 PROTECTION OF WORK

Protect newly seeded and sodded areas from all traffic by erecting temporary fences and signs. Protect slopes from erosion. Properly and promptly repair all damaged work when required.

3.07 APPLICATION OF FERTILIZER

Six weeks after completion of seeding or sodding apply granular fertilizer over all areas at the rate of two pounds of nitrogen nutrients per 1000 square feet of area.

3.08 CLEAN-UP

At the time of final inspection of work, but before final acceptance, remove from seeded and sodded areas all debris, rubbish, excess materials, tools, and equipment.

3.09 LAWN REPLACEMENT

Lawns not showing a close uniform stand of healthy specified grasses at the end of the guaranty period shall be replaced and maintained until acceptance. Scattered bare spots, none of which is larger than one square foot, will be allowed up to a maximum of 3% of the total area.

END OF SECTION

SECTION 33 13 10

DISINFECTION OF PIPING AND STRUCTURES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and procedures for disinfection of water mains by the continuous feed method and by the slug method and disinfection of structures. Disinfect piping in accordance with AWWA C651 and disinfect structures in accordance with AWWA C652 and C653, except as modified below.

1.02 SUBMITTALS

Submit shop drawings in accordance with Section 01 33 00.

1.03 JOB CONDITIONS

1. Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Dechlorinate the disinfection water such that the chlorine residual does not exceed 0.5 mg/L.
2. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with Owner and cognizant regulatory authorities: FDEP.
3. Use potable water for chlorination.
4. Submit request for use of water from waterlines of Owner 48 hours in advance.
5. At the option of the CONTRACTOR, JEA will provide bacteriological testing. The CONTRACTOR will provide means of water sampling. All disinfection is by the CONTRACTOR.

PART 2 MATERIALS

2.01 LIQUID CHLORINE

Inject with a solution feed chlorinator and a water booster pump. Follow the instructions of the chlorinator manufacturer.

2.02 CALCIUM HYPOCHLORITE (DRY)

Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.

2.03 SODIUM HYPOCHLORITE (SOLUTION)

Further dilute in water to desired concentration and pump into the pipeline at a metered rate.

2.04 CHLORINE RESIDUAL TEST KIT

For measuring chlorine concentration, supply and use a medium range, drop count, DPD drop dilution method kit per AWWA C651, Appendix A.1. Maintain kits in good working order available for immediate test of residuals at point of sampling.

2.05 DECHLORINATION MATERIALS

If dechlorination is required and the Contractor elects to use a means of chemical dechlorination, use one of the chemicals described in AWWA C655.

PART 3 EXECUTION

3.01 CONTINUOUS FEED METHOD FOR PIPELINES

Introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the chlorine concentration in the pipeline is maintained at a minimum concentration of 50 mg/L. Check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added.

3.02 SLUG METHOD FOR PIPELINES

Introduce the water in the pipeline at a constant measured rate. At the start of the test section, feed the chlorine solution into the pipeline at a measured rate so that the

chlorine concentration created in the pipeline is 300 mg/L. Feed the chlorine for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least 300 mg/L for at least three hours.

3.03 DISINFECTION OF VALVES, BLIND FLANGES, AND APPURTENANCES

During the period that the chlorine solution or slug is in the section of pipeline, open and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution.

3.04 DISINFECTION OF CONNECTIONS TO EXISTING PIPELINES

Disinfect isolation valves, pipe, and appurtenances per AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

3.05 DISINFECTION OF TAPPING SLEEVES AND LINE STOPPING

Flush exterior of pipe with potable water after removal of existing coating. Swab exterior of pipe with a 1% sodium hypochlorite solution. Disinfect per AWWA C651, Section 4.8. After completion of tapping and line stopping, swab interior of pipe, valves, and faces of flanges to be connected to bypass piping with a 1% sodium hypochlorite solution.

3.06 CONFIRMATION OF RESIDUAL IN PIPING

1. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, confirm that a chlorine residual of 50 mg/L minimum exists along the pipeline by sampling at air valves and other points of access such as tapping valves.

2. With the slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline that the chlorine concentration in the slug is at least 50 mg/L.

3.07 PIPELINE FLUSHING

After confirming the chlorine residual, flush the excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe no higher than that generally prevailing in the distribution system.

3.08 SAMPLING AND BACTERIOLOGIC TESTING

1. There shall be no water in trenches up to the connection for sampling. The sampling piping shall be clean, disinfected, and flushed prior to sampling.

2. Collect two sets of samples per AWWA C651, Section 5.1, deliver to a certified laboratory within six hours of obtaining the samples, and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline and in each structure after chlorination and refilling. Collect at least one set of samples from every 1,200 feet of the new water main and line stopping insertion point, plus one set from the end of the pipeline and at least one set from each branch. At each connection to an existing pipeline, take two additional samples. Use pipeline blowoffs or dedicated sampling ports for obtaining samples.

3.09 PIPING TEST FACILITY REMOVAL

After satisfactory disinfection, disinfect and replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

3.010 PIPING TO BE DISINFECTED

1. Disinfect all piping as indicated on the Flow Stream Identification in the drawings.

2. Disinfect (internally and externally) any piping inside the following structures:

    a. Ground Storage Reservoir No.1

3.011 DISINFECTION OF STRUCTURES

1. Disinfect per AWWA C652, Method 1, 2, or 3.

    a. Ground Strorage Reservoir No. 1

2. The Owner will provide potable water at no cost to the Contractor for the first disinfection effort. If bacteriological testing shows that the first disinfection effort was not successful, the Contractor will be charged the cost of additional water at the Owner's current rates.

3.012 REPETITION OF PROCEDURE

If the initial chlorination fails to produce required residuals and bacteriologic tests, repeat the chlorination and retesting until satisfactory results are obtained.

3.013 DECHLORINATION

Dechlorinate per AWWA C655. Perform testing of residual chlorine before discharge of water into the environment.

END OF SECTION

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SECTION 33 16 22

PRESTRESSED CONCRETE STORAGE TANK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section specifies the design and construction of an AWWA D110 Type II, wire-wound prestressed concrete storage tank with steel diaphragm complete including all reinforcing, concrete work, accessories, disinfection and testing directly related to the tank.

B. The tank contractor is responsible for furnishing all labor, materials, tools and equipment necessary to design and construct the prestressed concrete storage tank as indicated on the drawings and as described in this specification.

C. All materials in contact with water shall be meet NSF 61 requirements.

1.02 REFERENCES

A. ACI 117-10 – Specification for Tolerances for Concrete Construction and Materials

B. ACI 301/301M-10 – Specifications for Structural Concrete for Buildings

C. ACI 305R-10 – Guide to Hot Weather Concreting

D. ACI 306R-10 – Guide to Cold Weather Concreting

E. ACI 347R-04 – Guide to Formwork for Concrete

F. ACI 350/350R-06 – Code Requirements for Environmental Engineering Concrete Structures and Commentary

G. ACI 350.3-06 – Seismic Design of Liquid-Containing Concrete Structures and Commentary

H. ACI 372R-03 – Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures

I. ACI 506R-05 – Guide to Shotcrete

J. ACI 506.2-95 – Specification for Materials, Proportioning, and Application of Shotcrete

K. ACI SP4 – Formwork for Concrete

L. ANSI/AWWA C652-11 – Disinfection of Water Storage Facilities

M. ANSI/AWWA D110-04 – Wire and Strand-Wound, Circular, Prestressed Concrete Water Tanks

N. ASCE Standard 7-10 – Minimum Design Loads for Buildings and Other Structures

O. ASTM A416/A416M-12a – Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

P. ASTM A615/A615M-12 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

Q. ASTM A653/653M-11 – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by Hot Dip Process.

R. ASTM A821/A821M-10 – Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks

S. ASTM A882/A882M-04(2010) – Standard Specification for Filled Epoxy-Coated Seven-Wire Prestressing Strand

T. ASTM A884/A884M-12 – Standard Specification for Epoxy Coated Steel Wire and Welded Wire Reinforcement

U. ASTM A1064/A1064M-12 – Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

V. ASTM C31/C31M-12 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

W. ASTM C33/C33M-13 – Standard Specification for Concrete Aggregates

X. ASTM C39/C39M-12a – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

Y. ASTM C143/C143M-12 – Standard Test Method for Slump of Hydraulic-Cement

Z. ASTM C172/C172M-10 – Standard Practice for Sampling Freshly Mixed Concrete

AA. ASTM C231/C231M-10 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

BB. ASTM C881/C881M-10 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

CC. ASTM D1056-07 – Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber

DD. ASTM F593-13 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

EE. "Earthquake Induced Sloshing in Tanks with Insufficient Freeboard" by P.K. Malhotra, Structural Engineering International, IASBSE, 3/2006 pp 222-225

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Division 01 General Requirements, Section 01 33 00, and the General Conditions.

B. Qualifications and experience with the design and construction of prestressed concrete tanks.

C. Design criteria and fully detailed working drawings for the prestressed concrete tank as specified.

D. If a sliding water stop is used in the floor/wall joint, submit load/shear/deflection data to support shear and deflection calculations for base of wall. Tests must have been generated for the particular water stop configuration proposed.

E. Concrete mix design and strength test results of trial mixes for all concrete per Section 03 30 00.

F. Joint materials.

G. Mill certificates for prestressing steel and for appurtenant materials and work specified elsewhere in these specifications.

H. Provide submittals for admixtures that are proposed for use in the concrete.

I. Provide cut-sheets for all coatings, including coating thickness, proposed for the tank. Submit NSF 61 certification on all coatings in contact with potable water.

J. Provide documentation that all materials provided inside the ground storage tank are NSF61 approved materials.

K. Submit exterior paint colors for owner selection.

L. Submit where applicable shotcrete mix design per Section 03 30 00.

M. Forming construction plans including location of piping, access holes, and embedded items.

N. Prequalifications as described herein.

O. Prestressed Concrete Tank Design:

P. Design calculations and shop drawings in quadruplicate, showing detailed construction drawings for prestressed concrete tank, walls, vinyl baffle wall and it's supports/cables, aerials, or all pipe openings, and procedures of construction, shall be submitted to the Owner for review within 30 days after receipt of notice to proceed. After review by the Owner, one set of the accepted drawings and calculations will be returned to the Contractor. Make any revisions found necessary by the Owner and resubmit prior to final acceptance for construction by the Owner.

Q. Calculations to include stress in the tank at all stages, including prestressing, tank empty, and tank full.

R. Design data shall include Engineer signed and sealed load calculations for the roof including aerator, fan weight and pressure related to air flow.

S. Drawings will include details where applicable of tendon profile, anchorage details, stressing procedures and stressing sequence.

T. The design review by the Owner of the drawings and calculations submitted by the Contractor will not in any way relieve the Contractor of full responsibility for the accuracy and completeness of the drawings and calculations.

U. All tank design calculations and shop drawings shall be stamped by a professional engineer registered in the state of Florida.

V. Submit Engineer approved shop drawings that have been signed and sealed by the prestressed circular concrete tank designer to the Nassau County Building Department.

W. Submit certificate from manufacturer that sponge filler and bearing pads conform to specification.

1.04 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 AWWA D110 Type II wire-wound, circular prestressed concrete 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) dome-covered prestressed composite tanks of equal or greater size than that required for this project which meet these specifications and are now providing satisfactory service.

2. Construction: The entire tank, including all portions of the floor, wall, and roof 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 a professional engineer with no less than five years of experience in the design and construction of AWWA D110 Type II wire-wound, circular 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.

4. The steel shell design and epoxy injection procedure shall have been used in the ten tanks required in Section 1.5 A. of this specification.

B. Prequalification:

1. All tank construction companies must be prequalified and meet the criteria stated in Section 1.5 A. of this specification to be considered an acceptable tank builder.

2. A complete prequalification package shall be submitted to the Engineer for consideration 21 days prior to the date set for receipt of bids. The prequalification submittal shall include the following items:

    a. Complete construction drawings showing the principal sizes, thicknesses, reinforcing size and spacing for all structural members including: floor, wall, dome shell and dome edge.

    b. Complete details of other structural appurtenances as required by the project drawings showing principal sizes, thickness and reinforcing sizes and spacing.

    c. Complete design calculations which address applicable loads provided in Section 1.7 B. of this specification.

    d. Complete experience record for the tanks used to meet the experience requirement of Section 1.5 A. of this specification that have been designed and built in the tank construction company's own name. The record shall include the size of the tank, name, address and telephone number of the Owner, the year of construction and the name and telephone number of the Engineer for the project.

    e. Construction schedule which details the duration for tank construction.

    f. List of tanks constructed for JEA

    g. Shop drawing submittal of the tank design showing conformance to the specifications along with a list of AWWA D-110 type two tanks constructed in the name of the manufacturer must be submitted to the design engineer for consideration.

3. The following are preapproved as acceptable tank construction companies:

    a. The Crom Corporation, Gainesville, Florida & PreCon Corporation, Newberry, Florida. All other firms must provide prequalification data 21 days prior to be considered for approval. Approval shall be via addendum only.

1.05 WARRANTY

A. It is the intent of this specification that a singular responsibility for the design and construction of the proposed water storage tank be established.

B. The Owner's acceptance of the tank design or construction procedures does not relieve the Contractor of the guarantee required in these specifications.

C. The Contractor shall provide a written guarantee for workmanship and materials on the entire tank structure for a period of five years from date of acceptance of the work. In case leakage or other defects appear within the five-year period, the tank constructor shall make repairs upon written notice by the Owner that such defects have been found. Leakage is defined as damp spots where moisture can be picked up by touching with a dry hand on the exterior of the tank surface, the source of which is from the inside of the tank, or the continuous loss of water by volume measure which is determined to be penetrating the bottom slab.

1.06 SYSTEM DESCRIPTION

A. Tank shall consist of:

1. Cast-in-place concrete floor.
2. Prestressed composite wall with galvanized steel diaphragm.
3. Clear span dome roof.
4. Fiberglass Aerator (see Section 33 16 23)
5. Accessories to include:
    a. Exterior aluminum staircase including platforms and foundations.
    b. Liquid level indicator.
    c. Motorized Roof Ventilators.
    d. Power roof vent curbs for mounting motorized roof ventilators
    e. Two (2) 316 Stainless Steel manways with interior fiberglass platform, ladder and handrail

f. Precast concrete overflows with eyelids.

g. Vortex baffle breaker.

h. Dome probe curbs for level controls.

i. Piping as detailed on the Contract drawings.

j. Interior ladder.

k. Anodized aluminum handrail around top circumference of tank with toeboard

l. Anodized aluminum handrail to aerator with anodized aluminum gate 3 lb. 316 stainless steel hardware and fasteners.

m. Vinyl baffle walls.

2. The design shall be in conformance with ACI 372R-03 and AWWA D110, Type II.

1.07 DESIGN CRITERIA

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. The Tank Manufacturer shall be responsible for the entire design including but not limited to aerator and fans. Tank manufacturer shall be responsible for providing fans and shall coordinate design to accommodate weight of fans and air flow.

C. The prestressed concrete tank shall be designed for a highly corrosive environment with elevated levels of hydrogen sulfide and reduced sulfur.

D. The following loadings shall be utilized in the design:

1. Capacity: 100,000 Gallons

2. Dimensions: 40'-0" Inside Diameter

12’-8" Water Depth

3. Fluid Loads: Shall be the weight of all liquid when the reservoir is filled to capacity. The unit weight of the liquid material shall be 62.4 lbs/ft^3.

4. Roof Live Loads: Consideration shall be given to all applicable roof design loads in accordance with AWWA D110, Section 3.3 and ASCE 7. The minimum roof live load for the structure shall be 12 psf plus loading from 2,600 GPM natural draft aerator.

5. Dead Loads: Consideration shall be given to all permanent imposed loads including concrete and steel.

6. Seismic Loads: Seismic load shall be calculated using the effective mass procedure as specified in AWWA D110.

7. Soil Pressure: Earth loads shall be determined by rational methods of soil mechanics. Soil pressure shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.

8. Differential Backfill Loads: Forces from differential backfill loads shall be considered in the design and shall be based on the at-rest coefficient. Passive resistance shall not be used to resist differential backfill loads.

9. Wind Loads: Wind loads shall be considered in the design in accordance with ASCE 7.

E. Floor: The design of the floor for the prestressed concrete tank shall conform to the following:

1. 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.

2. 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.

F. Core wall:

1. The wire-wound, prestressed concrete tank core wall shall be designed as a thin shell cylindrical element using shotcrete and an embedded, mechanically bonded, steel shell diaphragm.

2. The design of the core wall shall take into account appropriate edge restraint. To compensate for bending moments, shrinkage, differential drying, and temperature stresses, the following minimum reinforcing steel shall be incorporated into the design:

    a. The top 2' of core wall shall have not less than 1% circumferential reinforcing.

    b. The bottom 3' of core wall shall have not less than 1% circumferential reinforcing.

    c. Inside Face:

        (1) The inside face of the core wall shall utilize the 26 gauge steel shell diaphragm as effective reinforcing.

        (2) Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.

    d. Outside Face:

        (1) Vertical reinforcing steel in the outside face of the core wall shall be: minimum of #4 bars at 12" center to center.

        (2) Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.

3. The minimum core wall thickness shall be 3½".

4. Reinforcing steel used in the core wall shall be designed using a maximum allowable design tensile stress, f_s, of 18,000 psi.

5. Allowable compressive stress in the core wall due to initial prestressing force, f_{gi}, shall be:

    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.

6. Allowable compressive stress in the core wall due to final prestressing force, f_g, shall be:

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.

G. Dome:

1. The dome roof shall be constructed of reinforced concrete and shall be circumferentially prestressed.

2. Dome shell reinforcement shall consist of reinforcing bars or welded wire fabric meeting ASTM A 185, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic. Wire ties shall be galvanized.

3. The dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have cross section suitable to accept the applied prestressing forces.

4. The high water level in the tank shall be permitted to encroach on the dome shell no higher than the upper horizontal plane of the dome ring girder.

5. Overflow outlets or the overflow pipe shall be capable of providing an overflow open area three times the area of the largest influent pipe.

6. Overflow outlets plus the dome ventilator shall be capable of providing an open area three times the area of the largest pipe.

7. The dome shall be designed as a free-span, spherical thin shell with one-tenth rise in accordance with the following:

a. Typical Dome Design: The typical dome thickness and steel reinforcement shall meet the requirements of AWWA D110-04.

b. In all cases, the thickness of the dome shall be no less than 3".

c. Dome Edge Design: The dome edge and upper wall shall be designed to resist the moments, thrusts, and shears that occur in this region due to dome and wall prestressing and loading conditions. The design of the edge region shall conform to the following:

(1) Dome Edge Thickness:

(a) A determination of the buckle diameter shall be made, as defined by:

$$d_b = 2.5 \cdot \sqrt{r_d \cdot t_d}$$ rounded up to the next foot

Where: d_b = buckle diameter in feet

r_d = dome radius in feet

t_d = typical dome thickness in feet

(b) Dome edge thickening shall begin at a radial location on the dome, defined as s_2 which is at least one buckle diameter away from the tank wall.

(c) A springline haunch shall be provided, which extends radially from the inside face of the tank wall to radial location s_1 which is defined as:

$$s_1 = 0.6 \cdot \sqrt{1.5 \cdot r_d \cdot t_d}$$ rounded up to the next foot

Where: s_1 = distance from inside face of wall to haunch in feet

s_2 = distance from inside face of wall to typical dome thickness in feet.

This springline haunch shall begin at the inside face of the tank wall with a springline thickness as required by paragraph (f) below and shall end at radial location s_1 with the following thickness:

$$t_{d1} = 1.33 \cdot t_d$$

Where: t_{d1} = minimum thickness at s_1 in feet

t_d = typical dome thickness in feet at one buckle diameter from tank wall

(d) Beginning at s_1 and continuing to s_2 the dome shell shall have a uniform straight line taper.

(e) Parameters (b), (c), and (d) above are not required for domes where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.

(f) Sufficient concrete thickness at the springline of the dome shall be provided so that no more than 2' of the springline haunch is considered in calculating the effective dome edge ring cross sectional area. Compressive stress in this area shall not exceed 1000 psi when subjected to initial prestressing, offset by dead load only.

(2) Dome Edge Steel Reinforcement:

(a) Throughout the dome edge, the percentage of steel reinforcement, both radially and circumferentially, shall be no less than 0.25% of the gross cross sectional area of concrete.

(b) Along the dome edge, steel reinforcement shall be distributed between the upper and lower layers unless finite element analysis calculations indicate that tensile stress does not exist in the concrete along the bottom face of the dome edge. In that case, only top bars are required radially and circumferentially. In addition, radial and circumferential reinforcing bars will not be required along the bottom face of the dome edge where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.

(c) Where reinforcing bars are required in the bottom layer, they shall be placed near the tank wall to insure adequate development at the intersection between dome and wall.

(d) In all cases, the percentage of circumferential steel reinforcement in the effective dome ring shall be no less than one percent of the gross cross sectional area of concrete. The effective dome ring is defined as ¼ of the haunch length not to exceed 2'.

(e) Where bottom dome edge steel reinforcement is required, vertical steel reinforcement along the inside face of the tank wall shall be no less than 0.5% of the cross sectional area of wall shotcrete.

H. Prestressing:

1. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM A 821 Type B, placed under high tension.

2. 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.

3. The prestressing design shall conform to the following minimum requirements:

   a. Working stress for the tank wall, fs, shall be a maximum of 115,000 psi.

   b. Working stress for the dome ring, fsd, shall be a maximum of 120,000 psi.

   c. The allowable design tensile stress in the prestressing wire before losses, fsi shall be 145,600 psi or no greater than 0.63 fu, where fu is defined as the ultimate strength of the wire.

   d. Areas to be prestressed will contain not fewer than 10 wires per foot of wall for 8 gauge and 8 wires per foot of wall for 6 gauge.

   e. 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.

I. Wall Openings:

1. 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.

2. Unbanded strips shall have a vertical dimension of no more than 36" unless an axi-symmetric shell analysis is performed to account for compressive forces plus shear and moments caused by displacement of the prestressing wires into adjacent bands.

PART 2 PRODUCTS

2.01 PERFORMANCE

A. Performance of the materials used in the tank construction shall conform to the minimum requirements of this specification.

B. Substitutions to the materials in this specification may only be made if submitted in writing and approved by the engineer.

2.02 CONCRETE

A. Concrete shall conform to ACI 301.

B. All concrete shall utilize Type I/II Portland cement.

C. A maximum of 30% of cementitious material may be fly ash.

D. Admixtures other than air-entraining and water reducing admixtures will not be permitted unless approved by the engineer.

E. Course and fine aggregate shall meet the requirements of ASTM C 33.

F. Concrete mixes used in the construction of the tank shall conform to the following:

Mix	Compressive Strength (psi)	Minimum Cement Content (lbs)	Maximum Aggregate Size (in)	Maximum W/C Ratio	Air Content (%)	Slump (in)
Floor	4000	560	¾	0.45	N/A	4"+/-1"
Dome	4000	600	⅜	0.45	5% +/- 1.5%	4"+/-1"

2.03 SHOTCRETE

A. Shotcrete shall conform to the requirements of ACI 506.2 except as modified herein.

B. All shotcrete mixes shall utilize Type I/II cement.

C. A maximum of 25% of cementitious material may be fly ash.

D. All shotcrete in contact with diaphragm or prestressing wire shall be proportioned to consist of not more than three parts sand to one part Portland cement by weight. All other shotcrete shall be proportioned to consist of not more than four parts sand to one part Portland cement by weight.

E. Admixtures will not contain more than trace amounts of chlorides, fluorides, sulfides or nitrates.

F. Shotcrete mixes used in the tank construction shall conform to the following:

Mix	Compressive Strength (psi)	Maximum W/C Ratio	Air Content (%)	Slump (in)	Fiber Reinforcement (lbs/cyd)
Core Wall	4000	0.42	N/A	4"+/-1"	-
Covercoat	4000	0.42	N/A	4"+/-1"	-

2.04 PRESTRESSED REINFORCEMENT

A. The prestressing wire shall conform to the requirements of ASTM A 821, Type B.

B. The prestressing wire size shall be 0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250".

C. The ultimate tensile strength, fu shall be, 231,000 psi or greater for 8 gauge wire, 222,000 psi or greater for 6 gauge.

2.05 NON-PRESTRESSED REINFORCEMENT

A. Non-prestressed mild reinforcing steel shall be new billet steel meeting the requirements of ASTM A 185 with a minimum yield strength, f_y, of 60,000 psi.

B. Welded wire reinforcing shall be plain wire conforming to the requirements of ASTM A 185 with a minimum yield strength, f_y, of 65,000 psi.

2.06 GALVANIZED STEEL DIAPHRAGM

A. The galvanized steel diaphragm used in the construction of the core wall shall be 26 gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall be not less than G90 of Table 1 of ASTM A653/A653M.

B. The diaphragm shall be formed with re-entrant angles and erected so that a mechanical key is created between the shotcrete and diaphragm.

C. The diaphragm shall be continuous to within 3 inches of the top and bottom of the wall. Horizontal joints or splices will not be permitted.

D. All vertical joints in the diaphragm shall be rolled seamed, crimped and sealed watertight using epoxy injection.

E. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to the waterstop.

2.07 PVC WATERSTOPS, BEARING PADS AND SPONGE FILLER

A. Plastic waterstops shall be extruded from an elastomeric plastic material of which the base resin is virgin polyvinyl chloride.

B. The profile and size of the waterstop shall be suitable for the hydrostatic pressure and movements to which it is exposed.

C. Bearing pads used in floor/wall joints shall consist of neoprene, natural rubber or polyvinyl chloride.

D. Sponge filler at the floor/wall joint shall be closed-cell neoprene.

2.08 EPOXY

A. Epoxy Sealants:

1. Epoxy used for sealing the steel shell shall conform to the requirements of ASTM C 881.

2. Epoxy used for sealing the steel shell shall be, Type III, Grade 1, and shall be a 100% solids, moisture insensitive, low modulus epoxy system.

3. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.

4. The epoxy sealants used in the tank construction shall be suitable for bonding to concrete, shotcrete, PVC and steel.

B. Bonding Epoxy:

1. Epoxy resins used for enhancing the bond between fresh concrete and hardened concrete shall conform to the requirements of ASTM C 881.

2. Epoxy resins shall be a two-component, 100% solids, moisture-insensitive epoxy and shall be Type II, Grade 2.

2.09 TANK ACCESSORIES

A. Minimum of two, 1' 5" x 4' 4" rectangular Type 316 stainless steel wall manhole for access to the interior of the tank. The cover and the bolts shall also be of Type 316 stainless steel. The wall manhole shall be designed to resist hydraulic loading without excessive deflection.

B. Interior ladder shall be fabricated from fiberglass with Type 316 stainless steel fasteners and shall conform with all applicable OSHA standards. The ladder shall have a safety climbing device manufactured from Type 316 stainless steel as required to meet applicable OSHA standards.

C. Roof hatch cover and liquid level indicator shall be fabricated from fiberglass with Type 316 stainless steel fasteners. Roof ventilator (non-motorized) shall be aluminum with stainless steel hardware.

D. Through-wall pipe sleeves or wall pipes shall be Type 316 stainless steel sleeves with neoprene modular seal units using stainless steel tightening bolts.

E. Provide aluminum stairs and handrails in connection with tank as shown on plans and specified in Section 05 51 00. Fastening gates and handrails shall utilize Type 316 stainless steel fasteners.

F. Handrail from stairs to aerator with gate and 8’ wide non-slip surface.

G. Vinyl Baffle Wall of the dimensions and locations shown on the Construction Drawings. All associated hardware, cables, and fasteners are to be 316 stainless steel.

H. All materials to be suitable for a corrosive environment with elevated levels of hydrogen sulfide and reduced sulfur components. 316 stainless steel.

2.010 COATINGS

A. Interior coating system shall consist of the following:

1. Two coats Tnemec Series N140 on wall, floor, and dome of tank structure. Tnemec morter clad series 218 surfacer a minimum thickness of 1/8” to be applied to the entire wall and dome prior to N140 system application. No other coating systems are allowed. Coating shall be NSF 61 approved.

B. Exterior coating system shall consist of the following:

1. Tnemec Series 156 Enviro-Crete Modified Waterborne Acrylate. No other coating systems are allowed. Exterior coatings shall be applied in a minimum of two coats with a thickness of 6.0 to 8.0 MDFT per coat. The minimum total thickness of 12.0 MDFT. All coatings shall be applied a minimum of 28 days after final application of concrete or shotcrete.

2. All application procedures for coatings shall be in accordance with manufacturer's recommendations.

2.011 CONCRETE FINISHES

A. Conform to Section 03 35 00 except as modified herein.

B. Roof: Light broom finish.

C. Wall: Light broom finish inside, tight shotcrete finish exterior.

D. Floor Slab: Soft Broom Finish

E. Friction finish 8’ wide from stair platform to aerator.

2.012 VENTILATION FANS

A. Fan units shall be direct driven aluminum vane axial reservoir forced draft ventilation fans.

B. Fan Housing: Fan shall be designed with a self-supported swing-out maintenance accessibility of motor and propeller, utilizing triple post aluminum pipe supports, stainless steel De-Sta-Co door hardware, gasketed door, 316 stainelss steel door shaft with pillow block style flanged bearings, and aluminum sloped roller entry ramp with 316 stainless steel wheel. Fan housing shall be minimum 0.125-inch aluminum continuous welded seam construction and be arranged for vertical upblast exhaust construction. Inlet and outlet flanges shall be continuously welded to fan basing constructed of heavy gauge aluminum

angle rings. Concentricity of fan casing shall be ensured through use of welding jigs and fixtures. Guide vanes shall be integrally welded with the outer housing providing a substantial weldment. Fan shall have a welded aluminum stack cap with 316 stainless steel hardware and “approved” mechanically fastened neoprene gasketing at damper edges and rain gutter. Neoprene gasketing shall also be field installed between the concrete curb and fan curb cap to provide an insect and waterproof seal. Fan curb cap shall be welded 0.125-inch aluminum with support gussets and 4-inch overlap on concrete curb.

C. Fan Propeller: The propeller shall be of sand cast 535 aluminum alloy, solid one-piece construction and dynamically and statically balanced in accordance with ISO 1940-1973, “Balance Quality Grade of G2.5”. In addition, the fan assembly shall be balanced after final assembly, in the fan casing, in accordance with ISO 1972. The propeller shall be secured to motor shaft with taper-lock bushing.

D. Finish: The fan units, after fabrication, shall be cleaned and aluminum welds shall be brushed with non-ferrous wire cleaning brush. Fans shall be mill finished.

E. Accessories: Extended lube lines shall be 316 stainless steel. All assembly hardware shall be 316 stainless steel.

F. Motors and Drives:

1. Fan motors shall be UL listed suitable for severe mill and chemical duty, TEFC, premium efficient with IEEE-841 rating. See Table 1 for motor speeds and HP. Provide motors with 120-volt winding space heater.
2. Duplicate motor junction box shall be mounted on exterior of fan housing for electrical connection.
3. Duplicate motor nameplate shall be mounted on fan exterior.

G. Testing and Certification: Fans shall be tested and certified in accordance with ANSI/ASHRAE 51 and ANSI/AMCA 210 test codes and guaranteed by manufacturer to deliver at rated published performance levels. Each unit shall be tested prior to shipment.

H. Acceptable Manufacturers: Fans shall be JEA Standard Aerovent Model VP-MA Triple Post Swing-Out provided by Markair.

I. Provide nameplate for each fan unit clearly and permanently inscribed with manufacturer's name, model number, serial number, rated capacity, electrical or other power characteristics and other customary or usual nameplate data. Nameplate shall be of 316 stainless steel. A separate phenolic nameplate with ½-inch letters shall be provided and fastened to the fan housing indicating the fan tags as scheduled.

J. All units shall be delivered with equipment fully lubricated insofar as is practical. All points not fully lubricated when delivered shall be clearly marked to this effect and that lubrication is required prior to operation. For each point not lubricated, provide an adequate supply of lubricant, with application instructions for each unit. Equipment shall be unloaded, stored, installed and started in accordance with manufacturer's instructions.

K. Fan manufacturer to provide NEMA 4X stainless steel safety disconnect switch factory mounted and wired to each fan exterior. Provide disconnect switch in accordance with Section 26 28 16.

L. Fan noise shall be less than 69dBA at 5 feet with a directivity factor of Q=2 based on AMCA testing procedures.

M. Operating requirements for fans are as shown in Table 1.

Table 1

Motor RPM	1,200
Motor Horsepower	3
Motor Voltage	460V, 3-phase, 60 Hz
Flowrate	5,000 cfm
Static Pressure	2.0 psig
Model	24D6-VP-MA

PART 3 EXECUTION

3.01 EXAMINATION

A. All subgrade elevations shall be verified prior to starting tank construction.

3.02 INSTALLATION

A. Floor:

1. The subgrade shall be prepared by fine grading to ensure proper placement of reinforcing steel with proper bottom cover.

2. A 6-mil polyethylene vapor-barrier shall be placed after subgrade preparation has been completed.

3. Form and screed boards shall be of proper thickness and sufficiently braced to ensure that the floor is constructed within proper thickness tolerances.

4. Plate bolsters shall be used to support reinforcing steel in the construction of the floor to ensure positive control of placement of reinforcing steel.

5. The floor shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

6. The floor shall be continuously water cured until tank construction is completed.

7. The floor shall receive a light broom finish.

B. Core Wall:

1. The wall shall be constructed in a predesigned manner utilizing steel shell diaphragm, layers of shotcrete and prestressing wire with each conforming to the following:

   a. Diaphragm Erection:

      (1) 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 epoxy sealant which complies with Section 2.8 Epoxy.

   b. Shotcrete:

(1) 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.

(2) Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer.

(3) No shotcrete shall be applied to reinforcing steel or diaphragm that is encrusted with overspray.

(4) No less than ⅛" thick shotcrete shall separate reinforcing steel and prestressing wire.

(5) The steel shell diaphragm shall be encased and protected with no less than 1" of shotcrete in all locations.

c. Curing:

(1) Interior and exterior portions of the shotcrete wall shall be water cured for a minimum of 7 days or until prestressing is started.

C. Epoxy Injection:

1. Epoxy injection shall be carried out from bottom to top of wall using a pressure pumping procedure.

2. Epoxy injection shall proceed only after the steel shell has been fully encased, inside and outside, with shotcrete.

D. Dome:

1. All concrete shall be consolidated by means of a vibrator for proper encasement of reinforcing steel and welded wire fabric.

2. All surfaces at the joint between the wall and the dome shall be coated with bonding epoxy which complies with Section 2.8 Epoxy.

3. Plastic bolsters shall be used to support reinforcing steel and welded wire reinforcement to ensure positive control on placement of steel.

4. The exterior surface of the dome shall receive a light broom finish.

5. The dome shall be water cured for 7 days after casting or until dome band prestressing is completed.

E. Prestressing:

1. 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.

2. 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 force 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.

3. 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.

4. 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 design and as shown on approved drawings.

5. 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.

6. 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.

7. When multiple layers of wire are required, shotcrete cover between layers shall be no less than ⅛" thick.

F. Covercoat:

1. 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. Horizontal sections of the wall shall form true circles without flat areas, excessive bumps or hollows.

3. The covercoat shall receive a sliced trowel finish.

G. Wall Openings:

1. All wall pipes, sleeves and manholes passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

3.03 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Concrete and Shotcrete Testing:

a. Compression Tests:

(1) Compression test specimens shall be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications. At least one set of test specimens shall be made for each 50 yards of concrete/shotcrete placed. Each set of test specimens shall be a minimum of 5 cylinders.

(2) Compression test specimens for concrete/shotcrete shall conform to ASTM C 172 for sampling and ASTM C 31 for making and curing test cylinders. Test specimens shall be 6-inch diameter by 12-inch high or 4-inch diameter by 8-inch high cylinders.

(3) Compression test shall be performed in accordance with ASTM C 39. Two test cylinders will be tested at 7 days and two at 28 days. The remaining cylinder will be held to verify test results, if needed.

b. Air Content Tests:

(1) Air content tests shall conform to ASTM C 231 (Pressure Method for Air Content).

(2) Tests for air content shall be made prior to concrete placement and whenever compression test specimens are made.

c. Slump Tests:

(1) Slump tests shall be made in accordance with ASTM C 143.

(2) Slump tests shall be made whenever compression test specimens are made.

d. Prepare and test the number of cylinder sets shown in the following schedule using ASTM C39:

	After 7 Days	**After 28 Days**	**Hold**	**Total**
Concrete Floor (per quarter area)	1	1	1	4
Core Wall (per day casting)	1	1	1	Varies
Shotcrete (per quarter area)	1	1	1	4
Outside Core Wall	2	2	2	8
Roof	1	1	1	4
Exterior Overcoat	1	1	1	4

2. Hydrostatic Testing:

a. On completion of the tank and prior to any specified backfill placement at the footing or wall, the tank shall be tested for watertightness.

b. The testing for watertightness shall be completed as follows:

(1) Fill the tank with water to the maximum water level and let it stand for a minimum of 24 hours.

(2) Inspect the exterior of the tank wall and footing for damp spots. Damp spots shall be defined as spots where moisture can be picked up on a dry hand, the source of which is from inside the tank.

(3) Leakage through the wall or wall-base joint shall be repaired and the tank shall be retested using the above procedure.

3.04 CLEANING AND DISINFECTION

A. The interior of the tank shall be cleaned to remove debris, construction items, and equipment prior to testing and disinfection.

B. The following disinfection procedure shall be used to disinfect storage tanks used for potable water:

1. Method 3 will be used for disinfection of the tank in accordance with AWWA C652.

2. When Method 3 is used, the disinfection plan required by Section 1.4 H. shall address any compatibility issues with the form of chlorine used for disinfecting the storage tank with the type of disinfectant used in the normal production of the water used to fill the tank.

END OF SECTION

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SECTION 33 16 23

NATURAL DRAFT AERATORS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The 100,000 gallon ground storage tank shall be equipped with a 2,600 gpm rated fiberglass natural draft aerator. The natural draft aerator shall be built in accordance with the plans, utilizing perforated circular trays.

B. The aerator shall be supplied and installed by the Ground Storage Reservoir Manufacturer.

C. The entire aerator structure shall conform to Specifications 06 70 00 – Fiberglass Reinforced Plastic Products.

1.02 QUALIFICATIONS

A. The aerator Manufacturer shall be a specialist, having at least five years experience in the design and fabrication of natural draft Fiberglass aerators. The Manufacturer shall have built in its own name no less than 10 comparable aerators now giving satisfactory service.

1.03 SHOP DRAWINGS

Prior to beginning field work, the Manufacturer shall submit a complete set of detailed working drawings for the aerator installation. Drawings must be approved before construction may proceed.

PART 2 - PRODUCTS

2.01 NATURAL DRAFT AERATOR

A. The natural draft aerator shall include louvers and be built in accordance with the plans, and shall be cascade type, having a normal flow capacity of 2,600 gallons per minute. The base of the aerator shall be sloped to the drain. Provide plugs for the drain and downcomers.

B. Aerator Design

The basis of design was based on information provided by The Crom Corporation. The aerator shall be structurally designed by the manufacturer to withstand wind loads as designated in the 2010 Florida Building Code. The aerator shall incorporate the following features:

1. Catch Basin

   The base of the aerator shall be a watertight circular Fiberglass catch basin of such height and diameter as will insure adequate capacity and proper ventilation at all tray levels, and preclude splashing of water outside the basin.

   A drain shall be provided for ease in cleaning the catch basin. To prevent backup, the downcomer shall be no less than twice the size of the influent pipe. No “bird baths” will be allowed in the aerator basin.

2. Cascade Trays

   The aeration system shall have a circular configuration, and shall consist of at least four (4) levels of tray cascade aerators as required by the manufacturer to treat 2,600 gpm per minute. The trays shall surround and be anchored to the “extended” influent pipe, which is to be furnished with work described herein. A perforated water breaker and baffle plate shall be used on the top level.

   To insure proper aeration, a vertical clearance of no less than 15 inches shall be provided between roof and top level of trays; between catch basin floor and bottom level of trays; and between the several levels of trays.

   The trays shall be of laminated Fiberglass construction. Laminate thickness shall be no less than ½-inch. All surfaces shall be finished with white gel coat no less than 20 mils thick. Edges shall be thoroughly sealed with gel coat to prevent delaminations. The column supports for 2,600 GPM aerator trays shall be made of prefabricated structural two (2) – inch square tubing, with the tubing wall thickness shall be ¼ - inch.

3. Aerator Roof

The roof shall be circular, and shall have a diameter at least four (4) feet greater than the catch basin diameter. The roof shall have a pitch of 4 – inches from center to outer edge to insure rain water runoff.

The roof shall be made of laminated fiberglass panels no less than ¼-inch thick. The exterior shall be a molded surface and shall be finished with white gel coat no less than 20 mils thick. The interior shall be a lay-up surface and shall be finished with green gel coat no less than 20 mils thick.

All panel joints shall be sealed with marine grade silicone caulk.

Peripheral column supports for the roof shall be made of 2-inch square tubing ¼-inch thick prefabricated structural components. Roof columns shall be securely anchored to the catch basin curb and braced with 1-inch square tubing.

4. Louvered Walls and Screening

The circular sidewalls of the aerator shall consist of the roof columns together with laminated fiberglass panels with louvers for ventilation. The louvers shall have 24 X 24 mesh polyester screening, resulting in a completely enclosed wall capable of preventing entry of birds, animals and insects. Screening shall be secured by means of contact cement and Fiberglass moldings anchored with stainless steel fasteners. All materials to be suitable for a corrosive environment with elevated levels of hydrogen sulfide and reduced sulfur components, 316 stainless steel.

Access to the aerator enclosure shall be provided by means of a hinged fiberglass door, thoroughly sealed.

5. Guarantee

The Manufacturer shall guarantee workmanship and materials on the entire aerator structure for a period of five years from date of acceptance by the owner.

6. Coatings

Coat exposed concrete areas with two coats Tnemec Series N140. Tnemec morter clad series 218 surfacer a minimum thickness of 1/8” to

be applied to prior to N140 system application. No other coating systems are allowed. Coating shall be NSF 61 approved.

Fiberglass areas of aerator are not to be coated.

Exterior of aerator including louvers shall be the same color as the tank to avoid showing any corrosion.

PART 3 - EXECUTION

3.01 GENERAL

A. Tank manufacturer shall be responsible for design and installation of the aerator.

END OF SECTION

SECTION 33 31 12

PVC GRAVITY SEWER PIPE

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of PVC gravity sewer pipe conforming to ASTM D3034. Sizes are 4 through 15 inches.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with the Section 01 33 00.

B. Submit reports on testing per ASTM D3034 (pipes 3 inches through 15 inches).

PART 2 MATERIALS

2.01 PVC MATERIAL

Additives and fillers, including stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 10 parts by weight per 100 of PVC resin in the compound.

2.02 PIPE

A. Pipe 4 through 15 inches shall conform to ASTM D3034, SDR 35.

2.03 JOINTS

Provide elastomeric gasket joints of the push-on type, conforming to ASTM D3212.

2.04 GASKETS

Gaskets for push-on joints shall conform to ASTM F477.

2.05 FITTINGS

A. Fittings for pipe 4 through 15 inches shall conform to ASTM D3034, SDR 35.

2.06 MANDREL FOR FIELD TESTING OF PIPE DEFLECTION

The mandrel shall:

A. Be a rigid, nonadjustable, odd-numbering-leg (nine legs minimum) mandrel having an effective length not less than its nominal diameter.

B. Have a minimum diameter at any point along the full length as follows:

Pipe Material	Nominal Size (inches)	Minimum Mandrel Diameter (inches)
PVC-ASTM D3034 (SDR 35)	6	5.619
	8	7.524
	10	9.405
	12	11.191
	15	13.849

C. Be fabricated of steel; be fitted with pulling rings at each end; be stamped or engraved on some segment other than a runner indicating the pipe material specification, nominal size, and mandrel outside diameter (e.g., PVC, D 3034-8"-7.524"); and be furnished in a carrying case labeled with the same data as stamped or engraved on the mandrel.

D. All costs incurred by the Contractor attributable to mandrel and deflection testing, including any delays, shall be borne by the Contractor at no cost to the Owner.

PART 3 EXECUTION

3.01 LABORATORY TESTING

A. Conduct tests required in ASTM D3034.

B. The acceptable rates of failure for quality control tests shall be as follows:

1. Outer Diameter: 0%.
2. Minimum Wall Thickness: 0%.
3. Other Dimensions: 0%.

4. Flattening: 0%.

5. Impact: Six of six samples must pass; if one fails, test six more; all six must pass.

3.02 INSTALLING PVC SEWER PIPE

A. Install in accordance with ASTM D2321, and as described below.

B. Pipe shall not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.

C. Minimum bedding thickness shall be in accordance with the trenching detail in the drawings.

D. Lay pipe without break, upgrade from structure to structure, with the socket ends of the pipe upgrade.

E. Do not use the pipe as a drain for removing water that has infiltrated into the trench.

F. After joint assembly, bring the bedding material up to pipe spring line. Place the bedding material on each side of the pipe. Tamp the bedding material into final position at pipe spring line and continue to the top of the pipe. Relative compaction shall be in conformance with Section 31 23 33

G. Then place bedding material to 1 foot above the top of the pipe and compact to the same relative compaction as in the pipe zone.

H. Do not use hydro-hammers to compact bedding or backfill.

3.03 INSTALLING LATERALS

A. Each wye branch fitting shall have its barrel diameter equal to the diameter of the sanitary sewer main and the spur (or branch) diameter as indicated in the drawings. Do not place wye branches within 5 feet of any structure.

B. Install wye fittings so that the outlet branch is inclined upward at an angle of 45 degrees. Plug wye branch fittings that are to be left unconnected with a stopper or plug. Join laterals to wye branch fittings at the sanitary sewer main by eighth bends. Eighth bends and quarter bends are a part of lateral sewer line.

C. End of the lateral shall be at least 3 feet below the existing or proposed grade of the ground at existing structure to be served or as called for in the drawings.

D. Where possible, laterals shall run perpendicular to the sewer main at a minimum grade of 1%. Bed laterals the same as the sewer main into which they connect.

E. Plug laterals with stopper in the socket of the last joint. Seal stopper in place so that it will withstand the internal pressure during the test for leakage and so that it may be removed without damage to the socket.

F. Mark the location of each lateral by chiseling a letter "S" 1 1/2 inches high on the top of the curb. If the terminal point of the lateral is more than 8 feet beyond the curb line or curb improvements do not exist, provide and install a 4-inch by 4-inch by 3-foot 0-inch stake extending 2 inches above the ground and placed at the end of the connection.

3.04 INSTALLING PIPE AT MANHOLES AND STRUCTURES

A. Place a 2-foot PVC length of pipe of the same inside diameter as the adjoining pipe at the inlet and outlet to each manhole or structure. Use one of the following methods:

1. Directly cast a manhole coupling into the manhole base. Provide rubber-ring gasket in the coupling.

2. Stretch a rubber-ring gasket around the pipe to serve as a water stop when cast into the structure wall.

B. Do not cast pipe bells into manholes or structures. Cut off the bell so that no recess or offset appears on the exposed face from the inside wall of the pipe to the outside wall of the pipe. The pipe shall have a plain end, flush with the inside wall of the manhole or structure, or as shown in the drawings.

3.05 TESTING FOR DEFECTS OF INSTALLED PIPE

Following placement and compaction of backfill and prior to placing permanent pavement, ball and mandrel the pipe to measure for obstructions (excessive deflections, joint offsets, and lateral pipe intrusions).

3.06 FIELD TESTING FOR PIPE DEFLECTION

A. Test installed pipe to ensure that vertical deflections for plastic pipe do not exceed the maximum allowable deflection. Maximum allowable deflections shall be governed by the mandrel requirements stated herein and shall nominally be:

Nominal Pipe Size	Percentage
Up to and including 12 inches	5.0

B. The maximum average inside diameter shall be equal to the average outside diameter per applicable ASTM standard minus two minimum wall thicknesses per applicable ASTM standards. Manufacturing and other tolerances shall not be considered for determining maximum allowable deflections.

C. Perform deflection tests not sooner than 30 days after completion of placement and compaction of backfill. Clean and inspect the pipe for offsets and obstructions prior to testing.

D. Pull a mandrel through the pipe by hand to verify that maximum allowable deflections have not been exceeded. Prior to use, the mandrel shall be certified by an independent testing laboratory. Use of an uncertified mandrel or a mandrel altered or modified after certification will invalidate test. If the mandrel fails to pass, the pipe will be deemed to be overdeflected.

E. Uncover any overdeflected pipe and, if not damaged, reinstall. Remove damaged pipe from the site. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any overdeflection, shall be uncovered, removed from the site, and replaced with new pipe.

3.07 LEAKAGE TEST

See Section 40 05 15.

3.08 TESTING FOR ALIGNMENT AND GRADE

After the pipe has been installed, tested for leakage, backfilled to existing grade, and manholes raised to grade and resurfaced, "ball" the pipe from manhole to manhole with a sewer scrubbing ball. After balling the pipe, perform the following:

A. "Mirror" straight sewers and inlet/outlet ends of curvilinear sewers. Perform balling and mirroring in the presence of the Owner to test for alignment, grade, damaged or defective pipe in place, or any other type of faulty installation. Should balling and mirroring indicate any faulty installation of the pipe, repairs or replacements shall be made at the Contractor's expense.

END OF SECTION

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SECTION 40 05 00

GENERAL PIPING REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

This section describes the application of the Piping Schedule shown in the drawings and the general requirements for selecting piping materials; selecting the associated bolts, nuts, and gaskets for flanges for the various piping services in the project; and miscellaneous piping items.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit affidavit of compliance with referenced standards (e.g., AWWA, ANSI, ASTM, etc.).

C. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

D. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.

1.03 DEFINITIONS OF BURIED AND EXPOSED PIPING

A. Buried piping is piping buried in the soil, commencing at the wall or beneath the slab of a structure. Where a coating is specified, provide the coating up to the structure wall. Unless detailed otherwise, coating shall penetrate wall no less than 1 inch. Piping encased in concrete is considered to be buried. Do not coat encased pipe.

B. Exposed piping is piping in any of the following conditions or locations:

1. Above ground.

2. Inside buildings, vaults, or other structures.

3. In underground concrete trenches or galleries.

1.04 PIPING SERVICE

Piping service is determined by the fluid conveyed, regardless of the pipe designation. For example, pipes designated "Air Low Pressure," "Air High Pressure," and "Air" are all considered to be in air service.

1.05 DEFAULT PIPING MATERIALS

If no material is shown in the drawings or in the Piping Schedule, use the following piping materials:

Service	Size Range (inches)	Material	Specification Section
Buried	3 and smaller	SCH80 PVC	40 20 90
	4	Ductile Iron	40 20 40
	6 and larger	Ductile Iron	40 20 40
Exposed	3 and smaller	316 Stainless Steel	40 20 76
	4	316 Stainless Steel	40 20 76
	6 and larger	316 Stainless Steel	40 20 76

PART 2 MATERIALS

2.01 MATERIALS SELECTION AND ALTERNATIVE MATERIALS

A. The Piping Schedule in the drawings lists the material and specification for each piping service in the project. In locations where the piping material referenced on the Piping Schedule is not appropriate, the piping material is indicated in the drawings. Materials called out in the drawings shall govern over materials stated in the Piping Schedule.

B. The Piping Schedule in the drawings may show alternative piping materials for certain services. In such cases, the same pipe material shall be used for all pipe sizes in all locations for the given piping service. Do not intermix piping materials.

2.02 THREAD FORMING FOR STAINLESS STEEL BOLTS

Form threads by means of rolling, not cutting or grinding.

2.03 BOLTS AND NUTS FOR FLANGES FOR DUCTILE-IRON PIPING (SPECIFICATION SECTIONS, 40 20 40)

A. Bolts and nuts for Class 125 or 150 flanges (including AWWA C207, Class D) located indoors, outdoors above ground, and in vaults and structures shall be carbon steel, ASTM A307, Grade B, hot-dipped galvanized per ASTM F2329.

B. Bolts and nuts for buried or submerged Class 125 or 150 flanges shall be Type 304 stainless steel conforming to ASTM A193 (Grade B8) for bolts and ASTM A194 (Grade 8) for nuts.

C. Hex head machine bolts for use with lugged valves shall comply with ASTM A193, Grade B7.

D. Fit shall be Classes 2A and 2B per ASME B1.1 when connecting to cast-iron valves having body bolt holes.

E. Bolts for AWWA C207 Classes E and F flanges and ASME B16.5 and B16.47 Class 300 flanges located indoors, outdoors above ground, and in vaults and structures shall conform to ASTM A193, Grade B7, with nuts conforming to ASTM A194, Grade 2H.

F. Bolts and nuts for buried or submerged Class 300 flanges shall be Type 304 stainless steel conforming to ASTM A193, Grade 8, Class 2, for bolts and ASTM A194, Grade 8 for nuts.

G. Bolts used in flange insulation kits shall conform to ASTM A193 (Grade B7). Nuts shall conform to ASTM A194 (Grade 2H).

H. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.04 BOLTS AND NUTS FOR FLANGES FOR STAINLESS STEEL PIPING (SPECIFICATION SECTION 40 20 76)

A. Bolts and nuts for flanges shall be Type 304 stainless steel conforming to ASTM A193, Grade B8 for bolts and ASTM A194, Grade 8 for nuts.

B. Hex head machine bolts for use with lugged valves shall comply with ASTM A193, Grade B8, Class 2.

C. Bolts for flange insulation kits shall conform to ASTM A193, Grade B7. Nuts shall conform to ASTM A194, Grade 2H.

D. Provide washer for each nut. Washers shall be of the same material as the nuts.

2.05 BOLTS AND NUTS FOR FLANGES FOR PVC PIPE (SPECIFICATION SECTION 40 20 90)

A. Bolts and nuts for flanges located indoors, outdoors above ground, and in vaults and structures shall be carbon steel, ASTM A307, Grade B, hot-dipped galvanized per ASTM F2329.

B. Bolts and nuts for buried and submerged flanges shall be Type 304 stainless steel conforming to ASTM A193, Grade B8 for bolts and ASTM A194, Grade 8 for nuts.

2.06 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

Lubricant shall be chloride free and shall be RAMCO TG-50, Anti-Seize by RAMCO, Specialty Lubricants Corporation Husky™ Lube O'Seal, or equal.

2.07 GASKETS FOR FLANGES FOR PVC (SPECIFICATION SECTION 40 20 90)

Gaskets for flanged joints shall be full faced, 1/8-inch thick, having a hardness of 50 to 70 durometer A. Gasket material for other than sodium hypochlorite service shall be EPR. Gasket material for sodium hypochlorite service shall be Viton ETP.

2.08 GASKETS FOR FLANGES FOR STAINLESS STEEL PIPING (SPECIFICATION SECTION 40 20 76)

Gaskets shall be full face, 1/8-inch thick. Gaskets for services other than chemical service shall be one of the following nonasbestos materials:

A. Cloth-inserted rubber, with a Shore "A" hardness of 75 to 85. Gaskets shall be suitable for a pressure of 200 psi at a temperature of 180°F. Products: Garlock Style 19 or equal.

B. Acrylic or aramid fiber bound with nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal. Gaskets shall be suitable for a water pressure of 500 psi at a temperature of 400°F.

2.09 MOLDABLE FILLER TAPE FOR PIPE SURFACE TRANSITION AREAS

A. Filler tape shall be a 100% solids mastic-like butyl-rubber filler designed to fill and smooth the transition areas between adjacent coating surfaces such as step-down weld areas, surface irregularities beneath heat-shrink sleeves, pipefittings, and exothermic welds for cathodic protection bonding wire connections. Characteristics:

1. Thickness per ASTM D1000: 1/8 inch minimum.
2. Peel adhesion to primed pipe: 300 ounces per inch minimum.
3. Elongation: 600% minimum.

B. Products: Tapecoat “Moldable Sealant,” Polyken No. 939 Filler Tape, or equal.

2.10 FLANGE INSULATION KITS

A. Flange insulation kits shall consist of insulating gasket, an insulating stud sleeve for each bolt, insulating washers for each bolt, and a steel washer between each insulating washer and the nut. The sleeves shall be one piece, integral with the insulating washer. Provide double sleeve and washer sets for each bolt.

B. Gasket material shall be phenolic, 1/8-inch (3 mm) thick. The flange insulating gasket shall be full diameter (full face) of the flange with a nitrile O-ring on each side of the gasket. Dielectric strength shall be not less than 500 volts per mil (0.025 mm) and a compressive strength of not less than 24,000 psi (165,000 kPa).

C. Insulating flange bolt sleeves shall be spiral-wrapped mylar having a minimum dielectric strength of 4,000 volts per mil (0.025 mm).

D. Insulating flange bolt washers shall be high-strength phenolic a minimum thickness of 1/8-inch (3 mm). Dielectric strength shall be not less than 500 volts per mil (0.025 mm) and a compressive strength of not less than 25,000 psi (172,000 kPa).

E. Steel flange bolt washers for placement over the insulating washers shall be a minimum thickness of 1/8-inch (3 mm) and be zinc plated or stainless steel.

F. Flange insulation kits shall be as manufactured by Advance Product Systems, PSI, Central Plastics Company, or equal.

2.11 INSULATING UNIONS

A. Insulating unions shall consist of a molded nylon sealing sleeve mounted in a three-piece malleable-iron (ASTM A47 or A197) body. Ends shall be threaded (ASME B1.20.1) when connecting to steel piping and copper solder joint when connecting to copper piping. Minimum working pressure shall be 150 psi (1034 kPa). Unions shall be as manufactured by Central Plastics Company, Capital Insulation, or equal.

PART 3 EXECUTION

3.01 INSTALLING PIPE SPOOLS IN CONCRETE

Install pipes in walls and slabs before placing concrete. See Sections 03 30 00 and 40 07 62.

3.02 RAISED FACE AND FLAT FACE FLANGES

Where a raised face flange connects to a flat-faced flange, remove the raised face of the flange.

3.03 INSTALLING ABOVEGROUND OR EXPOSED PIPING

A. Provide pipe hangers and supports as detailed in the drawings and as specified in Section 40 07 64.

B. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment.

3.04 INSTALLING FLANGED PIPING

A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within

1/16 inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.

B. Inspect each gasket to verify that it is the correct size, material, and type for the specified service and that it is clean and undamaged. Examine bolts or studs, nuts, and washers for defects such as burrs or cracks and rust and replace as needed.

C. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate carbon steel bolts with oil and graphite, and tighten nuts uniformly and progressively.

D. Bolt lengths shall extend completely through their nuts. Any that fail to do so shall be considered acceptably engaged if the lack of complete engagement is not more than one thread.

E. Do not use more than one gasket between contact faces in assembling a flanged joint.

F. Tighten the bolts to the manufacturer's specifications, using the recommended cross bolt pattern in multiple steps of increasing torque, until the final torque requirements are achieved. Do not over torque.

G. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

3.05 INSTALLING BLIND FLANGES

A. At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, and gaskets.

3.06 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

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SECTION 40 05 15

PRESSURE AND LEAKAGE TESTING OF PIPING

PART 1 GENERAL

1.01 DESCRIPTION

Work Specified Herein and Elsewhere

A. Work under this Section includes:

1. Piping system testing.
2. Leakage tests.
3. Testing equipment.
4. System testing.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide all necessary equipment and instrumentation required for proper completion of testing. Source and quality of water shall be approved by the Engineer.

B. The CONTRACTOR shall pretest all piping systems prior to scheduling a final test. The time and expense associated with any retesting shall be the responsibility of the CONTRACTOR, including the time and expense of the ENGINEER's representative witnessing the retest.

PART 3 EXECUTION

3.01 PIPING SYSTEM TESTING

A. General Requirements

1. Test procedures and method of disposal of water shall be approved by the Engineer. All tests shall be made in the presence of the Engineer. Preliminary tests made by the CONTRACTOR without being observed by the Engineer will not be accepted. Notify the Engineer at least twenty-four (24) hours before any work is to be inspected or tested.

2. All defects in piping systems shall be repaired and/or replaced and retested until acceptable. Repairs shall be made to the standard of quality specified for the entire system.

3. Sections of the system may be tested separately, but any defect which may develop in a section previously tested and accepted shall be promptly corrected and retested. Pressure tests shall be made between valves to demonstrate ability of valves to sustain pressure.

4. All piping shall be tested in accordance with the following test methods, in addition to any test required by local and state codes or building authorities.

B. Flushing

Prior to testing, flush all piping systems with water to remove construction debris.

C. Pressure Piping Testing

1. All piping subject to 5 psig pressure or more shall pass the following hydrostatic pressure test and leakage test.

2. Tests for any exposed piping shall be made before covering and insulation is placed.

3. The pressure and leakage test for buried piping shall be made after all jointing operations are completed and any concrete reaction blocks, and restraints have cured at least seven days. Lines tested before backfill is in place shall be retested after compacted backfill is placed.

4. Sections of piping between valves and other short sections of line may be isolated for testing. If shorter sections are tested, test plugs or bulkheads required at the ends of the test section shall be furnished and installed by the CONTRACTOR, together with all anchors, braces, and other devices required to withstand the hydrostatic pressure without imposing any thrust on the pipe line. The CONTRACTOR shall be solely responsible for any damage which may result from the failure of test plugs or supports.

D. Hydrostatic Tests for Pressure Piping

1. Piping shall be slowly filled with water and all air expelled. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

2. After the section of line to be tested has been filled with water, the specified test pressure shall be applied and maintained for a minimum period of 10 minutes and for such additional period necessary for the ENGINEER to complete the inspection of the line under test. Do not exceed pipe manufacturer's suggested time duration at the test pressure. If defects are noted, repairs shall be made and the test repeated until all parts of the line withstand the test pressure.

3. Hydrostatic test pressure shall be as determined by the ENGINEER.

E. Leakage Test for Pressure Piping

1. After the specified hydrostatic test has been completed, the line shall be subjected to a leakage test under a hydrostatic pressure in the range of 50% to 100% of the pressure required for the hydrostatic test. The selected pressure shall be maintained within a maximum variation of 5% during the entire leakage test. The duration of the leakage test shall be two hours minimum, and for such additional time necessary for the Engineer to complete inspection of the section of line under test. Leakage measurements shall not be started until a constant test pressure has been established. The line leakage shall be measured by means of a water meter installed on the supply side of the pressure pump.

2. No leakage is allowed in exposed piping, buried piping with flanged, threaded, or welded joints or buried non-potable piping in conflict with potable water lines.

3. Tested sections of buried piping with slip-type or mechanical joints will not be accepted if it has a leakage rate in excess of that rate determined by the formula:

   L = 0.00027 NDp, in which;

   L = Maximum permissible leakage rate, in gallons per hour, throughout the entire length of line being tested.

   N = Number of gasketed joints (two for each flexible coupling joint) in the line under test.

   D = Nominal internal diameter (in inches) of the pipe.

   p = The square root of the actual pressure in psig on all joints in the tested portion of the line. This actual pressure shall be determined by finding the difference between the average elevation of all tested pipe joints and the elevation of the pressure gauge and adding the difference in elevation head to the authorized test pressure.

3. Where the leakage rate exceeds the permissible maximum, the CONTRACTOR shall locate and repair leaking joints to the extent required to reduce the total leakage to within the prescribed amount.

4. All apparent leaks discovered within one year from the date of final acceptance of the work by the OWNER shall be located and repaired by the CONTRACTOR, regardless of the total line leakage rate.

END OF SECTION

SECTION 40 05 20

MANUAL, CHECK, AND PROCESS VALVES

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of manually operated valves, check valves, and process valves including gate, knife gate, butterfly, ball, hose bibbs, globe, angle, needle, eccentric plug, lubricated plug, nonlubricated plug, diaphragm, check, pinch, solenoid, pet cocks, mud valves, vacuum breakers, deluge valves, flap valves, balancing valves, gauge valves, instrument valve manifolds, and telescoping valves.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit manufacturer's catalog data and detail construction sheets showing all valve parts. Describe each part by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Identify each valve by tag number to which the catalog data and detail sheets pertain.

C. Show valve dimensions including laying lengths. Show port sizes. Show dimensions and orientation of valve actuators, as installed on the valves. Show location of internal stops for gear actuators. State differential pressure and fluid velocity used to size actuators. For worm-gear actuators, state the radius of the gear sector in contact with the worm and state the handwheel diameter.

D. Show valve linings and coatings. Submit manufacturer's catalog data and descriptive literature.

E. Submit six copies of a report verifying that the valve interior linings and exterior coatings have been tested for holidays and lining thickness. Describe test results and repair procedures for each valve. Do not ship valves to project site until the reports have been returned by the Owner's Representative and marked "Resubmittal not required."

PART 2 MATERIALS

2.01 GENERAL

A. Install valves complete with operating handwheels or levers, chainwheels, extension stems, floor stands, gear actuators, operating nuts, chains, and wrenches required for operation.

B. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached plate.

C. For buried locations, valves with mechanical joint ends may be substituted for the flanged ends specified provided the mechanical joint ends are compatible with the pipe ends.

2.02 VALVE ACTUATORS

A. Provide lever or wrench actuators for exposed valves 6 inches and smaller. For larger valves, provide handwheels.

B. Where manually operated valves (size 4 inches and larger) are installed with their centerlines more than 6 feet 9 inches above the floor, provide chainwheel and guide actuators.

C. Provide 2-inch AWWA operating nuts for buried and submerged valves. Provide 2-inch AWWA operating nuts with the handwheels for manually actuated valves 24 inches and larger for use with a portable electric valve actuator.

D. Provide enclosed gear actuators on butterfly, ball, and plug valves 6 inches and larger, unless electric motorized valve actuators are shown in the drawings. Gear actuators for valves 6 through 20 inches shall be of the worm and gear, or of the traveling nut type. Gear actuators for valves 24 inches and larger shall be of the worm and gear types.

E. Provide gear actuators on gate valves 14 inches and larger, unless electric motorized valve actuators are shown in the drawings. Gear actuators shall be of the bevel or spur gear type. Provide grease case. Gearing shall comply with AWWA C500.

F. Design gear actuators assuming that the differential pressure across the plug, gate, or disc is equal to the test pressure of the connecting piping and assuming a

fluid velocity of 16 fps for valves in liquid service and 80 fps for valves in air or gas service and a line fluid temperature range of 33°F to 125°F unless otherwise required in the detailed valve specifications. Size actuators using a minimum safety factor of 1.5 for valves in open/close service and 2.0 in modulating service.

G. Gear actuators shall be enclosed, oil lubricated, with seals provided on shafts to prevent entry of dirt and water into the actuator. Gear actuators for valves located above ground or in vaults and structures shall have handwheels. The actuators for valves in exposed service shall contain a dial indicating the position of the valve disc or plug. Gear actuators for buried or submerged valves shall have 2-inch-square AWWA operating nuts.

H. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets. Provide totally enclosed actuators designed for buried or submerged service.

I. Traveling nut and worm and gear actuators shall be of the totally enclosed design so proportioned as to permit operation of the valve under full differential pressure rating of the valve with a maximum pull of 80 pounds on the handwheel or crank. Provide stop limiting devices in the actuators in the open and closed positions. Actuators shall be of the self-locking type to prevent the disc or plug from creeping. Design actuator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel or chainwheel actuators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.

J. Handwheel diameters for traveling nut actuators shall not exceed 8 inches for valves 12 inches and smaller and shall not exceed 12 inches for valves 20 inches and smaller.

K. Self-locking worm gear shall be a one-piece design of gear bronze material (ASTM B427; or ASTM B84, Alloy C86200), accurately machine cut. Actuators for eccentric and lubricated plug valves may use ductile-iron gears provided the gearing is totally enclosed with spring-loaded rubber lip seals on the shafts. The worm shall be hardened alloy steel (ASTM A322, Grade G41500 or G41400; or ASTM A148, Grade 105-85), with thread ground and polished. Support worm-gear shaft at each end by ball or tapered roller bearings. The reduction gearing shall run

in a proper lubricant. The handwheel diameter shall be no more than twice the radius of the gear sector in contact with the worm. Worm-gear actuators shall be Limitorque Model HBC, EIM Series W, or equal.

L. Design actuators on buried valves to produce the required torque on the operating nut with a maximum input of 150 foot-pounds.

M. Valve actuators, handwheels, or levers shall open by turning counterclockwise.

2.03 CAST-IRON VALVE BOXES WITH DEBRIS CAPS FOR BURIED VALVES

A. Valve boxes shall be two-piece sliding type, cast iron, with extension shafts. Units shall be as manufactured by Tyler Pipe, Geneco, Star Pipe Products, or equal. Extension pipes shall be cast iron.

B. Debris cap shall be comprised of a hollow member having a cylindrical outer surface, a closure for one end, and three resilient contact pads projecting from the outer surface. Stainless steel springs under each contact pad shall hold the debris cap in position against the interior of the extension pipe or valve box. Provide handle to allow the contact pads to be extended and retracted. The cap shall have a flexible skirt providing an outward seal preventing debris from passing the cap. The cap shall withstand, without slipping, a minimum vertical force of 50 pounds when the contact pads are extended against the wall of the extension pipe or valve box. The cap shall be made of molded ABS plastic material. Color of handle shall be red. The cap shall have retaining prongs to retain a copper locating wire coil. Manufacturer: SW Services, Phoenix, Arizona, or equal.

C. Coat buried cast-iron pieces per Section 099000, System No. 30 or with fusion-bonded epoxy per Section 099761.

2.04 EXTENSION STEMS FOR BURIED AND SUBMERGED VALVE ACTUATORS

A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Where the valve is submerged, provide operating extension stems to bring the operating nut to 6 inches above the water surface. Extension stems shall be Type 316 stainless steel, solid core, and shall be complete with 2-inch-square operating nut. The connections of the extension stems to the operating nuts and to the valves shall

withstand without damage a pull of 300 foot-pounds.

B. Extension stem diameters shall be as tabulated below:

Valve Size (inches)	Minimum Extension Stem Diameter (inches)
2	3/4
3, 4	7/8
6	1
8	1 1/8
10, 12	1 1/4
14	1 3/8
16, 18	1 1/2
20, 24, 30, 36	1 3/4
42, 48, 54	2

C. Provide buried valves or valves located inside manholes or vaults with valve boxes cast in the manhole or vault roof with a valve position indicator designed to fit standard 5-1/4-inch valve boxes. The indicators shall show valve position and the direction and number of turns required to fully open (or close). All internal gearing shall be sealed. Ship each unit ready for field installation complete with valve box cast-iron adapter, cap screws, guide bushing, position indicator, flexible washer, centering plate, and 2-inch AWWA nut. Valve box and indicator shall be provided by the valve manufacturer. Indicators shall be Westran Position Indicator, Pratt Diviner, or equal.

2.05 FLOOR STANDS, EXTENSION STEMS, AND EXTENSION STEM SUPPORT BRACKETS

A. When required by the installations, provide floor stands and extension stems for operation of valves. Floor stands shall be of the nonrising stem, indicating type,

complete with steel extension stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Floor stands shall be cast-iron base type: Clow, Figure F-5515; Bingham and Taylor; Stockham; or equal. Handwheels shall turn counterclockwise to open the valves.

B. Provide Type 316 stainless steel anchor bolts.

C. Provide Type 316 stainless steel extension stems.

D. Provide adjustable stem guide brackets for extension stems. The bracket shall allow valve stems to be set over a range of 2 to 36 inches from walls. Provide bushings drilled to accept up to 2-inch-diameter stems. Base, arm, and clamp shall be ductile iron. Coat ductile iron components with fusion-bonded epoxy per Section 099761. Bushing shall be bronze (ASTM B584, Alloy C86400 or C83600). Bolts, nuts, screws, and washers (including wall anchor bolts) shall be Type 316 stainless steel. Provide slots in the bracket to accept 3/4-inch bolts for mounting the bracket to the wall. Products: Trumbull Industries, Inc., Adjustable Stem Guide or equal.

2.06 VALVE TAGGING AND IDENTIFICATION

Provide identifying valve tags per Section 40 07 75.

2.07 BOLTS AND NUTS FOR FLANGED VALVES

Bolts and nuts for flanged valves shall be as described in Section 40 05 00.

2.08 GASKETS FOR FLANGES

Gaskets for flanged end valves shall be as described in Section 40 05 00.

2.09 PAINTING AND COATING

A. Coat metal valves located above ground or in vaults and structures the same as the adjacent piping. If the adjacent piping is not coated, then coat valves per Section 09 90 00. Apply the specified prime coat at the place of manufacture. Apply intermediate and finish coats in field. Finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.

B. Coat buried metal valves at the place of manufacture per Section 099000, System No. 30.

C. Coat submerged metal valves, stem guides, extension stems, and bonnets at the place of manufacture per Section 09 90 00.

D. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless steel pieces, per Section 09 90 00. Apply lining at the place of manufacture. All linings to be NSF61 approved.

E. Alternatively, line and coat valves with fusion-bonded epoxy per Section 099761.

F. Coat floor stands per Section 09 90 00.

G. Test the valve interior linings and exterior coatings at the factory with a low-voltage (22.5 to 80 volts, with approximately 80,000-ohm resistance) holiday detector, using a sponge saturated with a 0.5% sodium chloride solution. The lining shall be holiday free.

2.010 PACKING, O-RINGS, AND GASKETS

Unless otherwise stated in the detailed valve specifications, packing, O-rings, and gaskets shall be one of the following nonasbestos materials:

A. Teflon.

B. Kevlar aramid fiber.

C. Acrylic or aramid fiber bound by nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal.

D. Buna-N (nitrile).

2.011 RUBBER SEATS

Rubber seats shall be made of a rubber compound that is resistant to free chlorine and monochloramine concentrations up to 10 mg/L in the fluid conveyed.

2.012 LOCATING MARKERS

Provide magnetic locating ball at each valve location.

2.013 VALVES

A. Gate Valves:

a. Ductile-Iron Resilient Wedge Tapping Gate Valves 4 Inches Through 16 Inches (AWWA C515):

Valves shall comply with AWWA C515 and the following. Valves shall be of the bolted bonnet type with nonrising stems. Valve stems shall be Type 304 or 316 stainless steel or cast, forged, or rolled bronze. Stem nuts shall be made of solid bronze. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum nor more than 7% zinc. Bronze shall conform to ASTM B62 or ASTM B584 (Alloy C83600), except the stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 10% elongation in 2 inches (ASTM B584 or B763, Alloy C87600 or C99500). Body bolts shall be Type 316 stainless steel. Ends shall be flanged, Class 125, ASME B16.1. One end shall have slotted bolt holes per AWWA C515, paragraph 4.4.1.3.4 to fit tapping machines.

Provide reduction thrust bearings above the stem collar. Stuffing boxes shall be O-ring seal type with two rings located in stem above thrust collar. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.

Valves shall be lined and coated at the place of manufacture with either fusion-bonded epoxy or heat-cured liquid epoxy. Minimum epoxy thickness shall be 8 mils. Valves shall be certified to NSF/ANSI Standard 61.

Manufacturers: American Flow Control (2500 Series), AVK s/s stem only (Series 45), Clow (F-6100), Kennedy (8571), M&H (4067), Mueller (A2360, A2361), U.S. Pipe (250), United Water (2010), Mueller –Aqua Grip (A-2361-77), American RD (D100)

b. Stainless Steel Gate Valves:

Stainless steel gate valves, 1/2 through 2 inches, shall be of the single wedge type with rising stem and handwheel. Minimum working pressure shall be 200 psig. Bonnet shall be of the screwed type. Ends shall be threaded, ASME B1.20.1. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet, plug, disc, and follower	Stainless steel	ASTM A351, Grade CF8M
Packing gland, nut, retainer ring, and stem	Stainless steel	ASTM A276, Type 316
Handwheel	Malleable iron	ASTM A47, A197
Stuffing box packing	Teflon	--

Valves shall be Powell Figure 1832, Crane/Alloyco Figure 90, or equal.

B. Ball Valves:

a. Full Port Threaded Bronze Ball Valves 2 Inches and Smaller:

Ball valves, 2 inches and smaller, for air or water service shall have a pressure rating of at least 600 psi WOG at a temperature of 100°F. Provide full port ball and body design. Valves shall comply with MSS SP-110. Provide bronze (ASTM B62 or ASTM B584, Alloy C83600 or C84400) body and plug ball retainer. Ball and stem shall be Type 316 stainless steel. Valves shall have threaded ends (ASME B1.20.1), nonblowout stems, reinforced Teflon seats, and have plastic-coated lever actuators. Valves shall be Stockham S-216 Series, Powell Fig 4210 T, Conbraco Ind. Apollo 7-100 Series, or equal.

b. Double Union PVC Ball Valves 3 Inches and Smaller:

Thermoplastic ball valves, 3 inches and smaller, for water and chemical service shall be rated at a pressure of 150 psi at a temperature of 105°F. Body, ball, and stem shall be PVC conforming to ASTM D1784, Type 1, Grade 1. Seats shall be Teflon. O-ring seals shall be Viton. Valve ends shall be of the double-union design. Ends shall be socket welded except where threaded or flanged-end valves are specifically shown in the drawings. Valves shall have handle for manual operation. Valves shall be as manufactured by Chemtrol, Hayward, R & G Sloan, Spears Manufacturing Company, Plast-O-Matic, IPEX Series VK or VKD, or equal.

c. Double Union PVC Ball Valves 3 Inches and Smaller with Vented

Ball for sodium hypochlorite service:

Vented PVC ball valves, 3 inches and smaller, for chemical service shall be rated at a pressure of 150 psi at a temperature of 105°F. Provide machined vent hole, deburred, in the ball to allow gases to vent. The vent hole shall be part of the manufactured valve assembly. Body, ball, and stem shall be PVC conforming to ASTM D1784, Type 1, Grade 1. Seats shall be Teflon. O-ring seals shall be Viton and suitable for the intended service. Valve ends shall be of the double-union design. Ends shall be socket welded except where threaded or flanged-end valves are specifically shown in the drawings. Valves shall have handle for manual operation. Provide stem extensions when valves are installed in insulated piping. Stem extensions shall be of a length sufficient to bring the bottom of the operating handle above the outside of the insulation. Products: Valves shall be Plast-O-Matic "Z-MBV-Vent," Asahi/America Type 21, or equal.

d. Regular Port Threaded Stainless Steel Ball Valves 2 Inches and Smaller:

Stainless steel ball valves, 2 inches and smaller, for water service shall be rated at a minimum pressure of 1,500 psi WOG at a temperature of 100°F. Valve body, ball, and stem shall be Type 316 stainless steel, ASTM A276 or A351. Seat and seals shall be reinforced Teflon. Valves shall have lever actuators, plastic coated. Provide locking lever handle. Valves shall have threaded ends (ASME B1.20.1) and nonblowout stems. Valves shall be McCanna Figure M402, Worcester Series 48, Stockham Figure SD 2120-SSMO-R-T, Apollo 76-100 Series, or equal.

C. Check Valves:

a. Check Valves (Rubber Flapper):

Check valves shall conform to AWWA C508. Check valves larger than 2-inch nominal size shall be iron body with stainless steel bolts and nuts, flanged ends, outside lever, spring loaded (stainless steel spring if available), swing-type with straight-away passageway of full pipe area. The valve shall have renewable bronze seat ring and rubber faced disc. Check valves shall

be 150 psi working pressure. Valves shall be GA FLG 200 with limit switch or Valmatic 500 series with limit switch.

b. Polypropylene Ball Check Valves, 3 Inches and Smaller:

Polypropylene check valves, 3 inches and smaller, shall be constructed of Polypropylene per ASTM D4101, Cell Classification PP0210B67272. Ends shall be double union, socket welded. Seats and seals shall be Teflon or EPDM. Valve shall have a pressure rating of 150 psi at a temperature of 73°F. The valve shall be U.S. Plastic Corp., George Fischer Type 360 or equal.

c. PVC Ball Check Valves, 3 Inches and Smaller:

PVC check valves, 3 inches and smaller, shall be constructed of PVC per ASTM D1784, Type I, Grade 1. Ends shall be double union, socket welded. Seats and seals shall be Viton for sodium hypochlorite, EPDM for other water services. Valve shall have a pressure rating of 150 psi at a temperature of 73°F.

d. Duckbill-Shaped Check Valves, 1 Through 3 Inches, slip-on:

Valve shall consist of a contoured rubber body with a duckbill sleeve-type exit. The valve shall be installed by slipping over the end of an exposed piece of pipe, and is fastened with compression clamps. The inside diameter of the valve's cuff shall be fabricated to exactly match the outside diameter of the pipe. The valve shall have a flare on the top and bottom. Material of construction of Hypalon Coated valves shall be EPDM for hydrofluosilicic acid and Viton for sodium hypochlorite applications. Provide Type 316 stainless steel compression clamp. The valve shall open at a differential pressure of 2 inches of water column and shall close under a no-flow condition. Products: Red Valve Company "Tideflex" Modified Series TF-2 or equal.

e. Sample Valve

Sample valve shall have 316 stainless steel body with quarter turn level handle and plain (unthreaded) outlet. It shall be NSF61 certified. Valve shall be ½-inch diameter with renewable seats. Valve shall be self-closing. Unit shall be Chicago Faucet Co. or equal.

D. Air Release Valves:

Air release valve shall be automatic float operated, all 316 stainless steel body and trim and fasteners. A check valve on the outlet is required to prevent air from re-entering the pressurized water main. Acceptable Air Valve Manufacturers: Valmatic and H-TEC.

E. Backflow Prevention Devices

Backflow prevention device shall comply with JEA's construction detail W-15, and shall be a JEA Approved product.

F. Pressure Gauges

Pressure gauges shall be by Bristol Babcock-Helicoid 900 series. Refer to Section 40 95 00 for Pressure Indicator Transmitter requirements.

PART 3 EXECUTION

3.01 VALVE SHIPMENT AND STORAGE

A. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Install closures at the place of valve manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures. Alternatively, ship flanged valves 3 inches and smaller in separate sealed cartons or boxes.

B. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Install caps or plugs at the place of valve manufacture prior to shipping. Alternatively, ship valves having threaded openings or end connections in separate sealed cartons or boxes.

C. Store resilient seated valves in sealed polyethylene plastic enclosures with a minimum of one package of desiccant inside. Store resilient seated valves in the open or unseated position. Valves with adjustable packing glands shall have the packing gland loosened prior to storage. Inspect valves at least once per week, replace desiccant if required and repair damaged storage enclosures. Do not store valves with resilient seats near electric motors or other electrical equipment.

D. Inspect valves on receipt for damage in shipment and conformance with quantity and description on the shipping notice and order. Unload valves carefully to the

ground without dropping. Use forklifts or slings under skids. Do not lift valves with slings or chain around operating shaft, actuator, or through waterway. Lift valves with eyebolts or rods through flange holes or chain hooks at ends of valve parts.

E. Protect the valve and actuators from weather and the accumulation of dirt, rocks, and debris. Do not expose rubber seats to sunlight or ozone for more than 30 days. Also, see the manufacturer's specific storage instructions.

F. Make sure flange faces, joint sealing surfaces, body seats, and disc seats are clean. Check the bolting attaching the actuator to the valve for loosening in transit and handling. If loose, tighten firmly. Open and close valves having manual or power actuators to make sure the valve operates properly and that stops or limit switches are correctly set so that the valve seats fully. Close valve before installing.

3.02 FACTORY PRESSURE TESTING

A. Hydrostatically test the valve pressure-containing parts at the factory per the valve specification or per the referenced standard. If no testing requirement is otherwise specified or described in the referenced standards, then test with water for 30 minutes minimum at a pressure of 1.5 times the rated pressure but not less than 20 psig. Test shall show zero leakage. If leaks are observed, repair the valve and retest. If dismantling is necessary to correct valve deficiencies, then provide an additional operational test and verify that the valve components function.

B. The chloride content of liquids used to test austenitic stainless steel materials shall not exceed 50 ppm. To prevent deposition of chlorides as a result of evaporative drying, remove residual liquid from tested parts at the conclusion of the test.

3.03 INSTALLING VALVES--GENERAL

A. Remove covers over flanged openings and plugs from threaded openings, after valves have been placed at the point to which the valves will be connected to the adjacent piping. Do not remove valves from storage cartons or boxes until they are ready to be installed.

B. Handle valves carefully when positioning, avoiding contact or impact with other equipment, vault or building walls, or trench walls.

C. Clean valve interiors and adjacent piping of foreign material prior to making up valve to pipe joint connection. Prepare pipe ends and install valves in accordance with the

pipe manufacturer's instructions for the joint used. Do not deflect pipe-valve joint. Do not use a valve as a jack to pull pipe into alignment. The installation procedure shall not result in bending of the valve/pipe connection with pipe loading.

D. Make sure valve ends and seats are clean. Check exposed bolting for loosening in transit and handling and tighten to manufacturer's recommendations. Open and close the valve to make sure it operates properly and that stops or limit switches are correctly set so that the vane, ball, gate, needle, diaphragm, disc, plug, or other seating element seats fully. Close the valve before installing. Check coatings for damage and repair. Handle valves carefully when positioning, avoiding contact or impact with other equipment or structures.

E. Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

3.04 INSTALLING EXPOSED VALVES

A. Unless otherwise indicated in the drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating stems vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the floor with their operating stems horizontal.

B. Install valves on vertical runs of pipe that are next to walls with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.

3.05 INSTALLING BURIED VALVES

A. Connect the valve, coat the flanges, apply tape wrapping or polyethylene encasement, and place and compact the backfill to the height of the valve stem.

B. Place block pads under the extension pipe to maintain the valve box vertical during backfilling and repaving and to prevent the extension pipe from contacting the valve bonnet.

C. Mount the upper slip pipe of the extension in midposition and secure with backfill around the extension pipe. Pour the concrete ring allowing a depression so the valve box cap will be flush with the pavement surface.

D. In streets without concrete curbs and in open areas, install the valve box as for a paved area with concrete curb except include a marker post. Cut the marker post from 4-inch by 4-inch dense structural grade Douglas fir No. 2 or Southern Pine No. 2 surfaced on four sides to a length of 5 feet. Chamfer the top. Set the post in concrete, 2 feet into the ground, away from traffic, and to the side of the pipeline. Coat with a seal and finish coat of white alkyd exterior paint. On the side facing the valve, letter in black the word "VALVE" and the distance in feet from the marker post to the valve box cap.

E. Install debris cap as close as possible under the cast-iron cover without interfering with the cover operation. Trim flexible skirt to provide a smooth contact with the interior or the extension pipe.

3.06 FIELD COATING BURIED VALVES

A. Coat flanges of buried valves and the flanges of the adjacent piping, and the bolts and nuts of flanges and mechanical joints, per Section 099000, System No. 30.

B. Wrap buried metal valves 6 inches and larger with polyethylene sheet in two layers of polyethylene conforming to AWWA C105, 8 mils in thickness each. Pass the two sheets of polyethylene under the valve and the coated flanges or joints with the connecting pipe and draw the sheets around the valve body, the valve bonnet, and the connecting pipe. Secure the sheets with plastic adhesive tape about the valve stem below the operating nut and about the barrel of the connecting pipe to prevent the entrance of soil. Fold overlaps twice and tape. Backfill the valve with care to avoid damaging the polyethylene.

3.07 ASSEMBLING JOINTS

A. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be

watertight.

C. Install lug-type valves with separate hex head machine bolts at each bolt hole and each flange (two bolts per valve bolt hole).

D. Install grooved-end couplings for valves in accordance with Section 40 05 00.

3.08 INSTALLING EXTENSION STEM GUIDE BRACKETS

Install at 6- to 8-foot centers. Provide at least two support brackets for stems longer than 10 feet, with one support near the bottom of the stem and one near the top.

3.09 MOUNTING GEAR ACTUATORS

The valve manufacturer shall select and mount the gear actuator and accessories on each valve and stroke the valve from fully open to fully closed prior to shipment.

3.010 FIELD INSTALLATION OF GEAR ACTUATOR

Provide the actuator manufacturer's recommended lubricating oil in each actuator before commencing the field testing.

3.011 VALVE FIELD TESTING

A. Test valves for leakage at the same time that the connecting pipelines are hydrostatically tested. See Section 40 05 15 for pressure testing requirements. Protect or isolate any parts of valves, actuators, or control and instrumentation systems whose pressure rating is less than the pressure test. Valves shall show zero leakage. Repair or replace any leaking valves and retest.

B. Operate manual valves through three full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. Do not backfill buried valves until after verifying that valves operate from full open to full closed. If valves stick or bind, or do not operate from full open to full closed, repair or replace the valve and repeat the tests.

C. Gear actuators shall operate valves from full open to full close through three cycles without binding or sticking. The pull required to operate handwheel- or chainwheel-operated valves shall not exceed 80 pounds. The torque required to operate valves having 2-inch AWWA nuts shall not exceed 150 ft-lbs. If actuators stick or bind or if pulling forces and torques exceed the values stated previously, repair or replace the actuators and repeat the tests. Operators shall be fully lubricated in accordance with

the manufacturer's recommendations prior to operating.

END OF SECTION

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SECTION 40 07 22

FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of flexible gasketed sleeve-type compression pipe couplings for steel and ductile-iron pipe; expansion joints 4 inches in diameter and smaller for steel, PVC, pipe; flexible expansion joints; and couplings for connecting different pipe materials.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit manufacturer's catalog data on flexible pipe couplings, and expansion joints. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings and joints are used. Show coatings.

C. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible gasketed sleeve-type compression pipe couplings.

D. Show materials of construction by ASTM reference and grade. Show dimensions.

E. Show number, size, and material of construction of tie rods and lugs for each thrust harness on the project.

PART 2 MATERIALS

2.01 COUPLING SYSTEM DESIGN AND COMPONENT UNIT RESPONSIBILITY

The coupling manufacturer shall furnish the gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings of all types and shall design these components as an integral system. Design the gaskets for the coupling and appropriately size to provide a watertight seal at the design pressure and temperature. Ship gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings with the pipe coupling and clearly label indicating the origin of the material, including place and date of manufacture. Package the manufacturer's printed installation instructions with each pipe coupling.

2.02 CARBON STEEL FLEXIBLE PIPE COUPLINGS AND FLANGED COUPLING ADAPTERS

A. Steel couplings shall have center sleeves and end rings made of carbon steel conforming to AWWA C219, Section 4. Minimum center sleeve length shall be 5 inches for pipe sizes 3/4 inch through 4 1/2 inches, 7 inches for pipe sizes 5 inches through 24 inches, and 10 inches for pipe sizes larger than 24 inches.

B. Sleeve bolts in exposed service shall be carbon steel per AWWA C219, Section 4. Sleeve bolts in buried or submerged service shall be Type 316 stainless steel per AWWA C219, Section 4.

C. End rings shall be cast, forged, or hot rolled in one piece. Do not use rings fabricated from two or more shapes.

D. Wall thickness of sleeve shall be at least that specified for the size of pipe in which the coupling is to be used.

2.03 STAINLESS STEEL FLEXIBLE PIPE COUPLINGS AND FLANGED COUPLING ADAPTERS

A. Stainless steel couplings shall have center sleeves and end rings made of Type 316 stainless steel conforming to AWWA C219, Section 4. Minimum center sleeve length shall be 5 inches for pipe sizes 3/4 inch through 4 1/2 inches, 7 inches for pipe sizes 5 inches through 24 inches, and 10 inches for pipe sizes larger than 24 inches.

B. Sleeve bolts shall be Type 316 stainless steel per AWWA C219, Section 4.

C. End rings shall be cast, forged, or hot rolled in one piece. Do not use rings fabricated from two or more shapes.

D. Wall thickness of sleeve shall be at least that specified for the size of pipe in which the coupling is to be used.

2.04 DUCTILE-IRON FLEXIBLE PIPE COUPLINGS

A. Couplings shall have center sleeves and end rings made of ductile iron conforming to AWWA C219, Section 4.

B. Sleeve bolts in exposed service shall be carbon steel per AWWA C219, Section 4. Sleeve bolts in buried or submerged service shall be Type 316 stainless steel per AWWA C219, Section 4.

2.05 JOINT HARNESSES

A. Tie bolts or studs shall be as shown in the following table. Bolt or stud material shall conform to ASTM A193, Grade B7. Nuts shall conform to ASTM A194, Grade 2H. Lug material shall conform to ASTM A36, ASTM A283, Grade B, C, or D, or ASTM A285, Grade C. Lug dimensions for steel pipe shall be as shown in AWWA Manual M11 (2004 edition), Figure 13-20, using the number and size of lugs as tabulated below.

B. Lugs for steel pipe shall be Type P for pipes 6 through 10 inches and Type RR for pipes 12 inches and larger. Lug or ear dimensions for ductile-iron pipe shall be as shown in the drawings.

TIE BOLTS OR STUD REQUIREMENTS FOR FLEXIBLE PIPE COUPLINGS FOR STEEL PIPE				
Nominal Pipe Size (inches)	Tie Bolt or Stud Minimum Requirements			
	150 psi		300 psi	
	No. Bolts or Studs and Size (inches)	Minimum Pipe Wall Thickness (inches)	No. Bolts or Studs and Size (inches)	Minimum Pipe Wall Thickness (inches)
6	2 x 5/8	0.193	2 x 5/8	0.282
8	2 x 5/8	0.239	2 x 5/8	0.354
10	2 x 5/8	0.312	2 x 3/4	0.466
12	2 x 3/4	0.188	4 x 7/8	0.250
14	2 x 7/8	0.188	4 x 1	0.250
16	2 x 1	0.250	4 x 1 1/8	0.250
18	2 x 1 1/8	0.250	4 x 1 1/8	0.250
20	2 x 1 1/4	0.250	4 x 1 1/8	0.250
24	4 x 7/8	0.250	4 x 1 1/8	0.250
30	4 x 1 1/8	0.250	4 x 1 3/8	0.375
36	4 x 1 3/8	0.313	6 x 1 3/8	0.375
42	6 x 1 1/4	0.375	6 x 1 5/8	0.375
48	6 x 1 3/8	0.375	6 x 1 3/4	0.500
54	6 x 1 1/2	0.375	8 x 1 3/4	0.625
60	6 x 1 5/8	0.375	12 x 1 3/4	0.625
66	8 x 1 5/8	0.469	14 x 1 3/4	0.688
72	8 x 1 3/4	0.500	14 x 1 7/8	0.750

TIE BOLTS OR STUD REQUIREMENTS FOR FLEXIBLE PIPE COUPLINGS FOR DUCTILE IRON PIPE						
	Tie Bolt or Stud Minimum Requirements					
	150 psi[1]			300 psi[2] Pipe		
Nominal Pipe Size (inches)	No. Bolts or Studs	Size (inch)	Ear[3] Type	No. Bolts or Studs	Size (inch)	Ear[3] Type
4	2	5/8	A	2	5/8	A
6	2	5/8	A	2	5/8	A
8	2	5/8	A	2	5/8	A
10	2	5/8	A	4	5/8	A
12	2	5/8	A	4	5/8	A
14	4	5/8	A	5	3/4	A
16	4	5/8	A	5	3/4	B
18	4	3/4	B	8	3/4	B
20	4	3/4	B	8	3/4	B
24	5	7/8	B	8	7/8	B
30	4	1 1/8	B	14	7/8	B
36	8	1	B	16	1	B
42	9	1	B	--	--	--
48	14	1	B	--	--	--
54	16	1	B	--	--	--

(1) Use ASME B16.1 Class 125 flanges.

(2) Use ASME B16.1 Class 250 flanges.

(3) Ear type as shown in the detail on the last page of Section 400722.

C. Select number and size of bolts based on the test pressure shown in the Piping Schedule in the drawings. Stagger bolts equally around pipe circumference. Where odd number is tabulated, place odd bolt at top. For test pressures less than or equal to 150 psi, use the 150-psi design in the table above. For test pressures between 150 and 300 psi, use the 300-psi design in the table above.

D. Provide washer for each nut. Washer material shall be the same as the nuts. Minimum washer thickness shall be 1/8 inch.

2.06 FLEXIBLE PIPE COUPLINGS FOR PLAIN-END DUCTILE-IRON PIPE

A. Couplings for pipe 12 inches and smaller shall be cast iron, Dresser Style 253 or 253 long sleeve, Smith-Blair Type 441, Baker Series 228, or equal.

B. Couplings for pipe larger than 12 inches shall be cast iron or steel, Dresser Style 38 or 253, Smith-Blair Style 411, Baker Series 228, or equal.

2.07 TRANSITION COUPLINGS

Couplings for connecting different pipes having different outside diameters shall be 316 stainless steel: Dresser Style 62 or 162, Smith-Blair Series 413, Baker Series 212 or 220, or equal. Couplings shall have an internal full circumference ring pipe stop at the midpoint of the coupling. Inside diameter of coupling pipe stop shall equal inside diameter of smaller diameter pipe.

2.08 FLANGED COUPLING ADAPTERS FOR CAST- AND DUCTILE-IRON PIPE

A. Adapters for cast- and ductile-iron pipe 12 inches and smaller shall be cast iron: Dresser Style 127, Smith-Blair Series 912, or equal.

B. Adapters for cast- and ductile-iron pipe larger than 12 inches shall be steel: Dresser Style 128, Smith-Blair Type 913, or equal.

C. Flange ends shall match the flange of the connecting pipe; see detail piping specifications.

2.09 SEGMENTED RESTRAINED SLEEVE COUPLINGS AND FLANGED ADAPTER COUPLINGS FOR CARBON AND STAINLESS STEEL PIPE

A. The coupling shall be of the split or segmented sleeve type with a double arch cross-section, which closes around plain steel pipe ends, and complying with AWWA C227 except as modified herein. The design pressure and wall thickness of the body shall be

at least that specified for the size of pipe on which the coupling is to be used. Provide welded steel restraint rings on the pipe ends for end restraint. As the coupling closes, it shall confine an elastomeric gasket on each pipe end to create a radial seal. The axial seal shall be affected at the closure plates as bolts pull the coupling snug round the pipe. Provide shoulders on each end of the couplings. Flanged adapter couplings shall incorporate a flange on one end (instead of an end ring and shoulder) to match the flange on the connecting pipe or valve. Products: Victaulic “Depend-O-Lok” Model F x F Type 2 for sleeve couplings or Victaulic “Depend-O-Lok” Model F x F flanged adapter coupling for flanged adapter couplings.

B. Carbon steel piping includes steel pipe lined with polyurethane, or epoxy.

C. Body, flange, and closure plates for couplings used with carbon steel pipe in exposed service shall be carbon steel per ASTM A36.

D. End restraint rings for couplings used with carbon steel pipe shall be carbon steel per ASTM A108, Grade 1020. Provide end restraint rings on each of the connecting pipes. The end rings shall be welded to the pipe ends using a welding procedure complying with the ASME Pressure Vessel Code, Section IX. Weld the end restraint rings to the pipe before applying the lining and coating (if any is specified) to the pipe. The welded end restraint rings shall have at least the pressure rating of the pipe to which the coupling is attached.

E. Fasteners for couplings used with carbon steel pipe in exposed service shall be carbon steel per ASTM A325, with carbon steel nuts and washers per ASTM A563.

F. Coupling body, flange, and closure plates for couplings used with stainless steel pipe shall be Type 316 or 316L stainless steel per ASTM A240 or A666.

G. End restraint rings for couplings used with stainless steel pipe shall be Type 316 or 316L stainless steel per ASTM A276. Provide end restraint rings on each of the connecting pipes. Weld the end rings to the pipe ends using a welding procedure complying with the ASME Pressure Vessel Code, Section IX. The welded end restraint rings shall have at least the pressure rating of the pipe to which the coupling is attached.

H. Fasteners for couplings used with stainless steel pipe shall be Type 316 stainless steel per ASTM A276, F593, or F738 with stainless steel nuts per ASTM F594 or F836.

I. Gaskets shall be isoprene, Buna-N, or EPDM conforming to ASTM D2000 for water and sewage service and having a temperature range of -20°F to +180°F.

J. Provide joint sealant between the pipe ends for piping 24 inches and larger after the sleeve coupling is installed: Sikaflex 2C with Sikaflex 429 primer.

PART 3 - EXECUTION

3.01 SHIPMENT AND STORAGE OF FLEXIBLE PIPE COUPLINGS, DISMANTLING JOINTS, AND EXPANSION JOINTS

A. Inspect on receipt for damage in shipment and conformance with quantity and description on the shipping notice and order. Unload carefully to the ground without dropping. Do not load or unload by inserting forklift tines or lifting chains inside the waterway. Use nonmetallic slings, padded chains, or padded forklift tines to lift items. Lift with eyebolts or rods through flange holes or chain hooks at ends.

B. Protect from weather and the accumulation of dirt, rocks, and debris. Do not expose rubber seats to sunlight or ozone for more than 30 days. Also, see the manufacturer’s specific storage instructions.

C. Make sure flange faces, joint sealing surfaces, body seats, and disc seats are clean.

D. Do not allow stainless steel couplings or other items to contact carbon steel surfaces during storage, handling, or installation and erection at the site.

3.02 INSTALLATION OF FLEXIBLE PIPE COUPLINGS, SEGMENTED SLEEVE COUPLINGS, DISMANTLING JOINTS, AND EXPANSION JOINTS

A. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installing.

B. Install expansion joints per manufacturer's recommendations, so that 50% of total travel is available for expansion and 50% is available for contraction.

C. Do not spring flanges or ends of connecting piping into position. Separately work connecting piping system into position to bring the piping flanges or ends into alignment with the matching coupling flanges or joints. Do not move couplings to achieve piping alignment.

D. Line up pipe flange bolt holes with coupling or joint flange bolt holes within 1/16 inch maximum offset from the center of the bolt hole to permit insertion of bolts without applying any external force to the piping.

E. Flange face separation shall be within the gasket spacing ±1/16 inch. Use only one gasket per flanged connection.

F. Lubricate bolt threads with graphite and oil prior to installation.

G. Thoroughly clean contact surfaces of gaskets and pipe ends of flexible pipe couplings just prior to assembly for a distance equal to center-sleeve length plus 2 inches. Install flexible pipe couplings such that the center sleeves are centered over the gap between the ends of the pipes being joined. Install centerline gaps per AWWA C219, Table 5 unless otherwise indicated. Install harnessed flexible pipe couplings in straight-run piping such that 50% of the total travel of the center sleeve or permissible centerline gap is available for expansion and 50% of the travel is available for contraction. In assembling the bolted or studded harnesses of flexible pipe couplings, tighten the nuts gradually and equally at diametrically opposite sides until snug. Do not misalign the harness bolts or studs. Tighten such that bolts or studs carry equal loads. Do not use wrenches or power fastening tools to tighten the nuts.

H. Install segmented sleeve couplings per AWWA C227, Section 4.6.

3.03 PAINTING AND COATING

A. Coat buried flexible pipe couplings (including joint harness assemblies), transition couplings, segmented sleeve couplings, and flanged coupling adapters per Section Coat buried bolt threads, tie bolt threads, and nuts per Section 09 90 00, System No. 30. Then wrap the couplings with polyethylene wrap.

B. Coat flexible pipe couplings (including joint harness assemblies), transition couplings, segmented sleeve couplings, and flanged coupling adapters located indoors, in vaults and structures, and above ground with the same coating system as specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings per Section 09 90 00. Apply prime coat at factory.

C. Line carbon steel and iron flexible pipe couplings and segmented sleeve couplings per Section 09 90 00.

D. Alternatively, line and coat carbon steel and iron flexible pipe couplings with fusion-bonded epoxy.

E. Coat, expansion joints,, and alignment guides located above ground or in vaults and structures with the same coating system as specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings per Section 09 90 00. Color shall match the color of the connecting pipe.

3.04 HYDROSTATIC TESTING

Hydrostatically test flexible pipe couplings, and expansion joints, in place with the pipe being tested. Test in accordance with Section 40 05 15.

END OF SECTION

SECTION 40 07 62

WALL PIPES, SEEP RINGS, AND PENETRATIONS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of steel, cast-iron, and ductile-iron wall pipes and sleeves (including wall collars and seepage rings) and penetrations.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit detail drawings for fabricated steel or cast-iron wall and floor pipes and sleeves, wall flanges, seep rings, and sealing materials. Show dimensions and wall thicknesses.

C. Show flange sizes and the appropriate ANSI or AWWA flange dimensional standard where flanged end wall pipes or penetrations are used.

D. Show grooved-end dimensions and AWWA grooved-end dimensional standard where grooved-end wall pipes or penetrations are used.

E. List coating systems to be applied, manufacturer, and dry thickness of coatings. Call out coatings where coatings are to be applied.

F. List materials of construction, with ASTM material reference and grade.

G. Submit manufacturer's instructions for installing rubber annular hydrostatic sealing devices.

H. Submit six copies of the results of the leakage test for cast-iron sleeves having shrink-fit steel collars or collar halves bottomed in a groove and steel sleeves having welded steel collars.

PART 2 MATERIALS

2.01 GENERAL

A. Use cast-iron, ductile-iron, or fabricated steel wall sleeves when containing rubber annular hydrostatic sealing devices through which piping passes.

B. Use only cast-iron or ductile-iron wall pipes when connecting to cast-iron and ductile-iron pipe. Use only fabricated steel or stainless steel wall pipes when connecting to steel or stainless steel pipe, respectively.

C. Cast-iron flanges shall conform to ASME B16.1, Class 125 or 250, to match the flange on the connecting pipe.

D. Class 150 steel flanges shall conform to AWWA C207, Class D. Flanges shall be flat face. Flanges shall match the flange on the connecting pipe.

E. See Section 40 05 00 for flange bolts and gaskets.

2.02 CAST-IRON OR DUCTILE-IRON WALL PIPES AND SLEEVES

A. Provide cast- or ductile-iron wall pipes with ends as shown in the drawings for connection to adjacent cast-iron and ductile-iron pipe or for containing pipes where they pass through concrete walls, ceilings, and floor slabs. Provide seepage ring on wall pipes and sleeves passing through concrete walls and slabs that are to be watertight. Locate collars such that the collar is at the center of the wall or floor slab, unless otherwise shown in the drawings.

B. Wall pipes and sleeves shall be of the following types:

1. Pipe or sleeve with integrally cast seep ring.
2. Pipe or sleeve with shrink-fit steel collar attached.
3. Pipe or sleeve with steel collar halves bottomed in a groove provided in the pipe or sleeve.

C. Minimum wall thickness for pipes and sleeves having integrally cast seep rings shall be as shown in the following table:

Pipe or Sleeve Size (inches)	Minimum Wall Thickness (inches)
3	0.48
4	0.52
6	0.55
8	0.60
10	0.68
12	0.75
14	0.66
16	0.70
18	0.75
20	0.80
24	0.89

D. Minimum wall thickness of pipes or sleeves having shrink-fit collars shall be special Class 52. Cut shrink-fit collars from a 1/4-inch-thick steel ring. Attach the collar to a cast-iron or ductile-iron pipe or sleeve by heating the steel collar and allowing it to shrink over the pipe at the necessary location. Provide an epoxy bond (Keysite 740 or 742 or Scotchkote 302) between the pipe and collar. Sandblast the area of the pipe to be epoxy coated per SSPC SP-10.

E. Wall pipes or sleeves having steel collar halves bottomed in a groove shall be ductile iron Special Class 54 minimum unless otherwise shown. Wall flanges shall consist of 1/4-inch-thick steel seep ring halves for pipes through 24-inch and 3/8-inch-thick halves for pipe 30 inches and larger, bottomed in a groove provided on the pipe. The pipe groove shall be machine cut to a depth of 1/16 to 5/64 inch to provide a press fit for the seep ring. Seep ring halves shall be welded together after fit into groove but shall not be welded to pipe. Seep rings shall be sealed completely around the pipe with silicon sealant manufactured by Dow-Corning No. 790, General Electric Silpruf, or equal.

F. The material used in cast- or ductile-iron wall flanges, wall sleeves, and wall penetrations shall conform to ASTM A395, A436, A536, A48 (Class 35), or A126 (Class B).

2.03 FABRICATED STEEL WALL PIPES AND SLEEVES

A. Provide fabricated steel wall pipes and sleeves with ends as shown in the drawings for connection to adjacent steel pipes, or for containing pipes, where they pass through concrete walls. Provide seepage ring or wall flange on wall pipes and sleeves passing through concrete walls and slabs that are to be watertight. Wall thickness shall be the same as the pipe wall thickness when connecting to steel pipe. Minimum wall thickness for sleeves containing pipes shall be standard weight per ASME B36.10 for sleeves 72 inches and smaller and 1/2 inch for sleeves greater than 72 inches through 96 inches.

B. Wall flanges shall be in the form of a steel wall collar welded to the steel sleeve or penetration. Cut welded wall collars from a 1/4-inch steel ring. Attach the collar to a steel wall pipe or sleeve with full circle, 3/16-inch fillet welds. Welding procedures shall be in accordance with ASME B31.3, Chapter V.

C. Steel pipe used in fabricating wall sleeves containing pipes shall comply with ASTM A53 (Type E or S), Grade B; ASTM A135, Grade B; ASTM A139, Grade B; or API 5L or 5LX. Wall pipes connecting to steel pipe shall be of the same material as the connecting pipe. Wall collar material shall comply with ASTM A36, A105, A181, or A182.

D. Stainless steel pipe used in fabricating wall pipes shall be of the same material as the connecting pipe. Wall collar material shall comply with ASTM A240.

2.04 RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

A. Rubber annular hydrostatic sealing devices shall be of the modular mechanical type, utilizing interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe sleeve and the passing pipe. Assemble links to form a continuous rubber belt around the pipe, with a pressure plate under each bolthead and nut.

B. Materials of construction shall be as follows:

Compound	Material
Pressure plate	Delrin plastic or reinforced nylon polymer
Bolts and nuts for links	316 stainless steel
Sealing element	EPDM rubber

C. The size of the wall sleeve needed to accommodate the passing pipe shall be as recommended by the rubber annular seal manufacturer.

D. Provide centering blocks in 25% of the sealing elements on pipelines larger than 12 inches in diameter.

E. The rubber annular hydrostatic sealing devices shall be Link Seal as manufactured by Thunderline Corporation; Innerlynx as manufactured by Advance Products & Systems, Inc.; or equal.

2.05 BOLTS, NUTS, AND GASKETS FOR FLANGED-END WALL PIPES

See Section 40 05 00.

2.06 POLYETHYLENE FOAM FILLER FOR PIPE PENETRATIONS

Packing foam shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethafoam, as manufactured by Dow Chemical Company, Midland, Michigan; or equal. The rod shall be 1/2 inch larger in diameter than the annular space.

2.07 POLYURETHANE SEALANT FOR PIPE PENETRATIONS

Sealant shall be multipart, polyurethane sealant, to cure at ambient temperature, for continuous immersion in water. Install as recommended by the manufacturer. Products: SIKA Sikaflex 2C or equal.

2.08 PAINTING AND COATING

A. Line and coat sleeves and pipes (except stainless steel) with fusion-bonded epoxy per Section 09 97 61.

B. Coat penetrations and sleeves exposed, above ground, or in vaults and structures in accordance with Section 09 90 00 unless fusion-bonded epoxy coatings are shown in the drawings or specified elsewhere.

C. Coat submerged sleeves and penetrations per Section 09 90 00 unless fusion-bonded epoxy coatings are shown in the drawings or specified elsewhere.

D. Coat buried sleeves and penetrations per Section 09 90 00 unless fusion-bonded epoxy per Section 09 97 61 is shown in the drawings or specified elsewhere.

E. Do not coat stainless steel sleeves and penetrations.

PART 3 EXECUTION

3.01 LOCATION OF PIPES AND SLEEVES

A. Provide a wall or floor pipe where shown in the drawings and wherever piping passes through walls or floors of tanks or channels in which the water surface is above the pipe penetration.

B. Provide a floor sleeve where shown in the drawings and wherever plastic pipe, steel, or stainless steel pipe 3 inches and smaller or stainless steel or copper tubing passes through a floor or slab. Provide a rubber annular sealing device in the annular space between the sleeve and the passing pipe or tubing.

C. Provide wall sleeves where shown in the drawings and wherever plastic, steel or stainless steel pipe 3 inches and smaller, or stainless steel or copper tubing passes through a wall. Provide a single rubber annular seal when the wall is 8 inches thick or less. Provide two rubber annular seals (one at each end of the sleeve) when the wall is more than 8 inches thick. Pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.

D. Where wall sleeves are installed in which water or soil is on one or both sides of the channel or wall, provide two rubber annular seals (one at each end of the sleeve).

E. Where pipes pass through walls or slabs and no sleeves or wall or floor pipe with seep ring is provided, pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.

3.02 INSTALLATION IN EXISTING CONCRETE WALLS AND SLABS

Core drill holes 1 to 2 inches larger in diameter than the outside diameter of the wall flange or collar. Install wall pipe and collar assembly axially aligned with the piping to which it will be connected or will contain. Pack the void space between the sleeve and

concrete with grout. See Section 033000 for grouting specification, or polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure where shown on the drawings.

3.03 INSTALLATION IN NEW CONCRETE WALLS AND SLABS

Install wall pipes and sleeves in walls before placing concrete. Do not allow any portion of the pipe or sleeve to touch any of the reinforcing steel. Install wall pipe or sleeve and collar assembly axially aligned with the piping to which it will be attached or will contain. Provide supports to prevent the pipe or sleeve from displacing or deforming while the concrete is being poured and is curing.

3.04 INSTALLATION IN DRY FLOORS AND SLABS

Install pipe sleeves and spools in concrete floors and slabs which do not have water over them such that the sleeve or pipe extends from the bottom of the floor or slab to 2 inches above the floor or slab unless shown otherwise in the drawings.

3.05 INSTALLATION OF WALL PIPES HAVING FLANGED END CONNECTIONS

A. Check alignment before grouting in place or pouring concrete. Realign if the sleeve is not properly aligned.

B. Install flanged end wall sleeves or penetrations with bolt holes of the end flanges straddling the horizontal and vertical centerlines of the sleeve.

3.06 QUALIFICATIONS OF WELDERS

Welder qualifications shall be in accordance with AWS D1.1.

3.07 INSTALLATION OF RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

Install in accordance with the manufacturer's instructions.

3.08 FIELD TESTING

Check each wall penetration for leakage at the time the hydraulic structure is tested for leakage; see Section 03 30 00. Penetrations shall show zero leakage.

END OF SECTION

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SECTION 40 07 64

PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of pipe hangers and supports including accessory items, such as anchor bolts and screws, neoprene isolation pads.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Provide line drawings of each piping system to the scale shown in the drawings, locating each support or hanger. Identify each type of hanger or support by the manufacturer's catalog number or figure.

C. Provide installation drawings and manufacturer's catalog information on each type of hanger and support used. Clearly indicate the actual pipe outside diameter (not just nominal pipe size) that is used for the hangers and supports.

D. Submit layout drawings for the drip guards, showing dimensions and thicknesses. Show design of seam or joint where field connections will be made between sections and pieces of drip guards. Submit a certificate listing the type of resin to be used, describing the manufacturer's brand name or designation, composition, and characteristics.

PART 2 MATERIALS

2.01 DESIGN CRITERIA

A. Not all pipe supports or hangers required are shown in the drawings. Provide pipe supports for every piping system installed. Support piping by pipe support where it connects to pumps or other mechanical equipment.

B. Pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes, fittings, and valves (all filled with water), plus valve actuators and any insulation, and shall have a minimum safety factor of five based on material ultimate strength.

2.02 HANGER AND SUPPORT SYSTEMS

A. Pipe hangers and supports shall be as manufactured by Anvil, Unistrut, B-Line, Superstrut, or equal.

B. Pipe hangers and supports shall comply with MSS SP-58 for the standard types referenced in the drawings. Construct special hangers and supports if detailed in the drawings. Type numbers for standard hangers and supports shall be in accordance with MSS SP-58 as listed below:

Type Number	Description	Manufacturer and Model (or Equal)
1	Adjustable steel clevis	Anvil Fig. 590 or 260, B-Line B3100 or B3102
3	Steel double-bolt pipe clamp	Anvil Fig. 295A or 295H, B-Line B3144 or B3144A
4	Steel pipe clamp (pipes smaller than 3 inches)	Anvil Fig. 212, B-Line B3140
4	Steel pipe clamp (pipes 3 inches and larger)	Anvil Fig. 216, B-Line 3142
5	Pipe hanger	B-Line B3690
6	Adjustable swivel pipe ring	Anvil Superstrut 714, Anvil Fig. 104
7	Adjustable steel band hanger	B-Line B3172
8	Extension pipe or riser clamp	Anvil Fig. 261, B-Line B3373
9	Adjustable band hanger	Anvil Fig. 97
10	Adjustable swivel ring band hanger	Anvil Fig. 70, B-Line B3170 NF

Type Number	Description	Manufacturer and Model (or Equal)
11	Split pipe ring with adjustable turnbuckle	Anvil Fig. 108, B-Line B3173
13	Steel turnbuckle	Anvil Fig. 230, B-Line B3202
14	Steel clevis	Anvil Fig. 299, B-Line B3201
15	Swivel turnbuckle	Anvil Fig. 114, B-Line B3224
16	Malleable iron socket	Anvil Fig. 110R, B-Line B3222
17	Steel weldless eye nut	B-Line B3200
18	Steel or malleable iron concrete insert	Anvil Fig. 281, Superstrut 452
19	Top beam C-clamp	Anvil Fig. 92, B-Line B3033
20	Side I-beam or channel clamp	Anvil Fig. 14 or 217
21	Center I-beam clamp	Anvil Figure 134
22	Welded attachment type	Anvil Fig. 66 B-Line B3083
23	C-clamp	Anvil Fig. 86, B-Line B3036L
24	U-bolt	Anvil Fig. 137, B-Line B3188
26	Clip	Anvil Fig. 262, B-Line B3180
28	Steel I-beam clamp with eye nut	Anvil Fig. 228
29	Steel wide flange	Anvil Fig. 228 clamp with eye nut
30	Malleable iron beam clamp with extension piece	Superstrut CM-754, B-Line B3054
31	Light welded steel bracket	Anvil Fig. 194, B-Line B3063
32	Medium welded steel bracket	Anvil Fig. 195, B-Line B3066

Type Number	Description	Manufacturer and Model (or Equal)
33	Heavy welded steel bracket	Anvil Fig. 199, B-Line B3067
34	Side beam bracket	Anvil Fig. 202, B-Line B3062
36	Pipe saddle support	Anvil Fig. 258, B-Line B3095
37	Pipe stanchion saddle	Anvil Fig. 259, B-Line B3090
38	Adjustable pipe saddle support	Anvil Fig. 264, B-Line B3089
39	Steel pipe covering	Anvil Fig. 160, 161, 162, 163, 164, or 165; Superstrut A 789; B-Line B3160/B3165
40	Insulation protection shield	Anvil Fig. 167, B-Line B3151
41	Single pipe roll	Anvil Fig. 171, B-Line B3114
43	Adjustable roller hanger with swivel	Anvil Fig. 181, B-Line B3110
44	Pipe roll, complete	Anvil Fig. 271, B-Line B3117SL

C. Pipe hangers and supports shall be carbon steel (ASTM A36, A575, or A576). Bases, rollers, and anchors shall be steel as described above or may be cast iron (ASTM A48). Pipe clamps shall be steel as described above or may be malleable iron (ASTM A47).

2.03 OFFSET PIPE CLAMP

Anvil Figure 103 or equal. Material shall be Type 316 stainless steel.

2.04 MISCELLANEOUS PIPE SUPPORTS AND HANGERS

A. Pipe Anchor Chair: Anvil Figure 198 or equal.

B. One Hole Clamp: Anvil Figure 126 or equal.

C. Roller Chair: Anvil Figure 175 or equal.

2.05 STEEL CHANNEL FRAMING SYSTEM

A. Steel channel frames shall be 1 5/8 inches wide by 1 5/8 or 3 1/4 inches high by 12-gauge metal thickness, unless otherwise shown in the drawings. Material shall conform to ASTM A36, A570 (Grade 33 minimum), or A653 unless stainless steel is indicated in the drawings. Stainless steel shall be Type 304. One side of the channel shall have a continuous open slot with inturned clamping ridges. Maximum allowable stress under any combination of applied uniformly distributed loads and concentrated loads shall not exceed those recommended in the AISC or AISI. Deflection shall not exceed 1/240 of span. Use multiple back-to-back channels to achieve these criteria if single channels are not sufficient. Products: Unistrut P1000 or P5000 Series, B-Line B11 or B22 Series, or equal.

B. Steel channels shall be hot-dipped galvanized per ASTM A153.

C. Nuts shall be machined and case hardened. Provide rectangular nuts with the ends shaped to permit a quarter turn crosswise in the framing channel. Provide two serrated grooves in the nut to engage the inturned edges of the channel.

D. Pipe clamps (including attachment screws and nuts) shall be Unistrut P1100 or P2000 Series, B-Line B2000 Series, or equal. Material shall be Type 316 stainless steel.

E. Hanger rods for trapezes shall be carbon steel (ASTM A36, A575, or A576) unless stainless steel is indicated in the drawings. Stainless steel hanger rod material shall comply with ASTM A276, Type 304.

F. Accessory fittings and brackets shall be the same material as the channel or trapeze. Provide coating on carbon steel fittings and brackets as specified for the channels and frames.

   a. Flat Plate Fittings: Unistrut P1065, P1066, P1925; Superstrut AB-206, AB-207; or equal.

   b. Post Bases: Unistrut P2072A, Superstrut AP-232, or equal.

   c. 90-Degree Brackets: Unistrut P1326, P1346; Superstrut AB-203; or equal.

   d. Rounded-End Flat Plate Fittings: Unistrut P2325, Superstrut X-240, or equal.

G. Parallel pipe clamps shall be Unistrut P1563 through P1573, Superstrut AB-719, or equal. Material shall be Type 304 stainless steel.

2.06 FRP CHANNEL FRAMING SYSTEM

A. FRP pipe hangers and supports shall be Aickinstrut, Inc., or equal.

B. Material properties shall be as follows:

	Longitudinal Direction
Ultimate Tensile (psi)	35,000 minimum
Ultimate Compressive (psi)	35,000 minimum
Ultimate Flexural (psi)	35,000 minimum
Tensile Modulus (psi)	3.0×10^6 minimum
Flexural Modulus (psi)	2.0×10^6 minimum
Ultimate Shear Strength (psi)	6,000 minimum
Izod Impact (ASTM D256) ft-lb/inch notch	30 minimum
	Transverse Direction
Ultimate Tensile (psi)	10,000 minimum
Ultimate Compressive (psi)	20,000 minimum
Ultimate Flexural (psi)	14,000 minimum
Tensile Modulus (psi)	1.0×10^6 minimum
Compressive Modulus (psi)	1.4×10^6 minimum
Flexural Modulus (psi)	1.0×10^6 minimum
Ultimate Shear Strength (psi)	5,500 minimum
Ultimate Bearing Stress (psi)	35,000 minimum
Izod Impact, ft-lb notch	5 minimum
	Hardness
Barcol Test	50 minimum

C. Glass fiber reinforced composites and plastic products shall have a flame spread rating of 25 or less when tested per ASTM E84.

D. Channel framing shall be 1 5/8 inches deep by 1 5/8 inches wide and shall be made using vinylester resin equal to Ashland Derakane 411, Ashland Hetron 922, or Reichhold Dion 9800. It shall have a nexus polyester surfacing veil over 100% of the surface which, along with a filler system, will protect against degradation from ultraviolet light. Channel shall be supplied with integral notches 1 inch on center. Notches shall be located on the interior flange to prevent slippage of pipe clamps and fittings after installation. In place of notched channel, unnotched channel may be used if the vertical channel sections supporting the horizontal piping are provided with stop lock hardware at each pipe clamp to prevent slippage. Channel framing shall be Aickinstrut G.R.P. Type V 2000 series or equal.

E. Channel framing connections shall be made with vinylester glass fiber composite nuts, bolts, all threaded rods, channel fittings, bases, and hanger assemblies. Nuts, bolts, and rods shall be Aickinstrut 4200 series, Strut Tech PVCG, or equal. Channel fittings shall be Aickinstrut 2800 style or equal.

F. Load-bearing pipe clamps and nonload-bearing pipe straps shall be nonmetallic and nonconductive and shall be made by the injection molding process using polyurethane base resin. Pipe clamps and straps shall be Aickinstrut 3100 series or equal.

G. Clevis hangers shall be made with vinylester glass fiber and be Aickinstrut 1500 series or equal.

H. Hanger rods for trapezes shall be carbon steel (ASTM A36, A575, or A576) unless stainless steel is indicated in the drawings. Stainless steel hanger rod material shall comply with ASTM A276, Type 304.

2.07 NEOPRENE ISOLATING SLEEVES FOR METAL PIPE 6 INCHES AND SMALLER

Unistrut P2600, B-Line "Vibrocushion," or equal.

2.08 ANCHOR BOLTS AND SCREWS

Anchor bolts and screws for attaching pipe supports and hangers to walls, floors, ceilings, and roof beams shall be Type 316 stainless steel, ASTM A276 or F593. Nuts

shall be Type 316 stainless steel, ASTM A194, Grade 8M or ASTM F594, Type 316 stainless steel.

PART 3 EXECUTION

3.01 PIPE HANGER AND WALL SUPPORT SPACING

Install pipe hangers and wall supports on horizontal and vertical runs at the spacing shown or detailed in the drawings. Provide hanger rods (for horizontal runs) and wall supports of the sizes shown or detailed in the drawings. If no spacing or rod sizes are given in the drawings or in the specifications for a particular piping system, use the following:

A. Pipe Hanger and Wall Support Spacing for Ductile-Iron, Stainless Steel (Sections 40 20 40, 40 20 76):

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
3/8 and smaller	4	3/8
1/2 through 1	6	3/8
1 1/4 through 2	8	3/8
2 1/2 and 3	10	1/2
3 1/2 and 4	10	5/8
6	12	3/4
8	12	7/8
10 and 12	14	7/8
14 and 16	16	1
18	15	1
20 through 24	9	1
30	6	1

B. Pipe Hanger or Wall Support Spacing for PVC Pipes (Section 402090):

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
3/4	4	3/8
1	4	3/8
1 1/2	5	3/8
2	5	3/8
2 1/2	5	1/2
3	6	1/2
4	6	5/8
6	7	3/4
8	7	7/8

C. Pipe Hanger or Wall Support Spacing for Copper Tubing and Pipe (Section 402022):

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (feet)
1 and smaller	4	3/8
1 1/4 through 2	6	3/8
2 1/2 through 3	8	1/2

D. Pipe Hanger or Wall Support Spacing for Polypropylene Pipe (Sections 402455):

Pipe Size (inches)	Maximum Hanger or Support Spacing (feet)	Minimum Rod Size (inches)
1	3	3/8
1 1/2	4	3/8
2	5	3/8
3	6	1/2
4	6	5/8
6	7	3/4
8	8	7/8
10	9	7/8
12	10	7/8
14 to 16	10	1
18	10	1
20 to 24	9	1
30	6	1

E. Pipe Hanger or Wall Support Spacing for Stainless Steel Tubing (Sections 402078):

Tube Outside Diameter (inches)	Maximum Hanger or Support Spacing (feet)	Minimum Rod Size (inches)
1/8 to 1/4	2	3/8
5/16 to 1/2	3	3/8
5/8 to 7/8	4	3/8
1 to 2	6	3/8

3.02 PIPE SUPPORT SPACING FOR SUPPORTS ON TOP OF SLABS OR GRADE

C.A.1 Install pipe supports on horizontal runs at the spacing shown or detailed in the drawings. Provide supports of the type shown or detailed in the drawings. If no spacings are given in the drawings or in the specifications for a particular piping system, use the following:

A. Pipe Support Spacing for Steel and Ductile-Iron Pipe (Sections 40 20 40 and 40 20 76):

Pipe Size (inches)	Maximum Support Spacing (feet)
3/8 and smaller	4
1/2 through 1	6
1 1/4 through 2	8
2 1/2 and 3	10
3 1/2 and 4	10
6	12
8	12
10 and 12	14
14 and 16	16
18	16
20 through 24	18
30	18

B. Pipe support spacing for other pipe materials shall be the same as described above in paragraph entitled “Pipe Hanger and Wall Support Spacing.”

3.03 INSTALLING PIPE HANGERS AND SUPPORTS

A. Provide separate hangers or supports at each valve. Provide one hanger or support around each end of the valve body or on the adjacent connecting pipe within one pipe diameter of the valve end. Provide additional hangers or supports to relieve eccentric loadings imposed by offset valve actuators.

B. Provide separate hangers or supports at each pipe elbow, tee, or fitting. Provide separate hangers or supports on both sides of each nonrigid joint or flexible pipe coupling.

C. Adjust pipe hangers per MSS SP-89, paragraph 10.6.

D. Install leveling bolts beneath support baseplates. Provide 1-inch thick grout pad beneath each base.

E. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, and other equipment to which the pipe is connected.

3.04 INSTALLING STEEL AND FRP CHANNEL FRAMES

A. Use 1-5/8-inch-high channel frames unless 3-1/4-inch is needed to provide clearance from walls. Use multiple back-to-back channels if additional clearance is needed.

B. Seal the ends of cut FRP channel frames with the channel manufacturer's sealant or resin.

3.05 INSTALLING NEOPRENE ISOLATING SLEEVES

Install a sleeve around each metal pipe 6 inches and smaller at the point of bearing or contact with the pipe hanger or support.

3.06 PAINTING AND COATING

A. Grind welds of fabricated steel pipe supports smooth, prepare surface by sandblasting, and apply coating system.

B. Paint exposed pipe hangers and supports to match the color of the adjacent wall using per Section 09 90 00. If the adjacent wall is not painted, paint the hangers and supports to match color code of the largest pipe on the support.

C. Coat submerged pipe hangers and supports per Section 09 90 00.

END OF SECTION

SECTION 40 07 75

EQUIPMENT, PIPING, DUCT, AND VALVE IDENTIFICATION

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of markers, labels, and signs for pipes, ducts, and valves; for mechanical equipment; for hazardous materials warnings; and for miscellaneous plant services.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit manufacturer's catalog data and descriptive literature describing materials, colors, letter size, and size of labels.

PART 2 MATERIALS

2.01 LABELS FOR EXPOSED PIPING

A. Labels for piping shall bear the full piping system name as shown in the Piping Schedule in the drawings. Provide separate flow directional arrows next to each label. Color, size, and labeling shall conform to ANSI A13.1 and Z535.1. Labels for piping inside buildings shall be vinyl cloth: W. H. Brady Co. B-500 vinyl cloth, Seton Name Plate Corporation Pipe Markers, or equal. Labels for piping located outdoors shall be weather- and UV-resistant acrylic plastic and shall be W. H. Brady Co. B-946, Seton Name Plate Corporation Pipe Markers, or equal.

B. Alternatively, provide preprinted, semirigid, snap-on, color-coded pipe markers. Color, size, and labeling shall conform to ANSI A13.1 and Z535.1. Label shall cover 360 degrees (minimum). Labels shall be fabricated of weather- and UV-resistant acrylic plastic. Labels shall be Seton Nameplate Corporation SetMark pipe marks or equal.

2.02 LABELS FOR EXPOSED VALVES

Provide each valve with an identification tag. Tag shall be 2-inch-square or circular aluminum or 1/16-inch-thick fiberglass: W. H. Brady B-60, Seton Name Plate Corp.

Series SVT, or equal. PVC tags shall have black-filled letters. Tag shall show the valve tag number and/or name or designation as given in the drawings.

2.03 LABELS FOR MECHANICAL EQUIPMENT

Provide a label for each pump, blower, compressor, tank, feeder, flocculator, flash mixer, clarifier mechanism, or other piece of mechanical equipment. Label shall show the equipment name and tag number as shown in the drawings. Labels shall be 1 1/2 inches (minimum) by 4 inches (minimum) brass, aluminum, or 1/8-inch-thick fiberglass tags: Brady B-120 Fiber-Shield, Seton Style 2065, or equal.

2.04 LABELS FOR EXPOSED TANKS

Signs shall be weather- and UV-resistant. Labels shall be Brady B-946, Seton Name Plate Corporation PSPL, or equal. Minimum size shall be 7 inches by 10 inches. Provide a sign on each tank bearing the tank tag number and the name of the liquid stored.

2.05 LABELS FOR AUTOMATIC START/STOP EQUIPMENT

Provide a sign reading "CAUTION--EQUIPMENT STARTS AND STOPS AUTOMATICALLY" on each piece of equipment listed below. Signs shall be pressure-sensitive vinyl with adhesive for application to equipment. Signs mounted on adjacent walls are also acceptable. Size shall be 10 inches by 7 inches minimum. Products: Seton, Brady, or equal.

Equipment Type	Location	Tag Number
High Service Pumps	HSP Building	
NAOCL Metering Pumps	HSP Building	

2.06 HAZARDOUS MATERIALS WARNING AND DANGER SIGNS

A. Provide hazardous materials warning diamond signs complying with NFPA 704. Size shall be 10 inches square. Wall signs shall be 1/8-inch-thick fiberglass: Brady B-120 Fiber-Shield or equal. Signs attached to tanks, cabinets, or pieces of equipment shall be self-adhesive vinyl cloth: Brady B-946 or equal. Provide signs at the following locations:

Room No.	Tag Number	Tank or Equipment	
		Location	Chemical
		NaoCl Bulk Storage	12.5% Sodium Hypochlorite

B. Provide signs reading "DANGER" followed by the name of the chemical, gas, or hazard. Size shall be 10 inches by 14 inches. Signs shall be 1/8-inch-thick fiberglass: Brady B-120 or equal. Provide signs at the following locations:

Room No.	Sign Location	Name of Hazardous Material
	NaoCl Skid in HSP Building	12.5% Sodium Hypochlorite

2.07 LABELS FOR EXPOSED VENTILATION DUCTS

Identify air supply, return exhaust, intake, and relief ductwork with duct markers, showing ductwork service and direction of flow. Signs shall be pressure-sensitive vinyl with adhesive for application to ducts and duct insulation. Size shall be 10 inches by 7 inches minimum. Products: Seton, Brady, or equal.

2.08 UNDERGROUND PLASTIC WARNING TAPE FOR METALLIC PIPE

Provide permanent, bright-colored, continuous-printed plastic tape, intended for direct burial service, not less than 6 inches wide by 3.5 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Fiber Optic	Orange
Chemical	Yellow
Electric	Red
Fuel Oil, Gasoline	Yellow
Gas	Yellow
Reclaimed Water	Violet
Sewer	Green
Telephone	Orange
Water	Blue
Oxygen	Yellow

2.09 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE FOR NONMETALLIC PIPE

Provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than 2 inches wide by 3 mils thick. Provide tape with printing which most accurately indicates type of buried service. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Fiber Optic	Orange
Chemical	Yellow
Electric	Red
Fuel Oil, Gasoline	Yellow
Gas	Yellow
Reclaimed Water	Violet
Sewer	Green
Telephone	Orange
Water	Blue
Oxygen	Yellow

PART 3 EXECUTION

3.01 INSTALLING PIPE LABELS

A. Provide label and flow arrow at each connection to pumps or other mechanical equipment, at wall boundaries, at tees and crosses, and at 20-foot centers on straight runs of piping.

B. On piping having external diameters less than 6 inches (including insulation, if any), provide full-band pipe markers, extending 360 degrees around pipe at each location.

C. On piping having external diameters of 6 inches and larger (including insulation, if any), provide either full-band or strip-type pipe markers but not narrower than three times letter height (and of required length), fastened by one of the following methods:

a. Laminated or bonded application of pipe marker to pipe or insulation.

b. Strapped-to-pipe or insulation application of semirigid type with Type 304 or 305

stainless steel bands.

3.02 INSTALLING VALVE AND EQUIPMENT LABELS

A. Attach labels to the valve or piece of equipment with Type 304 or 316 stainless steel chains or wires.

B. Attach valve labels to the valve handwheels. If the valve has no handwheel, attach the label to the valve by tying the tag wire or chain around the operating shaft or nut.

3.03 INSTALLING MISCELLANEOUS SIGNS

Attach per sign manufacturer's recommendations and per OSHA requirements.

3.04 INSTALLING WALL AND DOOR SIGNS

Attach to walls and doors using epoxy adhesive.

3.05 INSTALLING LABELS FOR AUTOMATIC START/STOP EQUIPMENT AND HAZARDOUS MATERIALS WARNING SIGNS FOR EQUIPMENT

A. Attach signs for exposed equipment directly to the equipment.

B. Attach signs for sump pumps on the adjacent wall.

3.06 INSTALLING VENTILATION DUCTWORK LABELS

A. In each space where ductwork is exposed or concealed only by a removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground, or similar concealment) and at 20-foot spacings along exposed runs.

B. Provide markers on each access door in ductwork and housings, indicating purpose of access.

C. Assure that all identification labels are clearly visible.

3.07 INSTALLING UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

During backfilling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6 to 8 inches above the top of the pipe. Where multiple small lines are buried in common trench and do not exceed overall width of 16 inches, install single line marker.

3.08 INSTALLING UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

Install tape 4 to 6 inches below finished ground surface, located directly over buried pipelines. Where multiple small pipelines are buried in a common trench and do not exceed an overall width of 16 inches, install a single marker tape.

3.09 INSTALLING MARKER POSTS FOR UNDERGROUND UTILITIES

A. Install marker posts over the centerline of the utility.

B. Install marker posts at the following locations and points:

a. Every 500 feet along the utility alignment.

b. At each angle point exceeding 3 degrees in the utility alignment.

c. At each point where the utility passes beneath a paved road. Install marker post within 5 to 8 feet of the edge of the roadway paving.

d. At each point where the utility passes beneath a property line.

e. At each point where a utility passes beneath a building slab. Install marker post within 2 to 4 feet of the building wall or the edge of the slab footing. If paving is provided around the building, excavate a hole for the utility marker post, install marker post, and then backfill with earth and install paving. Install such that the marker posts do not interfere with site traffic.

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SECTION 40 20 35

RUBBER AND PLASTIC HOSE AND TUBING

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and accessories for rubber and plastic hoses and tubing:

A. Flexible nylon-reinforced clear PVC tubing for water and chemical service (Type 8).

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit manufacturer's catalog data and descriptive literature for hoses, tubing, and couplings. Show pressure rating and materials of construction for tube, carcass, and cover. Show design of hose and tubing ends.

C. Submit procedures for making up insert fittings and joints and compression fittings and joints.

PART 2 MATERIALS

2.01 HOSE AND TUBING IDENTIFICATION

Hoses and tubing are identified in the drawings by size, type number, and in some cases (Types 1 through 5 hoses) by a suffix letter denoting the type of end connection. For example, a callout of 2" Type 1A means a 2-inch, abrasive slurry service hose, with grooved-end nipples at both ends.

2.02 TYPE 8: FLEXIBLE NYLON-REINFORCED CLEAR PVC TUBING (1/8 THROUGH 2 INCHES)

A. Provide clear PVC tubing with nylon braid reinforcement embedded in the wall of the tubing with smooth inside bore and smooth outside. Minimum operating pressure shall be 200 psi for tubing 3/4 inch and smaller, 150 psi for 1 inch, 100 psi for 1-1/4 and 1-1/2 inches, and 75 psi for 2 inches. Burst pressure shall be at least 4.0 times the specified operating pressure. Tubing shall be NSF 61 listed for potable water service. Join tubing to pipe with a single-barb male adapter fitting.

Secure tubing to the fitting with a stainless steel hose clamp. Connect tubing sections by means of single or multi-barb thermoplastic couplings with titanium hose clamps.

B. Products: Kuriyama “Kuri-Tech Clearbraid K3130 Series BF Heavy Wall PVC Food and Beverage Hose”, Ryan-Herco “Herco-Braid Heavy Duty Food Grade Clear PVC Tubing” or equal.

2.03 INSERT FITTINGS FOR TUBING

A. When insert fittings are specified, they shall be of the single-barb type. The completed tubing and fitting system shall have the same operating pressure ratings as specified for the tubing.

B. Rigid PVC pipe to PVC tubing transition fittings shall be solvent cement socket by single barb fittings with stainless steel clamps.

2.04 QUANTITIES

See drawings for total tubing lengths or quantities. Provide tubing in minimum 100-foot lengths or sections.

PART 3 EXECUTION

3.01 STORAGE

Store hoses in a protected room or building at a temperature range of 50°F to 70°F. Do not store hoses near sources of heat such as radiators or base heaters. Do not store hoses so that they are exposed to sunlight; provide covers to protect hoses from sunlight and from fluorescent or mercury lamps. Storage areas shall be cool and dark, free of dampness and mildew. Protect hoses from rodents and insects. Store hose that is shipped in coils so that the coils are in a horizontal plane.

3.02 HOSE INSTALLATION

Prior to assembling hose and components such as fittings and connectors, carefully examine components for correct material, style, size, catalog number, and length. Examine hoses for cleanliness, obstructions, blisters, cover looseness or damage, kinks, cracks, cuts, or any other visible defects. Inspect the fitting and sealing surfaces for burrs, nicks, corrosion, or other imperfections. Do not use any components that display such signs of nonconformance. No couplings (joints) shall be used between chemical junction boxes.

3.03 SERVICE CONDITIONS

A. Service and design conditions for hoses and tubing shall be as follows:

a. Type: 8.

Minimum Working Pressure: See Drawing G-03

Material Conveyed: 12.5% Sodium Hypochlorite

Hose or Tubing Size: See drawings.

3.04 FIELD TESTING

A. Hydrostatically test hose for leakage in accordance with Section 400515. Leakage shall be zero. Perform pressure testing using water. Fill hoses with water with the outlet ends raised and any outlet valves open to allow the complete removal of air. When the air has been expelled, close outlet valves or install blind flanges or plugs on the outlets and lower the raised ends. Raise the pressure to the specified test pressure. Examine hose for leaks at couplings, fitting slippage, or any indication of weakness in the hose structure. Remove and replace the hose or couplings or fittings if there are any signs of leakage, fitting slippage, or weakness in the hose. Drain the water from the hoses after completion of the pressure tests. See the Piping Schedule in the drawings for test pressures.

B. After completing the pressure testing and draining the water out of the hoses and before filling the hoses with the specified chemicals, flush the Type 8 hoses with alcohol to remove moisture. Then blow clean, dry, oil-free air having a dew point of at least 40°F through the hoses. Circulate the air through the hoses until the exiting air has the same dew point as the applied air. Dispose of the effluent from the hoses in accordance with local water quality requirements.

END OF SECTION

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SECTION 40 20 40

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION:

A. Provide and test ductile iron pipe, fittings and appurtenances as specified. Ductile iron pipe shall be limited to those areas identified and detailed on the drawings. Generally only ductile iron fittings and castings are being used on this project.

B. Options:

1. For buried exterior pipelines provide push-on joint pipe.

   a. Provide restrained push-on pipe as specified

   b. Provide either restrained push-on joint fittings as specified and indicated or provide mechanical joint fittings with restraint system as specified herein

2. For piping exposed as in buildings and galleries, provide flanged or rigid-joint, grooved-coupled pipe and fittings.

3. Cast iron pipe and fittings are not acceptable.

1.02 REFERENCES

A. American Society of Mechanical Engineers (AMSE):

1. B16.1: Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

2. B16.21: Nonmetallic Flat Gaskets for Pipe Flanges.

3. B16.42: Ductile Iron Pipe Flanges and Flanged Fittings.

4. B31.1: Power Piping.

B. American Society for Testing and Materials (ASTM):

1. A240: Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.

2. A307: Carbon Steel Bolts and Studs, 60,000 psi Tensile.

3. A380: Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems.

4. A530: Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.

5. A774: Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

6. A778: Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

C. American Water Works Association (AWWA):

1. A21.4: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. A21.10: Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids.

3. A21.11: Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe Fittings.

4. A21.15: Flanged Ductile-Iron Pipe with Threaded Flanges.

5. A21.50: Thickness Design of Ductile-Iron Pipe.

6. A21.51: Ductile-Iron Pipe, Centrifugally Cast in Metal Molds, or Sand-Lined Molds, for Water or Other Liquids.

7. A21.53: Ductile-Iron Compact Fittings, 3-in through 16-in. for Water and Other Liquids.

D. Fluid Sealing Association: Technical Handbook.

1.03 SUBMITTALS:

A. Submit the following in accordance with General Conditions and Section 01 33 00:

1. Pipe manufacturer's technical specification and product data.

2. Certified shop and erection drawings. Contractor shall submit electronic files of the piping layout including the following.

a. Pipe layouts in full detail.

b. Location of hangers and supports.

c. Location and type of anchors.

d. Location of couplings and expansion joints.

e. 1/2-inch = 1 foot-0 inch (25) scale details of all wall penetrations and special fittings.

f. Schedules of pipe, fittings, special castings, couplings, expansion joints and other appurtenances.

3. Certificates: Sworn certificates in duplicate showing compliance with material used and shop tests performed.

4. Catalog cuts and technical data for expansion joints, couplings, gaskets, pipe supports and other accessories.

5. Brochures and technical data on coatings and linings and proposed method of application.

6. Manufacturer's descriptive literature and technical data on insulation and proposed method of installation.

B. Material Certification:

1. Provide certification from the pipe and fittings manufacturer that the materials of construction specified are recommended and designed for the service conditions specified and indicated. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

2. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated.

C. A copy of the contract mechanical process, civil and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.

1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

2. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

    a. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

    b. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 QUALITY ASSURANCE:

A. Provide in accordance with Section 01 43 00 and as specified.

B. Provide manufacturer's certification in writing, that materials meet or exceed minimum requirements as specified.

C. Inspect and test at foundry according to applicable standard specifications.

D. Owner reserves right to inspect and test by independent service at manufacturer’s plant or elsewhere at his own expense.

E. Visually inspect before installation.

F. Job Conditions:

1. Coordinate dimensions and drillings of flanges with flanges for valves, pumps and equipment to be installed in the piping systems.

1.05 DELIVERY, STORAGE AND HANDLING:

A. During loading, transportation and unloading, prevent damage to pipes and fittings. Load and unload each pipe under control at all times. Under no circumstances will a dropped pipe be used unless inspected and accepted by Owner. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation.

PART 2 PRODUCTS

2.01 PIPE:

A. Ductile Iron:

1. Design conforming to AWWA A21.50.

2. Manufacture conforming to AWWA A21.15 or AWWA A21.51.

3. Thickness class, unless otherwise indicated or specified:

a. Minimum Thickness Class 52.

b. Minimum thickness Class 53 for use with threaded flanges.

c. Minimum thickness Class 53 for use with flanged pipe.

2.02 PIPE FOR USE WITH COUPLINGS:

A. As specified above except ends shall be plain.

B. With bolted split sleeve couplings, ends cast or machined at right angles to axis.

C. With grooved type coupling:

1. Ductile-Iron of thickness class specified above.

2.03 FITTINGS:

A. Buried ductile iron fittings on the AW-1 and PW-1 piping between the GSR and HSP station shall meet AWWA C110. All other buried ductile iron fittings may be compact ductile iron fittings meeting AWWA C153.

B. Provide fittings conforming to AWWA A21.10, at least Class 150 and match piping class.

C. Provide all bell push-on or mechanical-joint fittings unless otherwise indicated or specified.

D. Face and drill flanged fittings conforming to AWWA A21.10 except special drilling or tapping for correct alignment and bolting.

E. If flanged fittings are not available under AWWA A21.10 provide fittings conforming to ASME B16.1 in 125 lb. pressure class.

F. Provide standard base fittings where indicated.

2.04 NONSTANDARD FITTINGS:

A. Acceptable design.

B. Same diameter and thickness as standard fittings.

C. Manufactured to meet requirements of same specifications as standard fittings except for laying length and types of ends.

2.05 WALL CASTINGS:

A. Provide size and type indicated.

B. Wall Castings: Conform to requirements of AWWA A21.10 or fabricate of Class 53 ductile iron pipe with screwed on flanges and welded on waterstop.

C. Provide water stop centered in wall. Weld water stops on in factory under controlled conditions to ensure adequate strength to permit waterstop to absorb thrust up to the pressure rating of the pipe.

Wall Castings with annealed ductile iron water stops

Pipe Size	Waterstop thickness, in
4”-12”	0.50
14”-24”	0.75
30”-36”	1.00

Wall Castings with fabricated steel water stops

Pipe Size	Waterstop thickness, in
4”-16”	0.25
18”-24”	0.38
30”-36”	0.50

D. On flanged wall castings, provide space between the wall and flange to permit mounting the nuts on the flange bolts.

E. Flanged wall castings located with the flange flush with the wall are not acceptable.

F. Locate push-on joint wall castings with space between the bell and the wall to insert the follower bolts.

G. As an option, fabricated wall pipe of Schedule 40 Type 316L stainless steel may be substituted for wall castings specified above. Provide with waterstops of above dimensions and welded continuously on both sides of stop. Flanges of Type 316 stainless steel. Bolts for connection to buried pipe Type 316 stainless steel. Provide flange insulation gaskets, sleeves and washers for all flanges.

2.06 ADAPTERS:

A. Furnish and install for joining pipe of different types, unless solid sleeves indicated.

1. Provide ends conforming to above specifications for the correct type of joint, to receive adjoining pipe.

2. Joining two classes of pipe may be of lighter class provided annular space in bell-and-spigot type joints sufficient for jointing.

2.07 JOINTS:

A. Provide push-on joint and mechanical joint pipe with necessary accessories, conforming to AWWA A21.11.

1. Provide gasket composition designed for exposure to liquid within pipe.

B. Provide pipe flanges and accessories conforming to AWWA A21.15.

1. Provide flat faced flanges.

2. Provide 1/8-inch (3 mm) thick, full faced gaskets designed for exposure to liquid within pipe.

C. Provide restrained joint on pipe and fittings where indicated. Provide restrained joint which is:

1. Boltless

2. Capable of being deflected after assembly

3. Designs using set screws or requiring field welding are not acceptable.

4. Manufacturers:

a. American Cast Iron Pipe Co. Flex-Ring.

b. U.S. Pipe TR FLEX.

c. Clow Super-Lock.

D. Restrained joints for outfall piping to the cooling reservoir 36 inches and larger shall be American Cast Iron Pipe "Lok-Ring", U.S. Pipe “HP Lok” or equal. Weldments for restrained joints shall be tested by the liquid penetrant method per ASTM E165. The method of retainage shall be a factory installed in the bell retainer band that provides a positive axial lock between the interior surface and a retainer weldment on the spigot end of the pipe.

2.08 MECHANICAL JOINT FITTINGS – RESTRAINT SYSTEM:

A. Provide restraint devices for pipe consisting of multiple gripping wedges incorporated into a follower gland meeting requirements of AWWA A21.10.

1. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, retaining full mechanical joint deflection during assembly and allowing joint deflection after assembly.

2. Provide actuation of the gripping wedges ensured with torque limiting twist off nuts.

3. Provide restraint devices Listed by Underwriters Laboratories (3 inch (80 mm) through 24 inch (300 mm) size) and Designed by Factory Mutual (3 inch (80) through 12 inch (300 mm) size).

B. Working Pressure Rating:

1. 16-inch (400 mm) and Smaller: 350 psi (24 bar).

2. 18-inch (450 mm) and Larger: 250 psi (17.3 bar)

3. Minimum safety factor of 2 to 1.

C. Materials:

1. Gland body, wedges and wedge actuating components: Grade 65-45-12 ductile iron in accordance with ASTM A536.

2. Ductile iron gripping wedges: Heat treated, 370 to 470 BHN.

3. Provide three (3) test bars incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation in accordance with ASTM E8.

4. Provide chemical and nodularity tests performed as recommended by the Ductile Iron Society, on a per ladle basis.

5. Provide an identification number consisting of year, day, plant and shift (YYDDD)(plant designation)(Shift number) cast into each gland body.

6. Record all physical and chemical test results such that they can be accessed via the identification number on the casting. Provide the Material Traceability Records (MTRs) available, in hard copy.

D. Manufacturer:

1. EBAA Iron MegaLug Series 1100

2.09 FLANGE ADAPTORS:

A. Provide restrained flange adaptors for pipe consisting of multiple individual gripping wedges incorporated into a follower gland meeting requirements of AWWA A21.10.

1. Provide actuation of the gripping wedges ensured with torque limiting twist off nuts.

2. Provide restraint devices Listed by Underwriters Laboratories (3-inch (80 mm) through 12 inch size) and Designed by Factory Mutual (4-inch (100 mm) through 12-inch size).

B. Joint Deflection capability:

1. 3-inch thru 8-inch: 5 degrees

2. 10-inch and 12-inch: 3 degrees

3. 14-inch and 16-inch: 2 degrees

4. 18-inch and 20-inch: 1.5 degrees

5. 20-inch, 42-inch and 48-inch: 1 degrees

6. 30-inch and 36-inch: 3 degrees

C. Provide flange adaptor to maintain seal with and 0.6 inch (15 mm) gap between end of pipe and mating flange

D. Working Pressure Rating:

1. 16-inch and Smaller: 350 psi)
2. 18-inch : 300 psi
3. 20-inch: 250 psi
4. 24-inch: 200 psi
5. 30-inch thru 48-inch: 150 psi
6. Minimum safety factor of 2 to 1.

E. Materials:

1. Gland body, wedges and wedge actuating components: Grade 65-45-12 ductile iron in accordance with ASTM A536.
2. Ductile iron gripping wedges: Heat treated, 370 to 470 BHN.
3. Provide three (3) test bars incrementally poured per production shift as per Underwriter's Laboratory (U.L.) specifications and ASTM A536. Testing for tensile, yield and elongation in accordance with ASTM E8.
4. Provide chemical and nodularity tests performed as recommended by the Ductile Iron Society, on a per ladle basis.
5. Provide an identification number consisting of year, day, plant and shift (YYDDD)(plant designation)(Shift number) cast into each gland body.
6. Record all physical and chemical test results such that they can be accessed via the identification number on the casting. Provide the Material Traceability Records (MTRs) available, in hard copy.

F. Manufacturer:

1. EBAA Iron MegaFlange Series 2100

2.10 FLEXIBLE CONNECTIONS:

A. Use as specified or indicated:

1. Bolted split sleeve couplings
2. Expansion joints

2.11 BOLTED SPLIT SLEEVE COUPLINGS:

A. Provide in accordance with Section 40 07 22.

B. Pressure rating at least equal to that of related pipeline.

C. Provide with gaskets of composition designed for exposure to liquid within pipe.

2.12 EXPANSION JOINTS:

A. Provide in accordance with Section 40 07 22.

B. Pressure rating at least equal to that of related pipeline.

2.13 FILLING RINGS:

A. Provide where necessary.

B. Materials, workmanship, facing, and drilling, conforming to 125-lb. ANSI (PN 10).

C. Suitable length with nonparallel faces and corresponding drilling, if necessary, for correct assembly of adjoining piping or equipment.

2.14 CONNECTIONS – TAPPED:

A. Provide service saddles for all taps for lines 24-inch (600 mm) and smaller.

1. Body: Ductile iron ASTM A395 or Bronze.

2. Straps and Hardware: Type 316 stainless steel.

B. For 30-inch and larger provide watertight joint with adequate strength against pullout. Use only tapered thread taps.

1. Maximum size of taps in pipe or fittings without bosses not to exceed that listed in table of Appendix to AWWA A21.51 based on: 2 full threads.

2. Where size of connection exceeds that given above for pipe, provide boss on pipe barrel or use tapping saddle. Make tap in flat part of intersection of run and branch of tee or cross, or connect by means of tapped tee, branch fitting and tapped plug or reducing flange, or tapping tee and tapping valve, or permitted.

3. Provide taps and piping for gauges and pressure sensing instruments in accordance with ANSI/HI standards so that there are no erroneous readings.

2.15 STANDARD LINING AND COATING: - Fire water pipe only

A. Inside of pipe and fittings: Provide double thickness cement lining and bituminous seal coat conforming to AWWA A21.4.

B. Outside of pipe and fittings within structures: Clean and apply one shop coat with a 3 to 5 mil DFT of moisture cured urethane.

C. Outside surfaces of castings to be encased in concrete: No coating.

D. Machined surfaces cleaned and coated with rust-preventative compound at shop.

E. Outside of buried pipe and fittings: Standard bituminous coating conforming to AN Standard/AWWA C151.

2.16 GASKETS, BOLTS, AND NUTS:

A. Provide ring or full face synthetic rubber gaskets for flanged joints and neoprene faced phenolic for insulating gaskets in accordance with AWWA A21.11 and ASME B16.21.

1. 1/8 inch (3 mm) thick.

B. Make flanged joints with:

1. Bolts.

2. Bolt studs with nut on each end.

3. Studs with nuts where flange is tapped.

4. Plastic bolt sleeves and washers for insulating joints.

C. Number and size of bolts conform to same ANS as flanges.

D. Provide bolts and nuts, except as specified or indicated, Grade B, ASTM A307.

E. Provide bolt studs and studs of same quality as machine bolts.

F. Provide Type 316 stainless steel bolts, washers and nuts in the following areas:

1. Submerged

2. Wet Wells

3. Chemical Area

4. Piping exposed to weather

PART 3 EXECUTION

3.01 HANDLING AND CUTTING:

A. Mark pipe and fittings "Rejected" and remove from site when cracked or has received a severe blow.

B. If permitted, cut on sound barrel at a point at least 12 inch (300 mm) from visible limit of crack, at Contractor's expense.

C. Machine cut with milling type cutters, knives, or saws. Snap cutters, torch, or hammer and chisel NOT ALLOWED. Examine for possible cracks.

D. Chamfer cut ends if used for push-on joints.

E. Do not cut glass lined pipes.

3.02 INSTALLATION:

A. Visually inspect before installation.

B. Ensure pipelines parallel to building walls wherever possible. Install piping to accurate lines and grades. Where temporary supports are used, ensure rigidity to prevent shifting or distortion of pipe. Provide for expansion where necessary.

C. Pitch piping toward low points. Provide for draining low points.

D. Before assembly, remove dirt and chips from inside pipe and fittings.

E. Pipe and Fittings:

1. Remove and replace defective pieces.

2. Clear of all debris and dirt before installing and keep clean until accepted.

3. Lay accurately to lines and grades indicated or required. Provide accurate alignment, both horizontally and vertically.

4. Provide firm bearing along entire length of buried pipelines.

5. Do not allow deflection of alignment at joints to exceed permissible deflection as specified below:

PIPE DEFLECTION ALLOWANCES

Maximum permissible deflection, in.*

Maximum permissible deflection, in.*		
Size of pipe, in.	Push-on joint	Mechanical joint
4	19	31
6	19	27
8	19	20
10	19	20
12	19	20
14	11	13-1/2
16	11	13-1/2
18	11	11
20	11	11
24	11	9
30	11	9
36	11	8
42	7-1/2	7-1/2
48	7-1/2	7-1/2
54	7-1/2	0 (0)
*Maximum permissible deflection for 20-feet (6 meters) lengths; for other lengths in proportion of such lengths to 20-feet (6 meters).		

a. For push-on joint or similar pipe, clean bell of excess tar or other obstruction and wipe out before inserting next pipe spigot. Shove new pipe into place until properly seated and hold securely until joint completed.

b. Set castings to be encased in concrete accurately with bolt holes, if any, carefully aligned. Clean off rust and scale before setting.

F. Temporary Plugs: When pipe laying not in progress, close open ends of pipe with temporary watertight plugs. If water in trench, do not remove plug until danger of water entering pipe passed.

G. Appurtenances: Set valves, fittings and appurtenances as indicated.

3.03 JOINTS AND COUPLINGS:

A. Push-on Joints:

1. Insert gasket into groove bell. Apply thin film of nontoxic gasket lubricant over inner surface of gasket in contact with spigot end.

2. Insert chamfered end into gasket. Force pipe past it until it seats against socket bottom.

B. Bolted Joints:

1. Remove rust-preventive coatings from machined surfaces.

2. Clean pipe ends, sockets, sleeves, housings, and gaskets and smooth all burrs and other defects.

3. Use torque wrench to tighten to correct range of torque not to exceed values specified below:

TORQUE RANGE VALUES

Nominal pipe size, in	Bolt diameter, in	Range of torque, ft-lb
3	5/8	40-60
4-24, incl.	3/4	75-90
30, 36	1	100-120
42, 48	1-1/4	120-150

C. Flanged Joints:

1. Make up tight.

2. Do not put strain on nozzles, valves, and other equipment.

D. Mechanical Joints:

1. Wire brush surfaces in contact with gasket and clean gasket.

2. Lubricate gasket, bell, and spigot with soapy water.

3. Slip gland and gasket over spigot, and insert spigot into bell until seated.

4. Seat gasket and press gland firmly against gasket.

5. After bolts inserted and nuts made finger-tight, tighten diametrically opposite nuts progressively and uniformly around joint by torque wrench. Torque bolts to values specified above.

E. Flexible Joints:

1. Clean and dry before assembly.

2. Place gaskets, rings, glands and followers in position in back of spigot ball.

3. Coat ball and socket with thin film of lubricant conforming to joint manufacturer's standards.

4. Insert ball and seat in socket. Seat gasket against ball.

5. Boltless joints:

a. Assemble retainer rings and glands conforming to manufacturer's standard.

b. Lock in place with lead strips.

F. Tapped Connection:

1. Drill and tap normal to longitudinal axis.

2. Drilled by skilled mechanics using proper tools.

3. Use only tapered threads.

3.04 FIELD TESTING:

A. Provide in accordance with Section 40 05 15.

B. Clean of all dirt, dust, oil, grease and other foreign material, before conducting pressure and leakage tests.

C. Pressure and Leakage Tests:

1. Conduct combined pressure and leakage test in pipelines.

2. Furnish and install temporary testing plugs or caps; pressure pumps, pipe connections, meters, gages, equipment, and labor.

3. Test when desired and comply with specifications.

4. Test pipelines in excavation or embedded in concrete before backfill or placing of concrete and test exposed piping before field painting.

5. Fill section of pipe with water and expel air. If hydrants or blowoffs are not available at high points for releasing air, make necessary taps and plug after test completion.

6. Maintain section full of water for 24 hours before conducting combined pressure and leakage test.

7. Conduct pressure and leakage test consisting of first raising water pressure (based on elevation of lowest point of section under test and corrected to gage location) to pressure in psi numerically equal to pipe pressure rating, but not more than 150 psi.

8. If unable to achieve and maintain specified pressure for one hour with no additional pumping, section fails test.

9. If section fails pressure and leakage test, locate, uncover, and repair or replace defective pipe, fitting, or joint, at no additional expense and without time extension. Conduct additional tests and repairs until section passes test.

10. Modify test procedure only if permitted by Owner.

3.05 FIELD PAINTING:

A. Provide in accordance with Section 09 90 00.

3.06 DISINFECTING AND FLUSHING:

A. Disinfect potable water lines using procedures and materials conforming to AWWA C651.

B. Dosage to produce minimum 10 ppm after minimum of 24 hour contact period.

C. After treatment, flush with clean water until residual chlorine content less than 0.2 ppm.

D. Prevent contamination of water in existing water mains. Neutralize chlorine content of water used in disinfecting and flushing accordance with AWWA C651.

END OF SECTION

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SECTION 40 20 76

STAINLESS STEEL PIPE AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION:

A. Provide and test stainless steel pipe, fittings and appurtenances as indicated and specified.

B. Pipe and fittings 1/8 inch and larger are included in this specification.

1.02 REFERENCES:

A. American Society of Mechanical Engineers (AMSE):

1. B31.1: Power Piping.
2. B16.5: Pipe Flanges and Flanged Fittings
3. B16.11 Socket Welding Fittings

B. American Society for Testing and Materials (ASTM):

1. A182: Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
2. A240: Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
3. A312: Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
4. A380: Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems.
5. A403: Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
6. A530: Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
7. A774: Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.

8. A778: Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

9. F2015: Standard Specification for Lap Joint Flange Pipe End Applications

C. Fluid Sealing Association: Technical Handbook.

1.03 SUBMITTALS:

A. Submit the following in accordance with Section 01 33 00:

1. Pipe manufacturer's technical specification and product data.

2. Certified shop and erection drawings. Contractor shall submit electronic files of the piping layout including the following.

a. Pipe layouts in full detail.

b. Location of hangers and supports.

c. Location and type of anchors.

d. Location of couplings and expansion joints.

e. 1/2-inch = 1 foot-0 inches (25) scale details of all wall penetrations and fabricated fittings or special fittings.

f. Schedules of pipe, fittings, expansion joints and other appurtenances.

3. Certificates: Sworn certificates in duplicate showing compliance with material used and shop tests performed with appropriate standard.

4. Catalog cuts and technical data for expansion joints, couplings, gaskets, pipe supports and other accessories.

5. Submit reports required for welding certifications per ASME B31.1 paragraph 127.6.

6. Manufacturer's descriptive literature and technical data on insulation and proposed method of installation.

B. Material Certification:

1. Provide certification from the piping and fittings manufacturer that the materials of construction specified are recommended and designed for the service conditions specified and indicated. If materials other than those specified are proposed

based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of five (5) years. Provide proposed materials at no additional cost to the Owner.

2. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and designed for the service conditions specified and indicated.

C. A copy of the contract mechanical process, civil and structural drawings, with addenda that are applicable to the equipment specified in this section, marked to show all changes necessary for the equipment proposed for this specification section. If no changes are required, mark all drawings with “No changes required” or provide a statement that no changes are required.

1. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

2. A copy of this specification section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.

a. If deviations and clarifications from the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

b. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

1.04 QUALITY ASSURANCE:

A. Provide manufacturer's certification in writing, that materials meet or exceed minimum requirements as specified.

B. Welder Qualifications:

1. Quality and certify welding procedures, welders, and operators in accordance with ANSI B31.1, paragraph 127.5 for shop and project site welding of piping work.

C. Job Conditions:

1. Coordinate dimensions and drillings of flanges with flanges for valves, pumps and equipment to be installed in the piping systems.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Comply with the requirements specified in Section 01 66 10.

B. During loading, transportation and unloading, prevent damage to pipes and fittings. Load and unload each pipe under control at all times. Under no circumstances will a dropped pipe be used unless inspected and accepted by Owner's Representative. Place skids or blocks under each pipe in the shop and securely wedge pipe during transportation.

PART 2 PRODUCTS

2.01 STAINLESS STEEL PIPE:

A. Manufacturers:

1. Douglas Brothers

2. Felker

3. Bristol MetalsDixie SouthernMaterial:

1. Type 316L

a. Type 316L bar, sheet, and plate per ASTM A240.

b. Maximum carbon content of 316L material limited to 0.03 percent.

c. Finish: 2D.

2. Type 304L

a. Type 304L bar, sheet, and plate per ASTM A240.

b. Maximum carbon content of 304L material limited to 0.03 percent.

c. Finish: 2D.

C. Fabrication:

1. Pipe 12-inch and smaller shall be seamless and fabricated in accordance with ASTM A312.

2. Pipe 14-inch and larger shall be straight seamed and fabricated in accordance with ASTM A778. Spiral welded pipe is not acceptable.

3. Pipe sizes and wall thickness shall conform to ASME B36.19 in NPS sizes shown with dimensional tolerances per ASTM A530.

4. Perform welding by qualified welders conforming to standard procedures. Weld piping with wall thickness up to 11 gauge, 0.125-inch, with the TIG (GTAW) process. Properly bevel heavier walls and use a root pass with the TIG (GTAW) process followed by subsequent passes with the TIG (GTAW), MIG (GMAW), or Metallic Arc (SMAW) process.

5. Add filler wire of ELC grades to all welds to provide a cross section at the weld equal to or greater than the parent metal. Distribute smooth and evenly weld deposit and provide a crown of no more than 1/16-inch (1.5 mm) on the I.D. and 3/32-inch (on the O.D. of the piping.

6. Concavity, undercut, cracks or crevices are not acceptable.

7. Butt Welds: Full penetration to the interior surface, with inert gas shielding provided to the interior and exterior of the joint.

8. Remove excessive weld deposits, slag, spatter, and projections by grinding.

9. Continuously weld angle face rings on both sides to the pipe or fitting.

10. Grind all welds on gasket surfaces smooth.

11. Contour pipe branches, taps and bosses to the radius of the main pipe run and bevel and weld with full penetration. No projections to the inside of the branch or main run are acceptable. Provide a smooth transition from ID of run to ID of branch.

12. Wire-brush inside and outside weld areas with brushes of stainless steel that are specifically designed to be used only on stainless steel.

13. After manufacture, passivate stainless steel pipe, fittings, and appurtenances by immersion in a pickling solution of 6 percent nitric acid and 3 percent hydrofluoric

acid. Temperature and detention time to be sufficient for removal of oxidation and ferrous contamination without more than superficial etch of surface. Perform a complete neutralizing operation by immersion in a trisodium phosphate rinse followed by clean water wash. Perform in accordance with ASTM A380.

14. After fabrication, either passivate by immersion (see above paragraph) or scrub interior and exterior of welds with same solution or pickling paste and stainless steel wire brushes to remove weld discoloration and then neutralize and wash clean. Perform in accordance with ASTM A380.

15. Perform all welding in the shop. Field welding is not acceptable.

    a. If field welding is allowed for certain circumstances, the Contractor shall submit the welders qualifications and an acceptable method of cleaning the pipe and fittings for review prior to start of any field welding.

    b. All welds shall be annealed.

D. Fittings:

1. Fittings 2-inch and smaller shall be threaded or socket welded, conforming to ASME B16.11, 3,000-pound CWP. Material for threaded fittings shall conform to ASTM A403, Class WP 316 or ASTM A182, Grade F316. Material for socket welded fittings shall conform to ASTM A403, Class WP 316L or ASTM A182, Grade F316L.

2. Fittings 2.5 to 12-inch shall be butt welded, Schedule S10, Type 316L per ASTM A403, Class WP-S. Provide same material and wall thickness as the pipe, conforming to ASME B16.9. Elbows shall be long radius.

3. Fittings 14 to 24-inch shall be butt welded, Schedule S10, Type 316L per ASTM A774. Provide same material and wall thickness as the pipe, smooth flow-die formed, conforming to ASME B16.9. Elbows shall be long radius.

4. Fabricate tees and branch connections true and square with wall thickness same as pipe.

5. Reducers evenly tapered with tangent ends for butt weld connection.

6. Reducers may be straight tapered cone construction.

7. Secure flanges to pipe ends and plug openings prior to shipment.

8. All elbows shall be long radius.

E. Design:

1. Stainless steel pipe: Nominal pipe size diameter pipe fabricated of stainless steel sheets having the following Schedule, U.S.S. gauges and plate thickness:

Nominal Pipe Size (in)	Actual O.D. (in)	Schedule/Gauge/Plate	Nominal Wall Thickness (in)
1/8	0.405	80S	0.095
1/4	0.504	80S	0.119
3/8	0.675	80S	0.126
1/2	0.840	80S	0.147
3/4	1.050	80S	0.154
1	1.315	80S	0.179
1 1/4	1.660	80S	0.191
1 1/2	1.900	80S	0.200
2	2.375	80S	0.218
2.5	2.875	10S	0.120
3	3.500	10S	0.120
4	4.500	10S	0.120
6	6.625	10S	0.134
8	8.625	10S	0.148
10	10.750	10S	0.165
12	12.750	10S	0.180
14	14.000	10S	0.250
16	16.000	10S	0.250
18	18.000	10S	0.250
20	20.000	10S	0.250

Nominal Pipe Size (in)	Actual O.D. (in)	Schedule/Gauge/Plate	Nominal Wall Thickness (in)
24	24.000	10S	0.250
28	28.000	10S	0.312
30	30.000	10S	0.312
36	36.000	10S	0.312

2. Joints: Joints for pipes 2 inches and smaller shall be socket welded, same material as specified for fittings, 3,000-pound WOG, conforming to ASME B16.11. Joints for aboveground or exposed piping larger than 2 inches shall be flanged or butt welded.

3. Hardware: Type 316 stainless steel.

4. Isolate stainless steel flanges from other ferrous metal connections at valves and equipment with flange insulating kit.

    a. Pipe flange insulating kit, double washer type:

        (1) Flange gasket: Type E, 1/8-inch (3 mm) thick neoprene-faced phenolic.

        (2) Insulating sleeves: 1/32-inch (0.8 mm) thick polyethylene, full length, one for each flange bolt.

        (3) Insulating washers: 1/8-inch (3 mm) thick phenolic, two for each flange bolt.

        (4) Mechanical washers: 1/8-inch (3 mm) thick Type 316 stainless steel, two for each flange bolt.

2.02 FLANGES

A. Materials for flanges shall conform to ASTM A182/A182M, Grade F316L F304L, match pipe material.

B. Provide weld-neck, socket weld, or lap joint flanges (conforming to ASME B16.5) for piping 3 inches and smaller to connect to flanged valves, fittings, or equipment. Provide Weld-Neck, Slip-On, or Lap Joint flanges (for piping larger than 3 inches. Flanges shall

be Class 150 or 300 per ASME B16.5. Flanges shall match the connecting flanges on the adjacent fitting, valve, or piece of equipment.

C. Stainless steel flanges mating with cast iron, ductile iron, FRP, HDPE, and plastic flanges shall be flat face. Stainless Steel on Stainless Steel shall be raised faced.

2.03 BOLTS AND NUTS FOR FLANGES

A. Refer to Section 40 05 00 for bolts and nuts for stainless steel pipe flanges.

2.04 GASKETS

A. Refer to Section 40 05 00 for gaskets to be used for stainless steel piping.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Ensure pipelines parallel to building walls wherever possible. Install piping to accurate lines and grades. Where temporary supports are used, ensure rigidity to prevent shifting or distortion of pipe. Provide for expansion where necessary.

B. Pitch piping toward low points. Provide for draining low points.

C. Before assembly, remove dirt and chips from inside pipe and fittings.

D. Make flanged joints with bolts; bolt studs with nut on each end; or studs with nuts where one flange is tapped.

1. Except as otherwise specified, provide number and size of bolts conforming to same ANSI standards.

2. Provide Type 316 or 304 stainless steel hardware to match the pipe.

3. Provide ring gaskets of materials designed for the service specified and indicated, 1/16-inch thick gaskets.

4. Make up flanged joints tight with care being taken to prevent undue strain upon valves or other pieces of equipment.

3.02 FIELD TESTING:

A. Clean of dirt, dust, oil, grease and other foreign material, before pressure and leakage tests.

B. Pressure and Leakage Tests:

1. Conduct combined pressure and leakage test in pipelines.

2. Furnish and install temporary testing plugs or caps; pressure pumps, pipe connections, meters, gages, equipment, and labor.

3. Test when desired and comply with Owner's Representative orders and specifications.

4. Fill section of pipe with water and expel air.

5. Pressure and leakage test consists of first raising water pressure (based on elevation of lowest point of section under test and corrected to gage location) to pressure in psi (bar) numerically equal to test pressures indicated in the Process Pipe Schedule.

6. No visible leakage in joints.

7. If unable to achieve and maintain specified pressure for one hour with no additional pumping, section failed to pass test.

8. If section fails pressure and leakage test, locate, uncover, and repair or replace defective pipe, fitting, or joint, at no additional expense and without time extension. Conduct additional tests and repairs until section passes test.

9. Immediately upon completion of testing, drain and dry piping to remove all traces of water and condensation.

10. Modifications to test procedure only if permitted by Owner’s Representative.

3.03 CONTRACT CLOSEOUT:

A. Provide in accordance with Section 01 78 00.

END OF SECTION

SECTION 40 20 78

STAINLESS STEEL TUBING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes materials and installation of stainless steel tubing and fittings 2 inches in diameter and smaller.

B. Stainless steel pipe may be substituted for stainless steel tubing. However, tubing may not be substituted for pipe.

C. Submit shop drawings in accordance with the General Conditions and Section 01 33 00.

D. Submit materials list showing material of pipe and fittings with ASTM reference and grade. Submit manufacturer's catalog data for swaged fittings and joints.

E. Submit fitting manufacturer's instructions for assembling fittings and joints.

PART 2 MATERIALS

2.01 TUBING

A. Tubing shall conform to ASTM A269, Grade TP 316, seamless. Hardness shall not exceed Rockwell B80. Tube wall thicknesses shall be as follows:

Tube O.D. (inches)	Minimum Wall Thickness (inches)
1/8	0.028
3/16	0.028
1/4	0.028
5/16	0.035
3/8	0.035
1/2	0.042
5/8	0.058
3/4	0.065
7/8	0.072
1	0.083
1 1/4	0.109
1 1/2	0.134
2	0.165

B. Tubing shall be free of scratches. Tubing shall be suitable for bending and flaring.

C. Tubing shall be heat-treated, which shall consist of quenching in water or rapidly cooling by other means at a rate sufficient to prevent precipitation of carbides, as demonstrated by the capability of passing practice ASTM A262, Practice E (Supplementary Requirement S4 in ASTM A269).

2.02 FITTINGS AND JOINTS

A. Fittings and joints shall be of the SWAGELOK type as manufactured by Crawford Fitting Company, utilizing a nut and dual ferrule design to connect to tubing. Fitting and joint material shall comply with ASTM A479, Type 316, or ASTM A182, Grade F316. End connections shall be of the union type.

B. Joints connecting two straight tubes together shall be of the nut and ferrule union type.

2.03 PROTECTIVE END CAPS

Provide protective end caps on each piece of tubing, completely sealing the piece from contamination during shipment and storage. Provide the same type of seals on each fitting, or ship and store fittings in sealed boxes or containers.

2.04 OUTLETS AND NOZZLES

Use a tee with nut and ferrule union ends to connect to the tubing and with an outlet to match the connecting valve or instrument.

2.05 CONNECTIONS TO THREADED-END VALVES

When connecting tubing to threaded-end valves, provide tube to female NPT connectors. Provide a threaded Schedule 80S Type 316 stainless steel nipple (ASTM A312, seamless) between the connector and the valve end.

PART 3 EXECUTION

3.01 INSTALLING TUBING

A. Do not drag tubing out of tube racks. Do not drag tubing across any surface that could scratch it.

B. Keep tube cutters and saws sharp. Do not cut too deeply with each turn of the cutter or motion of the saw.

C. Deburr tube ends before inserting into fittings and joints. Clean both the inside and outside of fitting and pipe ends before making up joints. Do not miter joints for elbows or notch straight runs of pipe for tees. Do not kink tubing.

D. Bends in tubing shall be long sweep. Provide the straight length of tubing recommended by the fitting and joint manufacturer to allow the tube to be inserted into the fitting. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning the tubing wall at any point. Do not use bends to make turns greater than 45 degrees. Use fittings to make turns greater than 45 degrees.

3.02 INSTALLING BURIED TUBING

Install in accordance with Section 31 23 33.

3.03 INSTALLING EXPOSED TUBING

A. Install tubing without springing, forcing, or stressing the tubing or any adjacent connecting valves or equipment.

B. Provide pipe hangers and supports as specified in Section 40 07 64.

3.04 INSTALLING FITTINGS AND JOINTS

A. Follow the manufacturer's instructions for installing fittings and joints.

B. For fittings and joints larger than 1 inch, use the manufacturer's hydraulic swaging unit to make up the connections.

3.05 COATING BURIED TUBING

Coat buried tubing per Section 09 90 00.

3.06 INSTALLING WRAPPED OR COATED TUBING

Install buried tubing having wrapped coatings by extending the wrapping to the first joint after entering a building, penetrating a slab, or 6 inches above finished grade. Wrap joints spirally with a minimum overlap of 50% of the tape width.

3.07 FIELD HYDROSTATIC TESTING

A. See Section 40 05 15.

B. Do not allow test water to remain in the tubing for more than five days. Drain and dry the tubing after completing the testing.

END OF SECTION

SECTION 40 20 90

PVC PIPE, 3 INCHES AND SMALLER

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of PVC pipe and fittings of size 3 inches and smaller for use in process piping having a maximum design pressure of 150 psi and having a maximum design temperature of 105°F.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01 33 00.

B. Submit materials list showing materials of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM D1784, D1785, and D2467. Show wall thickness of pipe and fittings. Show fitting dimensions.

C. Submit data sheets for solvent cement demonstrating compliance with ASTM D2564 and F656.

PART 2 MATERIALS

2.01 PIPE

Pipe shall be Schedule 80, Type I, Grade 1 (Class 12454-B), conforming to ASTM D1784 and D1785.

2.02 FITTINGS

Fittings shall be Schedule 80 and shall conform to ASTM D2464 for threaded fittings and ASTM D2467 for socket-type fittings.

2.03 FLANGES

PVC flanges shall be of the one-piece solid socket design and shall be made of the same material as the pipe. Pressure rating shall be at least 150 psi at a temperature of 73°F. Minimum burst pressure shall be 500 psi. Flanges shall match the dimensions of

ASME B16.5, Class 150, steel flanges for outside diameter, bolt circle, and bolt holes. Do not use Van Stone flanges.

2.04 UNIONS

A. Unions shall have socket-type ends, Viton or EPDM O-rings shall be compatible with the service, and shall be Schedule 80. Material shall be Type I, Grade 1 PVC, per ASTM D1784.

B. Union connections to other metal piping materials shall comply with MSS SP-107. The fitting end for connection to PVC pipe shall be a female socket. Provide wrought or cast copper tailpieces for connection to copper piping and tubing. Provide Type 316 stainless steel tailpieces for connection to steel piping.

2.05 JOINTS

Pipe and fitting joints shall be socket welded except where threaded and flanged joints are required to connect to valves and equipment.

2.06 SOLVENT CEMENT IN OTHER THAN SODIUM HYPOCHLORITE SERVICE

Solvent cement for socket joints shall comply with ASTM D2564 and F656.

2.07 SOLVENT CEMENT IN SODIUM HYPOCHLORITE SERVICE

Solvent cement shall be free of silica. Products: IPS “Weld-On” CPVC 724 or Oatey “Lo V.O.C. PVC Heavy Duty Gray,” or Spears 24.

2.08 GASKETS FOR FLANGES

See Section 40 05 00.

2.09 BOLTS AND NUTS FOR FLANGES

See Section 40 05 00.

2.10 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

See Section 40 05 00.

2.11 WYE STRAINERS

PVC wye strainers shall be manufactured of the same basic material as the pipe, but clear, with 30-mesh screens and Viton seals. Connecting ends shall be the socket type, solvent welded. Provide one spare screen for each strainer.

PART 3 EXECUTION

3.01 GENERAL

A. Do not install PVC pipe when the temperature is below 40°F or above 90°F. Store loose pipes on racks with a maximum support spacing of 3 feet. Provide shades for pipe stored outdoors or installed outdoors until the pipe is filled with water.

B. Store fittings indoors in their original cartons.

C. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements that have exceeded the shelf life marked on the storage container.

D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section of pipe.

E. Do not drag PVC pipe over the ground, drop it onto the ground, or drop objects on it.

3.02 SOLVENT-WELDED JOINTS

A. Prior to solvent welding, remove fittings and couplings from their cartons and expose them to the air at the same temperature conditions as the pipe for at least one hour.

B. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent-welded pipe ends as recommended by the pipe manufacturer.

C. Wipe away loose dirt and moisture from the inside and outside of the pipe end and the inside of the fitting before applying solvent cement. Clean the surfaces of both pipes and fittings that are to be solvent welded with a clean cloth moistened with acetone or methylethyl ketone. Do not apply solvent cement to wet surfaces.

D. The pipe and fitting socket shall have an interference fit. Perform a dry fit test at each joint before applying solvent cement. The pipe shall enter the fitting socket between one-third and two-thirds of the full socket depth when assembled by hand.

E. Make up solvent-welded joints per ASTM D2855. Application of cement to both surfaces to be joined and assembly of these surfaces shall produce a continuous bond between them with visual evidence of cement at least flush with the outer end of the fitting bore around the entire joint perimeter.

F. Allow at least eight hours of drying time before moving solvent-welded joints or subjecting the joints to any internal or external loads or pressures.

G. Acceptance criteria for solvent-welded joints shall be as follows:

1. Unfilled Areas in Joint: None permitted.

2. Unbonded Areas in Joint: None permitted.

3. Protrusion of Material into Pipe Bore, Percent of Pipe Wall Thickness: Cement, 50%.

3.03 FLANGED JOINTS

A. Lubricate carbon steel bolt threads with graphite and oil before installation.

B. Tighten bolts on PVC flanges by tightening the nuts diametrically opposite each other using a torque wrench. Complete tightening shall be accomplished in stages and the final torque values shall be as shown in the following table:

Pipe Size (inches)	**Final Torque (foot-pounds)**
1/2 to 1 1/2	10 to 15
2 to 3	20 to 30

3.04 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

See Section 40 05 00.

3.05 ASSEMBLING THREADED JOINTS

A. Cut threaded ends on PVC to the dimensions of ASTM F1498. Ends shall be square cut. Follow the pipe manufacturer's recommendations regarding pipe hold-down methods, saw cutting blade size, and saw cutting speed. Gauges, gauge tolerances, and gauging procedures shall comply with ASTM F1498, Sections 7 and 8. Perform field gauging on every field-cut threaded connection.

B. Pipe or tubing cutters shall be specifically designed for use on PVC pipe. Use cutters manufactured by Reed Manufacturing Company, Ridge Tool Company, or equal.

C. If a hold-down vise is used when the pipe is cut, insert a rubber sheet between the vise jaws and the pipe to avoid scratching the pipe.

D. Thread cutting dies shall be clean and sharp and shall not be used to cut materials other than plastic.

E. Apply Teflon® thread compound or Teflon® tape lubricant to threads before screwing on the fitting.

F. Assemble threaded flanges and fittings per ASTM F1498, Sections 4, 7, and 8. Do not tighten threaded connections more than two turns past finger tightness for both internal and external threads.

3.06 INSTALLING UNIONS

Provide unions on exposed piping 3 inches and smaller as follows:

A. At every change in direction (horizontal and vertical).

B. 6 to 12 inches downstream of valves.

C. Every 40 feet in straight pipe runs.

D. Where shown in the drawings.

3.07 INSTALLING BURIED PIPE

A. Install in accordance with Section 31 23 33 and as follows.

B. Trench bottom shall be continuous, smooth, and free of rocks. See the details in the drawings for trench dimensions, pipe bedding, and backfill.

C. After the pipe has been solvent-welded and the joints have set, snake the pipe in the trench per the pipe manufacturer's recommendations in order to allow for thermal expansion and contraction of the pipe.

D. Do not backfill the pipe trench until the solvent-welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable soil. Do not use blocking to change pipe grade or to support pipe in the trench.

E. Install buried PVC pipe in accordance with ASTM D2774 and the pipe manufacturer's recommendations. Backfill materials in the pipe zone shall be imported sand per Section 31 23 16.

3.08 INSTALLING ABOVEGROUND OR EXPOSED PIPING

A. See Section 40 05 00.

B. Fill empty piping with water and provide temporary shading or other means to keep the surface temperature of the pipe below 100°F.

3.09 PAINTING AND COATING

Coat piping per Section 09 90 00.

3.10 HYDROSTATIC TESTING

Perform hydrostatic testing for leakage in accordance with Section 40 05 15.

END OF SECTION

SECTION 40 27 14

IN-LINE STATIC INJECTION RING MIXERS AND SOLUTION DIFFUSERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes materials and installation of chemical solution diffusers.

B. CONTRACTOR shall furnish all Equipment, labor, materials including fasteners, gaskets, and piping required to install the following as indicated in these specifications and on the plan drawings

1.02 QUALITY ASSURANCE

A. Static mixer and injector equipment manufacture shall be in the business of design and fabrication of this type equipment in both size and capacity as required. The manufacture shall provide, as may be requested, proof of successful installation of this type equipment.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Section 01 33 00.

B. Submit manufacturer's catalog data and descriptive literature showing dimensions, materials of construction by ASTM reference and grade, and flow capacity and pressure ratings.

PART 2 MATERIALS

2.01 MANUFACTURERS

A. In-line Static Mixers shall be manufactured by Westfall Manufacturing or approved equal.

B. Chemical Injectors shall be manufactured by SAF-T-FLO Chemical Injection or approved equal.

2.02 MIXER DESIGN

A. Product: Westfall Model 2800

B. Static mixer shall be of a compact ring body design for mounting between two pipe flanges. The ring body shall have a minimum thickness of 0.875 inch. Mount the mixing plate in a cavity on the upstream side of the ring body. The mixing plate shall have a minimum thickness of 0.175 inch. Provide ring-type gaskets (minimum 1/8-inch

thick) adhered to both sides of the mixer body. The body shall include one or more injection fittings.

C. Design the mixer plate to provide a geometric shape that will create the mixing vortices to effectively mix the injected fluid(s) with the main process fluid. The average variation in the concentration of the injection fluid shall be within ±1% of the mean 10 pipe diameters downstream from the mixer at design flow.

2.03 FRP MIXER MATERIAL

A. Mixer Material shall be compatible with 12.5% sodium hypochlorite

B. Provide injection body rings made of molded FRP. Resin shall be Derakane 411, Hetron 922, Reichhold Dion 9800, or approved equal.

2.04 CHEMICAL SOLUTION DIFFUSERS

A. Injector connection smaller than 1 inch shall be threaded, ASME B1.20.1. Injector connections 1 inch and larger shall have a connecting flange.

B. Injectors shall include flexible hose assembly for easy of removal and installation. Hose shall be compatible with each chemical application. Contractor shall field confirm hose assembly size and length prior to ordering and installation

C. Injector tips and check valve seal shall be compatible with each chemical application.

D. Chemical solution diffusers shall be retractable with Hastelloy C chemical injection assemblies.

E. Chemical solution diffusers shall consist of heavy-duty Hastelloy C ball valve with solution tube adapter and safety hook.

F. Solution tube assembly shall be Hastelloy C.

G. Injector tips types shall be configured to reduce scaling.

H. Diffusers shall be removable/insertion type that can be removed without shutting down the main process piping.

I. Injectors shall be supplied by the mixer manufacturer. Injectors shall include a ball valve type corporation stop with quill or solution tube, ball check valve in the solution tube, solution tube adapter, and packing nut and chain.

J. Diffusers shall be model No. EB-145-S-H-6-CV-V-10 Saf-T-FLO Chemical Injection, Anaheim, CA, or equal. Contractor shall field verify main connection size and insertions length; submit to Engineer.

2.05 BOLTS AND NUTS FOR BODY RING FLANGES

A. Use 316SS Nuts and Bolts and viton gaskets for ring mixer material.

PART 3 EXECUTION

3.01 SHOP HYDROSTATIC PRESSURE TESTING

A. After completion of fabrication, pressure test each mixer to a pressure equal to the design pressure or 150 psi, whichever is less. The duration of the test shall be at least one hour. When subjected to the above hydrostatic test pressure, the mixer shall show no leaks.

B. No repairs will be permitted to FRP mixers.

C. Repair any leaks or other defects in metallic mixers by chipping out and rewelding, after which the entire mixer shall again be tested until it shows no leaks or other defects.

3.02 SHIPMENT, STORAGE, AND HANDLING

A. Ship and store equipment in accordance with the mixer manufacturer written instructions.

B. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Install closures at the place of mixer manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures.

C. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Install caps or plugs at the place of mixer manufacture prior to shipping.

D. When loading mixers for shipment to the project site, use spacers and other protective devices to separate mixers to prevent damaging the surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the mixer surfaces after separation. Use padded chains or ribbon binders to secure the loaded mixers and minimize damage.

E. Cover mixers 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

F. Provide stulls, braces, and supports during shipping and storage such that out-of-roundness or deflection does not exceed 0.5% of the mixer diameter.

G. Inspect mixers on receipt for damage in shipment and conformance with quantity and description on the shipping notice and order. Unload mixers carefully to the ground without dropping. Do not load or unload mixers by inserting forklift tines or lifting chains inside the mixer waterway. Use nonmetallic slings, padded chains, or padded forklift tines to lift mixers. Do not lift mixers with slings or chain around injection ports or through waterway. Lift mixers with eyebolts or rods through flange holes or chain hooks at ends of mixer parts.

H. Handle mixers with care during unloading, installation, and erection operations to minimize damage. Do not place or store mixers on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place mixers above the ground upon platforms, skids, or other supports.

I. Store mixers at the site on pallets to prevent direct contact with ground or floor. Cover mixers during storage with protective coverings or tarpaulins to prevent deposition of rainwater, salt air, dirt, dust, and other contaminants.

J. Make sure flange faces, joint sealing surfaces, and injection ports are clean before installing.

K. Protect the mixer from weather and the accumulation of dirt, rocks, and debris. If the mixers are stored or installed outside or in areas subject to temperatures below 40°F or are exposed to the weather prior to permanent installation, provide the manufacturer's recommended procedures for extended storage.

3.03 EQUIPMENT INSTALLATION

A. Install in accordance with the manufactures instruction and in good pipe Installation procedures. The flanged connections of adjoining pipes shall be supported on both ends to keep stress from the mixer flanged faces.

B. Perform inspection and testing after installation acceptance. CONTRACTOR shall perform preliminary test on the system to ensure the equipment is operating in satisfactory condition.

C. Following the preliminary test a functional test shall be performed by CONTRACTOR for ENGINEER and the equipment manufacturer.

D. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe run to which the mixers are attached. Clean flanges by wire brushing before installing flanged mixers. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

E. Do not use duct tape and plastic for covering the ends of mixer flanges. Use a solid metal cover with rubber gasket to cover flange openings during installation. These metal covers shall remain in place until the piping is connected to the mixers.

F. Do not spring flanges of connecting piping into position. Separately work connecting piping systems into position to bring the piping flanges into alignment with the matching mixer flanges. Do not move mixers to achieve piping alignment. Do not use the mixer to straighten misaligned pipes. Do not use electrical heating stress relieving to achieve piping alignment.

G. Line up pipe flange bolt holes with mixer flange bolt holes within 1/16 inch maximum offset from the center of the bolt hole to permit insertion of bolts without applying any external force to the piping.

H. Flange face separation shall be within the gasket spacing ±1/16 inch. Use only one gasket per flanged connection.

3.04 LABELING AND MARKING

A. Provide a model number tag for each unit.

END OF SECTION

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SECTION 40 95 00

PROCESS INSTRUMENTATION AND CONTROL SYSTEM (PICS)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Work includes engineering, installing and furnishing field instruments and a Process Control Panel (PCP) at the JEA Otter Run Water Treatment Plant (WTP). JEA is henceforth referred to as OWNER.

B. All programming associated with the PCP equipment shall be performed by OWNER.

C. The work defined in this Specification Section shall be performed by one of the following control panel suppliers listed in the OWNER's list of Approved Suppliers and henceforth referred to as the SYSTEM SUPPLIER:

1. ECS. Contact Ralph Sinn at 904/367-5000.
2. EG Controls. Contact Brian Dail at 904/292-0110.
3. ITG. Contact Dale Young at 904/425-4760.
4. Suncoast. Contact Mark Owens at 904/693-3318.
5. Sun State Systems. Contact Barney Messer at 904/269-2544.

D. The SYSTEM SUPPLIER shall also be responsible for the Work specified in the following Specification Sections:

1. Specification Section 40 95 10 defines field instruments.
2. Specification Section 40 95 20 defines work associated with the Process Control Panel (PCP) that will interface the system with the field instruments defined hereunder.

E. It is the ultimate responsibility of the SYSTEM SUPPLIER to furnish a complete and fully operable PCP that reliably performs the specified functions. It is the intent of these Contract Documents that a single entity (henceforth referred to as the SYSTEM SUPPLIER) have overall responsibility for designing, furnishing, interfacing, adjusting, testing, documenting, and checking out the PICS equipment described in the Contract Documents.

F. Equipment storage and protection until installed shall follow the storage and handling instructions recommended by the SYSTEM SUPPLIER. Anti-static and winterization requirements shall be per the SYSTEM SUPPLIER's instructions and the SYSTEM SUPPLIER shall periodically verify that these instructions are followed.

G. The SYSTEM SUPPLIER shall observe and advise on the installation of the PICS to the extent required to certify, with the operational check-out tests, that the equipment will perform as required.

H. All engineering development required by the SYSTEM SUPPLIER will be in accordance with the Conditions of this Contract.

I. Equipment found to be defective prior to system acceptance shall be replaced and installed at no additional cost to the OWNER.

1.02 SYSTEM DESCRIPTION

A. The new PCP shall be a free-standing NEMA 12 steel enclosure located within the electrical room in the new High Service Pump Building.

B. The PCP shall include a Programmable Logic controller (PLC) that will monitor and control the WTP high service pumps and the well pumps. It shall also contain the following major elements:

1. A front-panel mounted Operator Interface Terminal (OIT).
2. Radio transceiver to connect the PICS with the OWNER’s existing Supervisory Control and Data Acquisition (SCADA) system.
3. An industrialized mixed media Ethernet switch to interconnect the PLC, OIT, radios, and the modified Well Pump Control Panel (WPCP) described below.
4. An Uninterruptible Power Supply (UPS) for contained equipment.
5. All other miscellaneous power distribution and control components specified elsewhere and required for a fully operational PCP.

1.03 RELATED WORK

A. Specification Section 23 32 12 “Generator” defines requirements associated with the equipment to be interconnected with the PLC.

B. Specification Section 26 13 33 “Fiber Optic Sub-system” defines requirements associated with the fiber optic sub-system.

C. Specification Section 26 29 33 “Variable Frequency Drives” defines requirements associated with the equipment to be interconnected with the PLC via Profibus.

1.04 SUBMITTALS

A. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section and its associated sections of the work.

B. Submit complete, neat, orderly, and indexed submittal packages. Handwritten diagrams are not acceptable and all documentation submittals shall be made using CADD generated utilities.

C. Partial submittals or submittals that do not contain sufficient information for complete review or are unclear will not be reviewed and will be returned by the ENGINEER as not approved.

D. Provide all shop drawing submittals electronically in PDF format.

E. Provide a single PICS shop drawing submittal containing the following:

1. Loop diagrams, consisting of complete wiring and/or plumbing diagrams for each control loop showing all terminal numbers, the location of the dc power supply, the location of any booster relays or common dropping resistors, surge arrestors, etc. The loop diagrams shall meet the minimum requirements of ISA S5.4 plus divide each loop diagram into four areas for identification of element locations: PLC I/O point(s), panel face, back-of-panel, and field, respectively.
2. System interconnect diagram that shows all connections required between component parts of the items covered in this section and between the various other systems specified in this Contract. Number all electrical terminal blocks and field wiring. Identify each line at each termination point with the same number. Do not use this number again for any other purpose in the complete control scheme.
3. Layout diagrams for all control panels and enclosures. Include panel elevations (front, side, interior), and sizing. Panel front elevations shall be

of sufficient scale to allow all engraved nameplates and inscriptions to be legible without the use of schedules.

4. Wiring diagrams for all control panels. Diagrams shall be complete electrical wiring diagrams showing all components and all auxiliary devices such as relays, alarms, fuses, lights, fans, heaters, etc. All wires and terminals shall be numbered on the diagrams, and line cross-references shall be labeled. Include wiring interface to the PLCs where applicable. Include on these drawings a tag number to identify each component and referenced to a component identification list
5. Bill of Materials: A list of all components, including all 3rd party software. Group components by type and include component model number and part number, component description, quantity supplied, and reference to component catalog information.
6. Descriptive Information: Catalog information, descriptive literature, performance specifications, internal wiring diagrams, power and grounding requirements, power consumption, and heat dissipation of all elements. Clearly mark all options and features proposed for this project.
7. Installation Details. Equipment installation drawings showing external dimensions, enclosure material and spacing, mounting connections, and installation requirements.
8. A bill of material list of, and descriptive literature for, spares and expendables.

F. Test Procedures: Submit the procedures proposed to be followed during all system testing. Procedures shall include test descriptions, forms, and check lists to be used to control and document the required tests.

G. Test Reports: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures to the ENGINEER.

1.05 FINAL DOCUMENTATION

A. As a part of the final acceptance requirements, submit the PICS record drawings. Record drawings shall include, corrected for any changes that may have been made up through Substantial Completion:

1. instrument loop wiring diagrams

2. panel wiring diagrams
3. panel elevations
4. interconnection diagrams showing terminal numbers at each wiring termination

B. Record drawings shall be developed or converted to the latest version of AutoCAD. Provide AutoCAD files on a USB flash drive.

C. Operating and Maintenance (O&M) Manuals: Provide two complete sets of three-ring bound O&M manuals. Include descriptive material, drawings, and figures bound in appropriate places. Include:

1. Cross references to 3rd party O&M manuals.
2. Additional operating and maintenance instructions in sufficient detail to facilitate the operation, removal, installation, adjustment, calibration and maintenance of each component provided with the PICS.
3. All the submittal data for each component from the approved shop drawing submittals with corrections made on approved as noted items.
4. A USB Flash drive containing the shop drawing data in PDF format in the binder sleeve.

1.06 QUALITY CONTROL

A. The SYSTEM SUPPLIER shall meet all of the requirements of these specifications, and, unless specifically stated otherwise, no prior acceptance of any subsystem, equipment, or materials has been made.

B. All equipment furnished by the SYSTEM SUPPLIER shall be of the latest and most recent design and shall have overall accuracy as guaranteed by the manufacturer.

C. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

D. Component equipment shall be as supplied by one of the manufacturers named or approved equal. The design of the PICS is based on the first-named manufacturer's equipment if there is a difference.

E. To facilitate the OWNER's operation and maintenance, products shall be of the same major MANUFACTURER, with panel mounted devices of the same type and model as far as possible.

F. In order to insure the interchangeability of parts and the maintenance of quality, strict compliance with the above requirements shall be maintained.

G. The SYSTEM SUPPLIER shall designate a single point of contact for interface with the ENGINEER on this project. The ENGINEER reserves the sole right to approve or reject this point of contact.

H. The SYSTEM SUPPLIER shall provide experienced personnel on-site to coordinate and/or perform installation, termination, and adjustment, on-site testing and startup assistance for the PICS.

1.07 STANDARDS

A. The design, testing, assembly, and methods of installation of the wiring materials, electrical equipment and accessories proposed under this Contract shall conform to the National Electrical Code and to applicable state and local requirements. UL listing and labeling shall be adhered to under this Contract.

B. International Society of Automation (ISA) and National Electrical Manufacturers Association (NEMA) standards shall be used where applicable in the design of the PICS.

C. Any equipment that does not have a UL, FM CSA, or other approved testing laboratory label shall be furnished with a notarized letter signed by the supplier stating that the equipment famished has been manufactured in accordance with the National Electric Code and OSHA requirements.

D. Any additional work needed resulting from any deviation from codes or local requirements shall be at no additional cost to the OWNER.

1.08 WARRANTY AND GUARANTEES

A. The SYSTEM SUPPLIER shall furnish to the OWNER a written two year guarantee commencing with substantial completion, that all equipment and parts thereof, material and/or workmanship are of top quality and free from defects.

B. The SYSTEM SUPPLIER shall guarantee all equipment provided under these specifications.

PART 2 PRODUCTS

2.01 GENERAL

A. Equipment to be installed in a hazardous area shall meet Class, Group, and Division classification as shown on the Contract Electrical Drawings, or comply with the local or National Electrical Code, whichever is the most stringent requirement.

B. Electronic equipment shall utilize printed circuitry suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose, to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

C. All equipment shall be designed to operate on a 60-Hertz alternating current power source at a normal 120 volts, plus or minus 10 percent, except where specifically noted otherwise. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

D. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single MANUFACTURER, insofar as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion through the installation of plug-in circuit cards or additional cabinets.

E. The equipment furnished shall be designed to operate satisfactorily between 0 degrees C and 40 degrees C at up to 95 percent Relative Humidity (non condensing).

F. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 volts-amperes (VA), unless specifically noted otherwise.

G. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

2.02 LIGHTNING/SURGE PROTECTION

A. Surge protection devices and lightning arrestors meeting the requirements of ANSI Standard C-62.41 (latest revision) shall be provided as further detailed below.

B. Profibus Connections. Each Profibus drop shall be furnished with a 2-wire RS-485 surge protector. Provide Phoenix Contact PT 3-HF-12 DC or approved equal.

C. AC Powered Instruments. Lightning and surge protection shall be provided on both the AC power supply and signal lines. The instrument, a breaker and the surge suppressor shall be mounted on a ½-inch aluminum plate. Outdoor instrument mounting plates shall also be equipped with 1/8 inch sun shields on top and both sides with front panel facing north wherever practical. The protectors shall meet the following criteria:

1. NEMA 4X small case.
2. Response time of less than five nanoseconds.
3. AC Power protection: IEEE/ANSI Std. C-62.41 rated C3 at 330 Volts clamping level.
4. Signal line protection: 10,000 Amp 8 x 20 microsecond surge, clamped at 36 Volts clamping level.
5. Test jacks for low level signal monitoring.
6. Manufacturer/model: EDCO SLAC series or approved equal.

D. Loop Powered Instruments. Lightning and surge protection shall be provided on the 4-20 mA DC signal line. The protectors shall meet the following criteria:

1. Encapsulated in 316 Stainless Steel Pipe nipples for in-line conduit mounting.
2. Response time of less than one nanosecond.
3. Capable of withstanding up to 10 occurrences of 8/20 microsecond impulses at 5000 Amps.
4. Protection of both lines plus shield

5. Manufacturer/model: Citel model TSP15M, no equal

E. Signals. Lightning and surge protection shall be provided on all 4-20 mA and discrete signal wires entering or leaving the panel. The protectors shall meet the following criteria:

1. 35 mm DIN rail mounted with spring terminals.
2. Response time of less than one nanosecond.
3. Operating signal voltage: as required for signal type.
4. Capable of withstanding up to 10 occurrences of 8/20 microsecond impulses at 10,000 Amps.
5. Nominal series resistance of less than 2 ohms each leg
6. Manufacturer/model:
    a. Citel model DLA series, no equal.

F. Single phase AC Power (to 15Amps). Lightning and surge protectors for AC power supply lines up to 15 Amps service shall meet the following criteria:

1. Serial protection with replaceable fuse.
2. Failure indicator
3. Response time of less than five nanoseconds.
4. Capable of withstanding up to 10,000 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.
5. Manufacturer/model:
    a. EDCO HSP121BT
    b. Dehn DG S 150
    c. Approved equal.

G. Single phase AC Power (over 15Amps). Lightning and surge protectors for AC power supply lines over 15 Amps service shall meet the following criteria:

1. Parallel protection using MOVs and thermal fusing technology.
2. Failure indicator
3. Response time of less than five nanoseconds.
4. Capable of withstanding up to 6,500 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.
5. Manufacturer/model:
    a. EDCO FAS-120AC

b. Approved equal.

2.03 SPARES AND EXPENDABLES

A. Provide the following spare parts:

1. Five (5) spare surge protection device of each type provided.

PART 3 EXECUTION

3.01 GENERAL

A. Prerequisite Activities and Lead Times: Do not start the following key project activities until the listed prerequisite activities have been completed and lead times have been satisfied:

1. Hardware Purchasing, Fabrication, and Assembly: Associated design related submittals completed (no exceptions, or approved as noted).
2. Shipment: Completion and approval of all design related submittals.
3. Startup: Operational Checkout Tests.

B. Substantial Completion: The following requirements must be fulfilled before consideration will be given for Substantial Completion of the PICS:

1. All PICS submittals have been completed.
2. The PICS has successfully completed the Demonstration Tests.
3. All spares, expendables, and test equipment have been received by OWNER.

3.02 PRODUCT HANDLING

A. Adequately pack manufactured material to prevent damage during shipping, handling, storage and erection. Pack all material shipped to the project site in a container properly marked for identification. Use blocks and padding to prevent movement.

B. Ship materials that must be handled with the aid of mechanical tools in wood-framed crates.

C. Ship all materials to the project site with at least one layer of plastic wrapping or other approved means to make it weatherproof. Anti-stat protection shall be provided for all sensitive equipment.

D. Inspect the material prior to removing it from the carrier. Do not unwrap equipment until it is ready to be installed. If any damage is observed, immediately notify the carrier so that a claim can be made. If no such notice is given, the material shall be assumed to be in undamaged condition, and any subsequent damage that is discovered shall be repaired and replaced at no additional expense to the OWNER.

E. Store and protect equipment until installation following the storage and handling instructions recommended by the equipment manufacturers. Place special emphasis on proper anti-static protection of sensitive equipment.

F. ESD Protection: Provide for the proper handling, storage, and environmental conditions required for the PCP components deemed static sensitive by the equipment manufacturer. Utilize anti-stat wrist straps and matting during installation of these items to prevent component degradation.

G. Protection During Construction: Throughout this Contract, provide protection for materials and equipment against loss or damage and from the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Provide covers for panels and other elements that may be exposed to dusty construction environments. Specific storage requirements shall be in accordance with the SYSTEM SUPPLIER's recommendations.

H. Corrosion Protection: Protect all consoles, panels, enclosures, and other equipment containing electrical or instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, include capsules in the shipping containers, and equipment as recommended by the capsule manufacturer. During the construction period, periodically replace the capsules in accordance with the capsule manufacturer's recommendations. Replace all capsules just prior to Final Acceptance.

I. The CONTRACTOR shall be responsible for any damage charges resulting from the handling of the materials.

3.03 INSTALLATION

A. Install the PICS in the location indicated on the Drawings and follow manufacturers' installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturers' instruction, and these Contract Documents, follow ENGINEER's decision, at no additional cost. Keep a copy of manufacturers' instructions on the jobsite available for review at all times

B. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance. Coordinate I&C work with the OWNER and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the existing plant during construction.

C. Provide finish on instruments and accessories that protects against corrosion by the elements in the environment in which they are to be installed. Finish both the interior and exterior of enclosures. Provide extra paint of each color used in the material from the manufacturer for touch-up purposes.

D. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. Clean and polish the exterior of all panels and enclosures upon the completion of the demonstration tests.

E. Ground each analog signal shield on one end at the receiver end only. Properly ground all surge and transient protection devices. Coordinate grounding system with Division 16, Electrical.

F. For the purposes of uniformity and conformance to industry standard, provide analog signal transmission modes of electronic 4-20 ma DC. No other signal characteristics are acceptable.

G. Fully isolate outputs for transmitted electronic signals between transmitters and receivers, equipment of different manufacturers and between control panels to conform to ISA Standard S 50. 1.

3.04 TESTING – GENERAL

A. The ENGINEER reserves the right to test or retest any and all specified functions whether or not explicitly stated in the approved test procedures. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing.

3.05 OPERATIONAL READINESS TEST

A. These inspections and tests shall include Loop/Component inspections and tests. The SYSTEM SUPPLIER shall fully debug problems in the system as a whole.

B. Check the entire PICS for proper installation, calibration and adjustment on a loop-by-loop and component-by-component basis to ensure that it is in conformance with related submittals and the PICS Specifications.

C. The Loop/Component Inspections and Tests shall be implemented using approved forms and checklists. These shall be developed by the SYSTEM SUPPLIER and submitted for approval.

D. Loop Status Report: Each control loop shall have a Loop Status Report to organize and track its inspection, adjustment, and calibration. These reports shall include the following information and check-off items with spaces for sign-off by the SYSTEM SUPPLIER:

1. Project Name
2. Control Loop Number or description
3. Tag Number or description for each component of the control loop
4. Check-offs/sign-offs for each component for proper installation, termination, and calibration/adjustment
5. Check-offs/sign-offs for the control loop for proper panel interface terminations, 1/0 interface terminations, I/0 signal operation relative to the computer network, and total loop operation ready
6. Space for comments

E. Maintain the Loop Status Reports and Component Calibration Sheets at the jobsite and make them available to the ENGINEER at any time.

F. Witnessing: These inspections and tests do not require witnessing. However, the ENGINEER will review the Loop Status Sheets and Component Calibration Sheets and spot-check their entries periodically and upon completion of the Operational Check-out Tests. Correct any deficiencies found.

END OF SECTION

SECTION 40 95 10

PROCESS INSTRUMENTATION AND CONTROL SYSTEM (PICS)

FIELD INSTRUMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Specification Section covers work related to the various field instruments to be supplied with the Process Instrumentation and Control System (PICS).

B. Field instrumentation, as specified herein, shall be furnished by the same SYSTEM SUPPLIER furnishing services and equipment as outlined in 13300.

1.02 RELATED WORK

A. Specification Section 40 95 00 defines work associated with the overall PICS.

B. Specification Section 40 95 20 defines work associated with the Process Control Panel (PCP) that will interface the system with the field instruments defined hereunder.

1.03 SUBMITTALS

A. Submit the following Field Instrumentation Shop Drawings in a single package:

1. Catalog information, descriptive literature, wiring diagrams, and shop drawings on all components of the field instruments, including all miscellaneous electrical and mechanical devices furnished under this section.

2. Individual data sheets for all components of the field instruments to supplement the above information by citing all specific features for each specific component (e.g. scale range, materials of construction, special options included, etc.). Each component data sheet shall bear the component name and instrument tag number designation shown in the Drawings and Specifications.

3. Installation details for all field mounted devices to show conformance with the Contract Documents.

4. Configuration documentation for all programmable devices to indicate actual settings used to set the device scale, range, trip points, and other control parameters.

5. Proposed tag numbers for each specific instrument.

PART 2 PRODUCTS

2.01 GENERAL

A. All instruments requiring plumbing shall utilize stainless steel components as follows:

1. Test Tap: Shall consist of Crawford Fitting Co. Swagelock quick connects Series QC4-DE, or equal.

2. Tubing, Stainless Steel: Shall be ASTM A 312, TP 316, seamless, soft annealed with 0.065 inch wall. Fittings shall be ASTM A 276, TP 316 compression or socket weld type.

3. Valve, Ball: Shall be stainless steel ball valves, Whitey Series 40, Hoke Flamite Series 7100, or equal.

B. All instruments shall be provided with mounting hardware and floor stands, wall brackets or instrument racks.

C. All transmitters located outdoors shall be equipped with aluminum sun-shields.

D. Except where specifically defined otherwise, all transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent. Indicator readouts shall be linear in process units.

2.02 FIELD INSTRUMENTS

A. Drawdown Level Transmitter (LIT-1011, -1021). The level measurement system shall comprise a submerged pressure transducer (Pressure Transmitter, PT), factory attached and sealed interconnecting cable, and junction/termination box with front panel mounted loop-powered indicator (Level Indicator, LI) that indicates the depth of process fluid in the vessel being monitored. Within the pressure transmitter, process pressure variations shall be sensed by a barrier diaphragm and transferred via a non-compressible fill liquid to a Wheatstones

Bridge strain gage diffused onto a silicon diaphragm. The electronics within the element shall produce an analog signal proportional to the process pressure.

1. Performance:

    a. Static accuracy of the pressure transmitter shall be less than or equal to 0.1% full scale including the combined effects of nonlinearity, hysteresis and non repeatability.

    b. The pressure transmitter shall be temperature compensated between -2 and 30 degrees C.

    c. The shielded and vented interconnecting cable shall be of sufficient length to allow the pressure transmitter to be properly positioned. The cable shall be able to withstand 200 pounds of tensile strength, allowing the transducer to be suspended directly by the cable.

    d. The cable shall be equipped with a dessicant filter at the surface end of the vent tube.

    e. The level indicator shall be loop-powered, backlit and rated for operation at up to 65 degrees C. Provide intrinsically safe model, Precision Digital PD688 or approved equal.

2. Materials:

    a. Exterior pressure transmitter parts – Titanium.

    b. Fill liquid - NSF approved for use in drinking water applications.

    c. Interconnecting cable jacket – Polyurethane.

    d. Terminal junction box – 316 Stainless Steel.

3. Ratings:

    a. Terminal junction box – NEMA 4X.

4. Electrical:

    a. Transmitter excitation: Loop powered.

5. Manufacturer, Model series:

    a. GE Druck PTX1830.

b. Approved equal.

B. Pressure Indicating Transmitter (PIT-1015, -1025, -5550). The pressure transducer shall sense variations in pressure and produce a standard current output signal linear with gage pressure.

1. Performance:

a. Built in temperature compensation.

b. Total accuracy of less than or equal to 0.2% of span.

c. Adjustable zero and span values anywhere within the nominal range.

2. Materials:

a. Metallic Wetted parts – 316 Stainless Steel.

b. Fill liquid - NSF approved for use in drinking water applications.

c. Electronics Housing – Plastic (PBT) with conductive coating.

d. Mounting hardware – 316 Stainless Steel.

3. Ratings:

a. Enclosure – IP65

4. Electrical:

a. Transmitter excitation: 12 to 36 Volts DC.

b. Output: 4-20 mA D.C.

5. Options:

a. Provide integral LCD indicator with displayed value in process units.

b. Provide ½ - inch stainless steel impulse piping.

c. Provide local gauge and valves as shown on the Contract Drawings.

d. Provide minimum half inch process connection.

6. Manufacturer, Model series:

a. Wika Model UPT-20 with Model DI-PT-U display unit.

b. Approved equal.

C. Electromagnetic Flow Metering System (FIT-1016, -1026). The magnetic flow metering system shall comprise a flow through spool piece with sensing electrodes (Flow Element, FE) and an electronics unit (Flow Indicating Transmitter, FIT). The spool piece shall contain a coil energized by d.c. pulses from the electronics unit. The voltage induced in the process fluid shall be sensed by the electrodes and converted, by the electronics unit, into a derived flow signal.

1. System Performance:

   a. Systems shall be wet calibrated at the factory using NIST traceable equipment.

   b. Overall system accuracy shall be plus or minus 0.2 percent of rate between 1 and 30 feet per second.

   c. It shall be possible to verify system calibration in the field. Methods which require removal of the spool piece or a second flow measurement (i.e. another meter or known volume) will not be acceptable.

2. Transmitter:

   a. Mounted remotely from the sensor.

   b. Profibus output.

   c. Krohne model IFC 300, no equal.

3. Sensor:

   a. Built in conductivity sensor.

   b. NSF Approved.

   c. Liner – Hard Rubber.

   d. Electrodes – Stainless Steel.

   e. Housing – Polyurethane coated steel.

   f. Flanges – Carbon steel.

g. Virtual reference to eliminate the need for grounding rings.

h. Krohne Enviromag 2000, no equal.

4. Ratings:

a. Vault located spool piece – Rated for continual submergence to 10 feet. This shall include potting of the able between the spool piece and electronics unit.

b. Other spool pieces –NEMA 4X.

c. Electronics Unit – NEMA 4X

5. Electrical:

a. Power Requirement - 24 VDC.

6. Functional:

a. Programmable low flow cut-out

b. Empty pipe detection

c. Electronic unit display: minimum of 2 x 16 character, backlit LCD.

7. Options

a. Provide special tools and software necessary to effect field calibration

b. Provide certificate of factory calibration

D. Electromagnetic Flow Metering System (FIT-5554). The magnetic flow metering system shall comprise a flow through spool piece with sensing electrodes (Flow Element, FE) and an electronics unit (Flow Indicating Transmitter, FIT). The spool piece shall contain a coil energized by d.c. pulses from the electronics unit. The voltage induced in the process fluid shall be sensed by the electrodes and converted, by the electronics unit, into a derived flow signal.

1. System Performance:

a. Systems shall be wet calibrated at the factory using NIST traceable equipment.

b. Overall system accuracy shall be plus or minus 0.2 percent of rate between 1 and 30 feet per second.

c. It shall be possible to verify system calibration in the field. Methods which require removal of the spool piece or a second flow measurement (i.e. another meter or known volume) will not be acceptable.

2. Transmitter:

   a. Mounted remotely from the sensor.

   b. Profibus output.

   c. Krohne model IFC 300, no equal.

3. Sensor:

   a. NSF Approved.

   b. Liner – Rilsan polymer.

   c. Electrodes – Stainless Steel.

   d. Housing – Steel.

   e. Built in reference electrode to eliminate the need for grounding rings.

   f. Krohne Waterflux 3300, no equal.

4. Ratings:

   a. Vault located spool piece – Rated for continual submergence to 10 feet. This shall include potting of the able between the spool piece and electronics unit.

   b. Other spool pieces –NEMA 4X.

   c. Electronics Unit – NEMA 4X

5. Electrical:

   a. Power Requirement – 120 VAC.

6. Functional:

   a. Programmable low flow cut-out

   b. Empty pipe detection

c. Electronic unit display: minimum of 2 x 16 character, backlit LCD.

7. Options

a. Provide special tools and software necessary to effect field calibration

b. Provide certificate of factory calibration

E. Ultrasonic Level System (LIT-8101). The system shall consist of a sensor (Level Element, LE) that uses a non-contact ultrasonic measurement technique to measure the liquid level in a vessel, tank or basin, interconnecting cable, and electronics unit that produces an analog signal proportional to level (Level Indicating Transmitter, LIT) or, in the case of weir applications, flow (Flow Indicating Transmitter, FIT).

1. System Performance:

a. Overall system accuracy shall be plus or minus 0.25 percent of span or 0.24 inches, whichever is greater, automatically compensated for temperature.

b. The electronics unit shall contain preset algorithms containing the necessary factors to convert a weir level into a flow value.

c. The system shall be field calibratable without the use of external calibrators.

2. Sensor Materials:

a. Chemical tank locations – All Teflon.

b. Other locations – PVC and Teflon.

3. Ratings:

a. Electronics Unit – NEMA 4X.

4. Electrical:

a. Power Requirement - 120 VAC plus or minimum 10 percent, 60 Hertz.

b. Maximum Power Consumption – 10 Watts.

5. Functional:

a. Profibus output.

b. Provided with discrete input.

c. Span, output, linearization and digital output scaling shall be adjustable at the transmitter.

d. Echo status and loss indication shall be provided at the transmitter.

e. Electronic unit display: 16 character, backlit LCD.

6. Manufacturer, Model series:

a. Siemens, HydroRanger 200.

b. No equal.

F. Limit Switch (ZSH-5131, -5132, -5133). The limit switch shall detect the closed position of a hatch, door, check valve, etc. by means of an actuator. The actuator shall energize the switch while the door is closed.

1. General:

a. Actuator orientation: As required for application

b. Actuator mechanism: Adjustable lever roller.

c. Switch shall not be mounted on the moving portion of the door, hatch or valve.

2. Materials:

a. Normal applications: Phosphate coated zinc with Epoxy coating.

b. Corrosive locations: All 316 Stainless Steel including actuating lever.

3. Ratings:

a. NEMA 4X for normal applications.

b. NEMA 6 where potential submergence exists.

c. Use explosion proof switches with factory installed cable for all Class I rated locations.

4. Electrical:

a. Normally open and normally closed dry contacts

b. Dry contact rated to 10 Amps at 120 VAC

5. Options

a. Provide stainless steel supports/mounting and strike plates as required.

6. Manufacturer, model:

a. Honeywell, model HDLS or LSX as applicable

b. Approved equal.

G. Level Switch, Float (LSH-, LSL-3011). The level switch shall be a direct acting, weighted float suspended on its own cable. As the liquid level rises the float tilts and actuates a hermetically sealed switch inside the float. The cable shall be terminated within a junction box located outside the tank or basin. For multiple float applications, all cables shall terminate in a single junction box.

1. Materials:

a. Float wetted part – Polypropylene

b. Cable – PVC jacketed

c. Junction box – 316 SS

2. Ratings:

a. Junction box – NEMA 4X

b. NSF approved for potable water.

3. Electrical:

a. Dry contact rated to 4.5 Amps at 120 VAC

b. Normally open or normally closed as required for the application

4. Options

a. Provide stainless steel hanging bar. Attach the float cables to the bar using Kellum grips.

b. Provide other supports/mounting accessories as required.

5. Manufacturer, model:

a. Anchor Scientific, Roto-float type G

b. Approved equal.

H. Pressure Transmitter (PT-5131A,B, -5132A,B, -5133A,B, LIT-3011). The pressure transducer shall sense variations in pressure and produce a standard current output signal linear with gage pressure or, by inference, level.

1. Performance:

a. Built in temperature compensation.

b. Total accuracy of less than or equal to 0.25% of span.

2. Materials:

a. All 316 Stainless Steel construction.

b. Fill liquid - NSF approved for use in drinking water applications.

3. Ratings:

a. Enclosure – NEMA 4X.

4. Electrical:

a. Transmitter excitation: 11 to 30 Volts DC.

b. Output: 4-20 mA D.C.

5. Options:

a. Provide minimum half inch process connection.

b. Provide ½ - inch stainless steel impulse piping.

c. Provide local gauge and valves as shown on the Contract Drawings.

6. Manufacturer, Model series:

a. Wika Model F-20.

b. Approved equal.

I. Water Quality Analyzer (AIT-5552). The analysis system shall continuously measure the level of free chlorine and pH using two sensors, Analysis Elements

(AE), in a flow cell and the Analysis Indicating Transmitter (AIT). Automatic pH and temperature compensation shall be provided.

1. Type:
    a. The flow cell shall be equipped with an integral flow regulator to maintain a constant 33 l/hr sample flow.
    b. The flow cell shall be equipped with a pH sensor and membrane sensor for total chlorine residual.
    c. The sensor shall have an integral PT 1000 temperature monitor.
    d. The analyzer shall be provided with a loss of sample flow alarm.
    e. The analyzer shall be provided with a Profibus DP interface module for connection to the plant control system.
2. Performance:
    a. Chlorine residual range: 0-10 ppm (mg/L).
    b. pH Range: 4-10.
    c. The analyzer must operate for at least 30 days continuously without maintenance or calibration.
    d. Analyzers that require reagents or buffers shall not be acceptable.
    e. Two programmable alarm contacts.
3. Materials:
    a. Sensors: Suitable for application.
    b. Transmitter: ABS.
4. Ratings:
    a. Transmitter: NEMA 4X.
5. Electrical:
    a. 120 V AC, 60 Hz supply.
    b. Backlit LCD display.
6. Manufacturer:

a. Wallace & Tiernan Depolox 3 Plus with VariaSens flow cell.

b. No equal.

2.03 TEST EQUIPMENT AND SPECIAL TOOLS

A. Provide a hand held programmer suitable for calibrating the pressure transmitters.

2.04 SPARES AND EXPENDABLES

A. Provide the following spare parts:

1. One spare analysis sensor of each type used.

2. Ten percent spare fuses (minimum of 10) of each type and rating supplied.

B. Provide the following expendables:

1. One year’s (or shelf life worth if less than one year) supply of buffer and reagents used for analyzers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the PICS field instruments in strict accordance with the respective manufacturer’s instructions and recommendations, in locations as shown on the Drawings, and as indicated on the installation details of the Drawings.

B. Fully calibrate each instrument.

3.02 TRAINING

A. Two 8-hour days of on-site (field) training shall be conducted at the OWNER's plant site and shall provide detailed hands-on instruction to OWNER's personnel covering all supplied field instruments.

B. Training shall include:

1. Calibration procedures.

2. Preventive maintenance methods and timing.

3. Fault-finding techniques.

C. The training shall run at times chosen by the OWNER following installation and check-out of field instrumentation.

END OF SECTION

SECTION 40 95 20

PROCESS INSTRUMENTATION AND CONTROL SYSTEM (PICS)

SYSTEM HARDWARE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section defines work associated with the control system hardware to be furnished.

B. The SYSTEM SUPPLIER shall design, furnish and install all interior wiring within the control panels and furnish complete wiring diagrams showing the electrical circuits inside the panel and interconnections between the panel and the external instruments and components.

C. Size control panel(s) to adequately dissipate heat generated by equipment mounted inside or on the panel front face.

PART 2 PRODUCTS

2.01 CONTROL PANEL REQUIREMENTS

A. General:

1. All conduit entry shall be from the bottom only. The PCP shall be limited to maximum dimensions of 48 inches in width by 20 inches in depth by 84 inches in height.
2. The panel shall be provided with an isolated copper grounding bus to ground all signal shield connections.
3. The panel shall be equipped with an internal, hand-switch controlled, 40-watt fluorescent light and 120V, 15 amp, duplex utility receptacle. These shall be serviced through a dedicated breaker.
4. The panel shall be protected from internal corrosion by the use of corrosion – inhibiting vapor capsules. The vapor capsules shall be provided by the following:
   a. Northern Instruments Model Zerust VC-6-2
   b. Hoffman, model A-HC15E
   c. Approved equal.

5. All outdoor panels and enclosures containing electronic or electrical components shall be equipped with sunshields on both sides, the back and the top with a minimum separation of one inch and a maximum separation of one and one-half inches. Sun shields shall be 14 gauge Stainless Steel or 12 gauge Anodized Aluminum or thicker. Finish with reflective white, two part epoxy coating or reflective, white, polyester powder deposited coating.
6. All outdoor control panels and enclosures shall be equipped with 3 ½" stainless steel mounting uni-struts across the width of the back. For free-standing panels the struts shall be located half-way up the panel and six inches from the top. For other panels they shall be located 3" from the top and 3" from the bottom.
7. All discrete inputs entering the panel shall be wetted by 120 VAC. Provide isolation relays where necessary to accommodate this requirement.
8. All discrete output signals shall be equipped with interposing relays to electrically isolate them from the control system I/O.

B. Finish:

1. All front panel openings for panel-mounted equipment shall be cut with counter-boring and provided with trim strips as required to give a neat finished appearance.
2. All steel panel surfaces shall be treated with phosphatized treatment inside and out, and then finished on the exterior with two coats of baked enamel of the approved color. Interiors of panels shall be white, ANSI No. 51.

C. Doors:

1. Control panels shall have a continuous piano hinge door for ease of access. A minimum of 80% of the panel interior shall be exposed by doors.
2. The inside of each door shall be equipped with a print pocket.
3. Two-door enclosures shall have a removable center post.

D. Nameplates:

1. All front-face panel mounted controls and indicators shall be equipped with 10-year outdoor-rated adhesive laminated plastic nameplates to completely define their use. Provide Brady Type BBP31 or BBP33 as applicable or approved equal.
2. All internal components shall be equipped with identification tags.
3. All wiring shall be labeled.

E. Power Supplies.

1. An Uninterruptible Power Supply (UPS) shall be provided as follows:
2. Size the UPS for all internal equipment.
3. Provide 15 minutes battery back-up capability at full load.
4. Provide Eaton 9130 series, no equal.

F. Provide isolated 24 Volt DC power supplies as follows:

1. Redundant supplies with separately fused connections to power the PLC and miscellaneous field instruments as shown in the Contract Drawings.
2. A wetting supply for interposing relay contacts that provide discrete inputs to the PLC, separately fused for each input group. An additional, separately fused connection, from this supply shall also power the discrete output isolation relay coils.
3. A loop power supply for analog inputs, with each analog input separately fused.

G. Electrical:

1. Main circuit breaker and branch circuit breaker for each branch circuit as required to distribute power from the main power feed.
2. All breakers accessible when the panel door is open.
3. No more than 20 devices on any single circuit.
4. No more than 12 amps for any branch circuit.
5. Panel (or site) lighting, receptacles, heaters, controls, telemetry and fans on separate branch circuits.

H. Wiring:

1. Power wiring shall be 300 volt, type THWN stranded copper, No. 14 AWG size, for 120V service.

2. Discrete wiring shall be 300-volt type THWN stranded copper, sized for the current carried, but not smaller than No. 16 AWG.
3. Analog signal wiring shall be 300 volt, stranded copper in twisted shield pairs, no smaller than No. 16 AWG.
4. Panel wiring shall be routed within wire troughs or panduits.
5. Hinge wiring shall be secured at each end with the bend portion protected by a plastic sleeve.
6. Analog or dc wiring shall be separated from any ac power or control wiring by at least six inches.
7. Each wire shall be uniquely identified at all terminations using machine printed plastic sleeves.

I. Construction:
1. Minimum metal thickness: 14-gauge.
2. Stiffeners as required to prevent deflection under instrument loading and permit lifting without racking or distortion.
3. When required, removable lifting rings and fill plugs to replace rings after installation.
4. All components and terminals shall be accessible without removing other components except for covers.

J. The panel shall be a manufactured item, Hoffman Engineering, or equal.

2.02 PANEL DEVICES

A. Selector Switch. Units shall meet the following:
1. Heavy-duty, oil-tight, industrial type selector switches rated for NEMA 4 service.
2. Contacts rated for 120-volt ac service at 10 amperes continuous.
3. Number of positions and contact arrangements as required.
4. Factory-engraved legend plate indicating position definition.
5. Panel mounting accommodating panel thickness between 1/16 to ¼ inch.
6. Black knob type operator.
7. Square D Class 9001, Type K, Allen Bradley 800T Series or approved equal.

B. Pushbutton. Units shall meet the following:

1. Heavy-duty, oil-tight, industrial type push buttons rated for NEMA 4 service.
2. Contacts rated for 120-volt ac service at 10 amperes continuous.
3. Number of positions and contact arrangements as required.
4. Factory-engraved legend plate indicating function.
5. Panel mounting accommodating panel thickness between 1/16 to ¼ inch.
6. Operator: Red extended head for STOP, green flush head for START, black flush head for other functions.
7. Square D Class 9001, Type K; Allen-Bradley type 800T, or approved equal.

C. Indicating Light. Units shall meet the following:

1. Heavy-duty, oil-tight, push-to-test industrial type with integral transformer for 120V AC application.
2. Rated for NEMA 4 service.
3. Screwed on flat-faced lenses in colors shown on the drawings.
4. Factory-engraved legend plates.
5. Square D type K, Allen-Bradley Type 800T, or approved equal.

D. Control/Relays: All relays shall meet the following:

1. Compact, general-purpose, plug-in type.
2. Socket mounted.
3. Contacts rated for not less than 10 amperes at 120V.
4. Equipped with neon status lights and test buttons.
5. Permanent, legible identification.
6. Potter & Brumfield series KRPA or approved equal.

E. Time Delay Relay. Time delay relays shall meet the following:

1. Available functions: On delay, Off delay, or one shot.
2. Socket mounted.
3. Knob adjustment.
4. Contacts rated for not less than 10 amperes at 120V.
5. Timing range as appropriate for the application.
6. Magnecraft series W211 or approved equal.

2.03 CONTROL SYSTEM HARDWARE

A. The PLC shall comprise a single rack containing Siemens S7 series components. The use of other manufacturer's products will not be acceptable.

B. The rack shall comprise the following modules:

1. Power Supply Module. The power supply module shall convert 120 VAC power into the DC voltages necessary to power the rest of the rack. Siemens model PS 407 with battery option installed.
2. Central Processing Unit (CPU) Module. The CPU module shall contain the user program and be equipped with the battery back-up option to protect the program in the event of a power loss. It shall contain an integral Profibus DP connection configured as a master to support the main network with the OIT and Profibus hubs which in turn connect with selected plant equipment. The CPU shall also contain an Ethernet port to communicate with the future plant control system. Siemens model S7 414-2.
3. Input/Output Modules. Furnish I/O modules sufficient to accommodate the hard-wired signals shown on the Contract Drawings plus a minimum of 15% pre-wired spare signals of each type. Use the following modules:
    a. Analog Input Module. Sixteen, optically isolated analog input channels. Siemens model SM-431-0HH0.
    b. Analog Output Module. Eight, isolated analog output channels. Siemens model SM-432-1HF00.
    c. Four (4) Discrete Input Modules. Sixteen 120 VAC input channels. Siemens model SM-421-5EH00.
    d. Three (3) Discrete Output Modules. Eight 120 VAC, 5A rated isolated outputs. Siemens model SM-422-1FF00.

C. All PLC input/output modules shall be fully wired to field wiring termination blocks together with all required surge protection, etc. The initial live signals are listed on the instrumentation drawings. The remaining signals shall be spare for future use. All spare signals shall be equipped with surge protection devices.

D. The Operator Interface Terminal (OIT) shall be a Simatic 10.4" touch screen. Siemens model MP 277.

E. Mixed Media Ethernet Switch. Provide an Ethernet switch with a minimum of two full duplex 100 Base FX ports and four 100 Base TX ports. Ntron model 106FX2 or approved equal.

F. Media Converter. Provide a stand alone RS-485 to fiber media converter connected to the Profibus network for the future fiber connection to the remote I/O drops. Siemens model OLM, no equal.

G. FPP shall comprise one or more housings with sufficient quantities of ST compatible adaptor panels to accommodate all fibers terminating within the FPP. This requirement includes all dark fibers.

H. The housing shall be equipped with strain relief for the cables and shall have a lockable access door.

I. Provide Corning SPH-01P housing with CCH-CP12-15T connector panels or approved equal

2.04 GENERATOR INTERFACE PANEL.

A. The Generator Interface Panel shall be furnished for installation adjacent to the fuel tank monitoring panel. It shall convert the following from hard-wired inputs to Profibus for connection to the PICS:

1. Fuel leak status from the fuel tank monitoring panel.
2. Fuel tank level from the fuel tank monitoring panel.
3. Generator run and fault status from the generator control panel.

B. The panel shall be a NEMA 4X stainless steel enclosure with aluminum sun-shields on top and both sides.

C. Field wiring shall be converted to Profibus within the panel using the following components:

Qty	Part #	Manufacturer	Description
2	6ES7131-4BD00-0AA0	Siemens	Electronic module, 4DI, DC 24V, standard
1	6ES7134-4GB00-0AB0	Siemens	Electronic module, 2AI, I, standard, for 2-wire-MU
1	6ES7138-4CA00-0AA0	Siemens	PM-E DC 24V power module for electronic modules
1	6ES7151-1AA03-0AB0	Siemens	IM 151-1 connecting the ET200S to PROFIBUS DP
5	6ES7193-4CA40-0AA0	Siemens	Universal terminal module; screw connection
1	6ES7193-4CD20-0AA0	Siemens	Terminal module for AUX1 supply; screw connect.

1	PA9D01-42	Molex	Profibus fast connect RS485 connector 90 Deg.
1	DLAW-06D3	Citel	Surge Protection for Profibus
2	1061200000	Weidmuller	End Bracket
1	6ES7972-0DA00-0AA0	Siemens	Active Profibus Terminator Resistor
1	Standard DIN Rail Standard DIN Rail for mounting the ET200S		

2.05 SPARES AND EXPENDABLES

A. Provide the following spare parts:

1. One of each PLC module including the CPU.
2. One spare DC power supply of each type provided.
3. Five (5) spare relays of each type provided.
4. Five (5) spare surge protection device of each type provided.

B. Provide the following expendables:

1. Twenty Five (25) corrosion inhibitor capsules
2. Ten (10) spare fuses of each type and rating supplied.
3. Ten (10) spare indicator light bulbs of each type and color supplied.

PART 3 EXECUTION

3.01 TRAINING

A. Hardware Maintenance: Provide a minimum of two days of hardware training for up to three of the OWNER's personnel in the maintenance of the PLC hardware which shall include:

1. Training in standard hardware maintenance for the equipment provided.
2. Specific training for the actual hardware configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up.
3. Test, adjustment, and calibration procedures.
4. Troubleshooting and diagnosis.
5. Component removal and replacement.
6. Periodic maintenance.

END OF SECTION

SECTION 41 22 30

HAND-OPERATED HOISTS AND TROLLEYS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials and installation of hand-operated hoists, consisting of chain-operated hoist, chain-operated trolley, and trolley track.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions.

B. Submit manufacturer's catalog data and dimensional drawings for hoists and trolleys. Show materials of construction. Show coatings.

C. Show required trolley track size.

PART 2 MATERIALS

2.01 STANDARDS, SPECIFICATIONS, AND CODES

Design and construction of hand-operated hoists and trolleys shall comply with ANSI B30.16 and ANSI HST-2-1999 (reaffirmed 2004).

2.02 MANUFACTURERS

Hoists and trolleys shall be manufactured by Lift-Tech International, Eaton Corporation, or equal.

2.03 SUSPENSION FRAME AND GEAR CASE

A. Hoist frame and gear case shall be aluminum or steel. Gear case shall be enclosed in a sealed housing and lubricated with a pressure-type lubricant. Trolley sideplates shall be steel.

B. Wheel flanges on one side of the trolley shall be geared and meshed with a pinion driven by a handwheel and hand chain.

2.04 GEAR TRAIN

Gear train shall consist of heat-treated steel gears arranged so that gear teeth on each side of the load gear carry the load. Pinion shafts shall be steel, heat treated, and

ground. Support gearings between antifriction bearings with no overhung gears. Connections between gears and shafts shall be by means of splines.

2.05 LOAD WHEELS

Load wheels for both hoist and trolley shall be heat-treated steel castings. Trolley wheels shall have sealed or integral ball bearings.

2.06 LOAD BRAKE

Load brake shall comply with ASME B30.16 and the following. The load brake shall be of the Weston self-adjusting type. Brake flange shall be steel, machined and heat treated with ACME ground thread. Ratchet wheel shall be heat-treated steel, ground and finished, and shall operate on an antifriction bearing.

2.07 HOIST CHAIN AND HAND CHAIN

Provide separate hoist and trolley drive chains. Hoist and drive chains shall be Type 316 stainless steel.

2.08 LOAD HOOKS

Hooks and hook sleeves shall be forged steel, full swiveling. Provide hook latch.

2.09 CHAIN CONTAINER

Provide receptacle to receive the slack load chain as it reeves over the load sheave.

2.10 OVERLOAD PROTECTION DEVICE

Provide a roller-detent or friction-type overload device built into the hand chain wheel to prevent the hoist from lifting loads greater than the rated capacity of the hoist. Load shall be under control of the load brake at all times.

2.11 TRACK CLAMPS

Provide track clamps with steel jaws grooved to bite and hold firmly to the flange of the runway beam. Actuation of jaws shall be by means of a hand chain, separate from the load chain and drive chain.

2.12 TROLLEY TRACK

Provide trolley track or beam, ASTM A36, sized for the required trolley (refer to Drawings S-1 and S-2 for minimum beam size requirements).

PART 3 EXECUTION

3.01 SERVICE CONDITIONS

A. Performance conditions and design data shall be as shown below.

Equipment Capacity:	2 tons
Equipment Location:	Indoors
Environmental Conditions:	25-100 °F
Type of Trolley:	Separate or Integral Acceptable

3.02 PAINTING AND COATING

Coat steel portions of trolley per Section 09 90 00. Do not coat stainless steel, bronze, and aluminum parts. Apply prime coat at factory. Color of finish coat shall be OSHA Safety Yellow.

3.03 INSTALLATION

Install per ANSI/HST-2-1999, Section 4.

3.04 FIELD TESTING

Attach a load equal in weight to the specified capacity. Raise and lower weight three times. Move the trolley three times through a full travel over the trolley track. Hoist and trolley shall operate without binding or sticking. Chain shall fall into the chain container without becoming tangled. Track clamps shall provide a firm, rigid support. Load brake shall function without showing any drift or vertical movement of the chain and load when set.

END OF SECTION

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SECTION 43 21 10

HORIZONTAL END SUCTION CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of horizontal end suction, single-stage, flexible-coupled centrifugal pumps for water service.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit dimensional drawings.

C. Submit manufacturer's catalog data and detail drawings showing all pump parts and describe by material of construction specification (such as AISI, ASTM, SAE, or CDA) and grade or type. Show linings and coatings. Identify each pump by tag number to which the catalog data and detail sheets pertain.

D. Submit pump curves from manufacturer's catalog data on which the specified operating points are marked. Show efficiency and brake horsepower for the selected pump curve. Show NPSH required.

E. Submit manufacturer's reports on hydrostatic tests and performance tests.

F. Submit manufacturer's sample form for reporting the performance test results at least two weeks before the tests. The test form should contain the data presented in the sample form in Section 6 of the ASME PTC 8.2 or ANSI/HI 1.6.

G. Submit manufacturer's certified performance curves for review at least two weeks prior to shipping the units from the factory. Show flow, pump total head, brake horsepower, pump efficiency. Provide copies of the data recorded during the test and methods of data reduction for determining certified test results.

1.03 DEFINITIONS

Terms shall be as defined in the Hydraulics Institute Standards ANSI/HI 1.1-1.2 for horizontal pumps.

1.04 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

A. One labor day for each service listed in the subsection on "Service Conditions" to check the installation and advise during start-up, testing, and adjustment of the equipment.

B. One labor day to instruct the Owner's personnel in the operation and maintenance of the equipment.

PART 2 MATERIALS

2.01 PUMP DESIGN

A. The pump manufacturer shall provide equipment for the pumps, including motors and baseplates, as a complete unit.

B. Pumps shall be horizontal, end suction, single stage. Pumps and motors shall be flexible coupled.

C. The design pressure of the casing, including the stuffing box and gland, shall be at least as great as the pressure-temperature rating of ASME B16.1, Class 125 flanges. Design casing and cover to withstand a hydrostatic test pressure of 150% of the maximum design pressure for the pump or 125% of the shutoff head whichever is greater.

D. Each pump shall be capable of at least a 10% head increase at normal operating conditions by installing a larger impeller or an impeller of different hydraulic design.

E. Pump curve shall be continuously rising and shall be free of dips and valleys from the design point to the shutoff head. The shutoff head shall be at least 110% of the head that occurs at the design point.

F. The NPSH required shall be at least 10 feet less than the minimum NPSH available at the design point and less than the NPSH available at all other points on the pump curve up to 120% of the flow at the BEP.

G. Design the pumps and its components to operate continuously over a preferred operating range (POR, as defined in ANSI/HI 9.6.3-1997) of 70% to 120% of the flow at the BEP.

2.02 SUCTION AND DISCHARGE CONNECTIONS

A. Suction and discharge connections smaller than 2 inches shall be threaded, ASME B1.20.1; or flanged Class 125, ASME B16.1.

B. Suction and discharge connections 2 inches and larger shall be flanged, ASME B16.1, Class 125 or Class 250, as shown in the subsection on "Service Conditions."

C. Flanges shall be flat faced. Bolt holes shall straddle the horizontal and vertical centerlines.

2.03 CASING

A. The casing halves shall be flanged, bolted, and doweled together. Provide machined surfaces where the casings mate. The design shall permit removal of the rotating elements from the back of the casing without disturbing the suction and discharge connections. The internal wall of the casing halves shall match with not more than 1/16-inch overhang or underhang between the two casing halves. Support the pump by feet at two points: beneath the rear bracket and beneath the front bracket or casing.

B. Provide threaded (ASME B1.20.1) drain connections in the bottom of the casing. Provide threaded (ASME B1.20.1) vent connections in the top of the casing if the discharge is on the side of the casing. Provide plugs in the connections. Minimum connection or outlet size shall be 1/2 inch.

C. Casing, cover, and gland shall have a corrosion allowance of at least 1/8 inch.

2.04 IMPELLERS AND SLEEVES

Impellers shall be of the fully open design. Statically and dynamically balance the impellers. Provide shaft and sleeve design such that the sleeves tighten with the rotation of the shaft. Provide Teflon or neoprene gaskets between impeller hub and shaft sleeves.

2.05 SHAFT

A. Tolerance on the shaft diameter, with shaft rotated on centers, shall not exceed 0.002-inch TIR. Shaft runout at the seal chamber face and at the impeller shall not exceed 0.002-inch full indication movement. The shaft stiffness shall limit the total deflection under the most severe dynamic conditions over the allowable operating range of the pump, with the maximum impeller diameter installed, to 0.002 inch at the primary seal faces or at the stuffing box faces.

B. The first lateral critical speed of the rotating assembly shall be at least 120% of the maximum pump operating speed.

C. Machine and finish shafts and sleeves so that the surface finish of the shafts or sleeves through the stuffing box and at the rubbing contact-bearing housing seals shall not exceed a roughness of 32-microinch TIR.

2.06 SEAL CHAMBER OR STUFFING BOX

A. The design of the seal chamber shall provide space and clearance for the packaging, and for the seals as described in the Services Conditions (Part 3.A), herein.

B. The type of packing or seal shall be as shown in the subsection on "Service Conditions."

2.07 GLAND

Design pumps to accept glands having four bolts. Gland shall be:

A. Four-bolt for conventional packing.

B. Four-bolt for mechanical seals.

2.08 BEARINGS

A. Provide two labyrinth-style antifriction-bearing assemblies for flexible-coupled pumps. Do not use lip-seal type. One assembly shall be free to float within the frame to carry radial thrust only. Design the other assembly to carry both radial and axial thrust. Provide one bearing assembly within the motor frame for close-coupled pumps. Bearings subject to radial thrust only shall be single row. Bearings subject to both radial and axial thrust shall be single row. Bearing life shall be a minimum of 100,000 hours per the AFBMA L-10 rating.

B. Bearings shall be grease lubricated as shown in the subsection on "Service Conditions." Bearing housings shall have register fits and shall be bolted to the pump casing. Provide constant level oiler when oil lubrication is used.

2.09 VIBRATION AND RESIDUAL UNBALANCE

A. The maximum vibration levels shall not exceed those shown in Figure 9.6.4.12 in ANSI/HI 9.6.4. Maximum residual unbalance in rotors shall not exceed that shown in Figure 9.6.4.15B in ANSI/HI 9.6.4.

B. Provide two-plane balancing for impellers in which the D/b ratio (per API 610, tenth edition, Figure 30) is 6.0 or greater.

2.010 MATERIALS OF CONSTRUCTION

A. Materials of construction shall be as listed below.

Component	Material	Specification
Casing	Cast Iron	Class 35
Impeller	Stainless Steel	AISI Type 316
Impeller Nuts	Stainless Steel	AISI Type 316
Shaft		
	Stainless steel	ASTM A582 Type 416
Shaft sleeve (for pumps having steel shafts)	Stainless steel	AISI 420 or 440C or 316 stainless steel (450 Brinell hardness)
Shaft sleeve (for pumps having stainless-steel shafts)	Stainless steel	AISI Type 316
Lantern ring	Bronze	See paragraph 2 below

B. Bronze components shall have the following chemical characteristics:

Constituent	Content
Zinc	7% maximum
Aluminum	2% maximum
Lead	0% maximum
Copper + Nickel + Silicon	83% minimum

All bronze and other wetted materials shall be lead free as defined by Section 1417 of the 2011 Safe Drinking Water Act

2.011 COUPLINGS AND COUPLING GUARDS FOR FLEXIBLE COUPLED PUMPS

A. Flexible couplings shall be heavy duty Falk Corporation “Steel Flex” nonspacer T-type couplings, sized in accordance with the manufacturer’s recommendations. The spacer shall permit the removal of the coupling, bearings, seal, and rotor without disturbing the driver or the suction and discharge piping. Couplings shall be keyed in place. Couplings shall meet the requirements of API 610 (tenth edition), Section 6.2. A service factor of at least 1.5 shall be used in selecting couplings, based on the manufacturer’s ratings.

B. Spacer-type elastomeric flexible coupling may be provided for pumps 25 horsepower and smaller. The spacer length shall permit the removal of the coupling halves from the pump and driver shafts and the impeller/rotor and bearing frame as an assembly without moving the pump casing, piping, or driver. Provide carbon steel hubs. Provide weather-resistant cover. Coupling-to-shaft fits shall be Class I clearance fits as defined in AGMA 9002. Service factor shall be at least 1.25 times the nameplate rating of the driver. Couplings shall be Falk, Fasts, or equal.

C. Provide coupling guards conforming to OSHA requirements.

2.012 BASEPLATE

Provide fabricated steel baseplate.

2.013 SPARE PARTS

A. Provide the following spare parts for each model of pump:

Quantity	Description
2	Sets packing (for pumps specified to have packing)
1	Lantern ring (for pumps specified to have packing)
2	Mechanical seal (for pumps specified to have mechanical seals)
1	Radial bearings (complete set)
1	Thrust bearings (complete set)
1	Set of gaskets and O-rings

B. Pack spare parts in a wooden box; label with the manufacturer's name, local representative's name, address, and telephone number; and attach list of materials contained within.

PART 3 EXECUTION

3.01 SERVICE CONDITIONS

1. Pump hydraulic performance conditions and design data shall be as shown below.

Pump Tag Numbers: HSP No. 1

Location	HSP Building
Service	Indoors, ventilated, not airconditioned, environmental temperature range of 20°F to 100°F
Elevation	Approximately 13.5 feet above mean sea level
Relative humidity	35% to 95%
Fluid temperature range	50°F to 90°F

Pump Data

Capacity (gpm)	Pump Total Head (feet)	Minimum Pump Efficiency (%)
200	200	55%
300 *	173	60%
325	160	59%
*Design point.		

Maximum pump speed	3600 rpm
Minimum NPSH available	27.4 feet
Maximum NPSH required at run-out	15 feet or less
Motor and pump coupling type	Falk Steelflex
Motor horsepower (minimum)	30
Motor type (4AEHMTV)	Per Section 26 26 50
Variable speed drive required per Section 26 29 23	YES
Type of packing or seals	Stainless steel with EPDM elastomers Seals shall be cartridge type; John Crane or Chesterton
Suction flange rating	Class 125
Discharge flange rating	Class 125
Bearing lubrication	Grease

Manufacturers	Peerless 2x3-10G MTP 8196, Goulds 3196 MTi 2x310, Flowserve D814-3x2x8F

2. Pump Tag Numbers: HSP No. 2 and HSP No. 3

Location	HSP Building
Service	Indoors, ventilated, not air conditioned, environmental temperature range of 20°F to 100°F
Elevation	Approximately 13.5 feet above mean sea level
Relative humidity	35% to 95%
Fluid temperature range	50°F to 90°F

Pump Data

Capacity (gpm)	Pump Total Head (feet)	Minimum Pump Efficiency (%)
300	180	40%
750 *	174	60%
800	150	52%
*Design point.		

Maximum pump speed	1800 rpm
Minimum NPSH available	27.4 feet

Maximum NPSH required at run-out	27 feet or less
Motor and pump coupling type	Falk Steelflex
Motor horsepower (minimum)	75
Motor type (4AEHMTV)	Per Section 26 26 50
Variable speed drive required per Section 26 29 23	YES
Type of packing or seal	Stainless steel with EPDM
Suction flange rating	Class 125
Discharge flange rating	Class 125
Bearing lubrication	Oil
Manufacturers	Peerless 3x4-8G MTP 8196, Goulds 3196 LTi 3x4-13, Flowserve 3K6x4-16RV

3.02 FACTORY PERFORMANCE TESTING

A. Each pumping unit shall be subjected to a nonwitnessed laboratory performance test. Conduct tests in accordance with the ASME PTC 8.2 or ANSI/HI 1.6, using the actual job driver or a calibrated test motor. The performance test shall be equivalent to Level “A” per ANSI/HI 1.6.

B. No motor overload along the entire published performance curve will be allowed at any flow.

C. Deviations and fluctuations of test readings shall conform to ASME PTC 8.2, 1.11 (Type A), or ANSI/HI 1.6, paragraph 1.6.5.4.2.

D. Measure flow by the “Capacity Measurement by Weight,” the “Capacity Measurement by Volume,” or the “Capacity Measurement by Venturi Meter, Nozzle, or Thin Plate Orifice” methods in ASME PTC 8.2 or ANSI/HI 1.6.

E. For pumps in variable speed service, factory tests at hertz ratings less than 100% rating shall not be required, however manufacturer shall plot VFD curves from the full speed test curves using the affinity laws.

F. Perform tests and record data, including head, flow rate, speed, and power, at a minimum of seven points. These points shall include shutoff, minimum flow, midway between minimum flow and design flow, design flow, 120% of design flow, and maximum flow.

G. Perform a hydrostatic test on pump pressure-containing components per ANSI/HI 1.6, paragraph 16.4.

3.03 PAINTING AND COATING

A. Coat exterior of pump, frame, motor and baseplate per Section 099000. Apply the specified prime coat at the place of manufacture. Apply intermediate and finish coats in field. Color of finish coat shall match the color of the connecting piping.

B. Line and coat volute and interior wetted surfaces, volute exterior, with fusion-bonded epoxy per Section 09 97 61 meeting NSF 61. Do not coat wear rings. Apply coating in factory.

3.04 SHIPMENT AND STORAGE

A. Prepare equipment for shipment including blocking of the rotor when necessary. Identify blocked rotors by means of corrosion-resistant tags attached with stainless steel wire. The preparation shall make the equipment suitable for six months of outdoor storage from the time of shipment, with no disassembly required before operation, except for inspection of bearings and seals.

B. Identify the equipment with item and serial numbers and project equipment tag numbers. Material shipped separately shall be identified with securely affixed, corrosion-resistant metal tags indicating the item and serial number and project equipment tag numbers of the equipment for which it is intended. In addition, ship crated equipment with duplicate packing lists, one inside and one on the outside of the shipping container.

C. Pack and ship one copy of the manufacturer’s standard installation instructions with the equipment. Provide the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the jobsite and before start-up.

D. Store and protect pumps per API 686 (first edition), Chapter 3, paragraphs 1.4 through 1.9, 1.15, 1.16, 1.20, and 1.21 and as described below.

E. Coat exterior machined surfaces with a rust preventative.

F. The interior of the equipment shall be clean and free from scale, welding spatter, and foreign objects.

G. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Provide closures at the place of pump manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures.

H. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Provide caps or plugs at the place of pump manufacture prior to shipping.

I. Clearly identify lifting points and lifting lugs on the equipment or equipment package. Identify the recommended lifting arrangement on boxed equipment.

J. Wrap exposed shafts and shaft couplings with waterproof, moldable waxed cloth or volatile-corrosion-inhibitor paper. Seal the seams with oil-proof adhesive tape.

K. If electric motors are stored or installed outside or in areas subject to temperatures below 40°F or are exposed to the weather prior to permanent installation, provide the manufacturer’s recommended procedures for extended storage. Provide temporary covers over the motor electrical components. Provide temporary conduits, wiring, and electrical supply to space heaters. Inspect electrical contacts before start-up.

3.05 PUMP INSTALLATION

A. Provide the manufacturer's recommended lubricants in the pumps, bearings, and other mechanical equipment.

B. Verify that the installed pump is fully self-supporting before bolting pipe flanges, so that no strain is imparted on the flanges, pipes, or pipe supports from the pump assembly. Adjust the position of the pump assembly so that the pump flanges are plumb and aligned with the adjacent pipe flanges. Do not use temporary shims or jacking nuts for leveling, aligning, or supporting equipment.

C. Provide continuous protection of the equipment from the elements, dust, debris, paint spatter, or other conditions that will adversely affect the unit's operation until such time as the equipment is scheduled for start-up testing.

3.06 FIELD TESTING

A. Bump motor to ensure that motor has been connected for proper rotation.

B. Perform field tests for 24 consecutive hours on each pump. Measure flows at the head points shown in the service conditions for each pump.

C. If the measured flows at the above tabulated pump heads are more than 5% below the flows obtained on the laboratory or factory test, adjust the impellers or provide new impellers or otherwise repair or replace the pumps or calibrate meters or pressure gauges.

D. Conduct vibration-level tests with pumps operating at their rated capacity. Adjust or replace pumps that exceed the maximum vibration levels.

E. Operate each pump one at a time. Manually adjust the speed for each pump (one at a time) via the respective speed control starting at 100% and dropping down incrementally until shutoff is demonstrated and then back up in 10% increments in order to demonstrate flow range capability. The duration at each flow rate shall be at least 10 minutes.

F. Assure that in the automatic mode each pump responds to its flow or pressure signal. Assure that each pump operates at a steady rate (±5% of set point) at any given flow or pressure for each increment of the maximum capacity specified.

G. Assure that limit switches on the pumps' check valves indicate and transmit the signals for the valves in the open and closed positions.

H. Demonstrate that the pumping units, motors, and control system meet the following requirements:

   a. The pumping units operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.

   b. Automatic and manual controls function in accordance with the specified requirements.

   c. A drive equipment operates without being overloaded.

I. Certification-Provide a written certification from the pump supplier that the pump components have been properly installed according to the drawings, specifications and manufacturer’s specifications, and that the equipment is operating normally.

Make all necessary corrections and adjustments including but not limited to labor, parts or freight at no additional cost to the Owner.

J. Pump supplier shall provide laser alignment of the pump and motor. Two (2) trips, one (1) for preliminary alignment and one (1) for final alignment shall be conducted at no additional cost to the Owner.

END OF SECTION

SECTION 43 32 80

CHEMICAL METERING PUMPS AND SKID SYSTEMS

PART 1 GENERAL

1.01 SUMMARY:

This section includes fabrication, materials, testing, and installation of packaged, skid mounted chemical feed systems suitable for application of the following chemical applications:

A. Post-Chlorination (12.5% Sodium Hypochlorite) – One (1) Duplex Skid

(1) Two (2) Grundfos chemical feed pumps (Two (2) per skid): DMH 35-10 11.0 GPH at 145 PSI.

(2) Pulsation Dampener, one per pump

(3) Pressure Relief Valves, one per pump

(4) Diaphragm Protected Gauges, one per pump

(5) Back Pressure Valves, one per pump

(6) Calibration Column sized for pump capacities, one per skid

(7) Polypropylene skid with built-in leak containment.

(8) Electrical power and control wiring and conduit Junction Box with terminal strip.

1.02 WORK SPECIFIED HEREIN

A. Equipment

(1) Chemical Metering Skids and Accessories

(2) Chemical Metering Pumps and Pump Controls

(3) Spare Parts

1.03 EXECUTION

A. Testing

B. Installation

C. Documentation

D. Services

1.04 SERVICE CONDITIONS

A. Chemical name: Sodium Hypochlorite (NaClO)

(1) Concentration: 12.5 Trade Percent

(2) Specific Gravity: 1.159 to 1.169

(3) Maximum Temperature: Ambient

1.05 QUALITY ASSURANCE

A. For purpose of establishing quality assurance, experience, and system reliability, products described herein are based on metering pumps and a complete skid-mounted system**.** All pumps and components shall be pre-assembled onto a skid-mounted system for each chemical and shop-tested for capacity and pressure prior to shipment with documented results provided.

B. Products of this section shall be provided by a single supplier, who shall demonstrate previous experience in manufacture of skid-mounted chemical metering systems. Manufacturer must have a service center with trained direct company employed technicians authorized to make repairs to all components of the chemical feed system located within the State of Florida. The supplier shall be responsible for providing all equipment, accessories, spare parts, documentation and installation supervision required for a complete and operational chemical feed system.

C. Pump skids shall be a regularly marketed product of the manufacturer who must have a physical plant, technical and design staff, and production personnel to complete the work as specified. Systems assembled by second party fabricators, integrators, equipment-distributors/representatives, contractors or manufacturers not normally engaged in chemical metering skid design and manufacturing shall not be acceptable.

D. Chemical feed equipment shall be the product of a pump manufacturer who has designed and manufactured similar skid mounted feed systems and equipment, and has a record of ten years or more of successful operation of such equipment in the field. Manufacturer of the chemical feed pumps and skid systems shall be ISO 9001 certified.

E. Manufacturer shall supply up to fifteen (15) separate references with contact names

and phone numbers, where substantially similar installations for the equipment as specified has been in satisfactory operation for a minimum of two (2) years.

F. Manufacturer shall have a proven track record of aftermarket sales and service support on its equipment.

1.06 WARRANTY

A. Chemical metering pump manufacturer shall provide a two-year warranty on the metering pump mechanical drive and a one-year warranty on the liquid end, pump accessories, and the skid-mounted system.

B. This warranty shall be in addition to and not in lieu of any warranties provided by the manufacturer of the equipment itself.

C. System manufacturer shall pass through any warranties from equipment suppliers for pumps, controllers, and other system components manufactured by others.

1.07 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit a list of successful installations of similar packaged chemical feed systems. Submit the names of at least five references for similar chemical feed systems operating in the State of Florida.

C. Submit data for packaged chemical feed skid as a single complete package for pumps, motors, piping, skid, valves, power, and controls.

D. Submit dimensional drawings for all equipment and packaged systems. Show overall metering pump skid dimensions in plan and section. Submit installation and arrangement drawings showing dimensions for pump, piping, supports and equipment layout on the fabricated skid. Include plans and sections of skids as required to show orientation of each component. Submit a drawing or schematic of skid and how pumps can be individually calibrated while remaining in operation.

E. Submit materials of construction by ASTM reference and grade. Show sizes of members. Show welding, bolting or other assembly arrangements.

F. Submit electrical wiring diagrams showing wiring and conduit, controls, interlocks, terminals and power disconnects. Show number and sizes of power and control

wiring. Label each terminal showing which control or electrical power wire connects to each terminal.

G. Submit operations and maintenance manuals in accordance with Section 01 33 00. Manual to include but not limited to contact information, spare parts list, O&M procedure for operation of skid and calibration sequence for each pump while maintaining continuous operation.

H. Submit manufacturer's catalog data and detail drawings showing metering pump and associated speed reducer parts and describe by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show stroke speed at the specified flow. Show pump operating capacity and discharge pressure limits at manufacturer’s recommended minimum and maximum operating conditions and at design conditions. Show linings and coatings.

I. For Sodium Hypochlorite feed systems, submit calculations supporting sizing of pulsation dampeners.

J. Submit a schedule and written procedure for the demolition of existing sodium hypochlorite chemical metering system. Submit schedule and written procedure to the Owner and Engineer at least 30 calendar days prior to performing demolition work. Owner and Engineer shall review the Contractor’s submittal and work with the Contractor to finalize the schedule and procedure at least 7 calendar days before the demolition work begins.

K. Factory test reporting templates. Results of factory testing using the accepted templates.

L. At least 30 calendar days prior to factory testing, provide the Owner with written notification stating the schedule of the factory test so that the owner can plan in advance to witness the testing.

M. Chemical compatibility charts for materials of wetted components including piping, fittings, valve bodies, gaskets, rings and seals to substantiate material selection for the associated chemicals.

N. Affidavit of compliance with ANSI/NSF standard 61 for products and materials on the chemical feed skids that directly contact the liquid chemical. Alternatively,

submit affidavit of compliance with F.A.C.62-555.320(3)(b) for products and materials on the pump skid that directly contact the liquid chemical.

1.08 MANUFACTURER AND SYSTEM RESPONSIBILITY

A. Contractor shall assign the design and fabrication of the packaged skids to a single system manufacturer who will be responsible for coordinating and integrating the scope of work with the instrumentation and control system integrator. The packaged skids shall be integrated with the plant wide instrumentation and control system.

B. Packaged skids system manufacturer shall assemble each complete system on a single fabricated skid or base and shall factory test each skid as a complete system, including pumps, piping and valves.

C. Packaged skids manufacturer shall determine and verify quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and the

D. Packaged chemical system manufacturer shall review and coordinate each submittal with the requirements of the contract documents.

E. Packaged skids manufacturer shall have factory trained and certified personnel residing in the State of Florida.

1.09 MANUFACTURER'S SERVICES

Provide chemical metering pump system supplier's services at the jobsite for the minimum labor days listed below, travel time excluded:

A. Two labor days for each packaged skid to check the installation and advise during start-up, testing, and adjustment of the equipment.

B. One labor day for each packaged skid to instruct the Owner's personnel in the operation and maintenance of the equipment.

PART 2 MATERIALS

2.01 MANUFACTURERS,

A. Chemical metering shall be completely self-contained and designed to safely feed metered amounts of all chemicals as listed under **Section 1.04** Service Conditions. Chemical metering skid shall include diaphragm chemical metering pumps, accessories, controls and option characteristics as indicated in **Table #1.**

The chemical metering skids will be completely assembled and tested under simulated field conditions using water prior to delivery to the job site.

TABLE #1: Chemical Metering Skid Characteristics

Skid Number (Chemical - WTP # - Skid #)	**CL-01-01**
Application	Post Chlorine
Chemical	12.5% Sodium Hypochlorite
Location	Chemical Feed Room
Number of Pumps	Two (2) (Duplex Skid)
Type of Pump	Mechanically Actuated Diaphragm
Manufacture/Model	Grundfos/DMH 35-10
Control	Manual & Analog
Pump Capacity	11 gph
Power	115-230 V 1 Phase 50/60 Hz
Piping Pressure	150 psi
Liquid End Mtls	PVDF/PTFE/Cer
Piping Material	½" Sch 80 PVC/Viton Seals
Type Valves	Type 21 vented Ball Valves

B. Provide services of one (1) of the following chemical metering pump system integrator/suppliers:

(1) Guardian Equipment Inc. – Sanford, FL

(2) Blue Planet Environmental Systems, Inc. – Melbourne, FL

(3) or Approved Equal

C. Packaged skid system suppliers shall be responsible for providing and installing the packaged skids. Packaged skids shall include the new metering pump skids, metering pumps, piping, fittings, valves, pulsation dampeners, pressure gauge assemblies, supports, and the associated local controls located within the pump skids as shown on the respective drawings. Packaged skid supplier shall be responsible for coordinating the design and construction of the control panel with the instrumentation and control integrator such that complete functionality is obtained.

A. Wetted Parts

Wetted parts, components or materials of construction that will be in direct contact with chemicals shall meet NSF International Standard 61 or F.A.C. 62-555.320(3)(b).

B. Metering Pump Skids – General Requirements

A. Design the skid or base to fit within the designated area shown on the drawings.

B. Chemical metering pump skids shall be self-supporting and constructed of ½" PVC (or polypropylene). The design of the skid shall include gussets and supports as required for all components and shall be self-supporting.

C. All components of the chemical metering system shall be contained within the skid.

D. Provide the skid or base with four lifting lugs, one at each corner, designed to lift the weight of the complete skid or base with all equipment attached to it. As an alternate skid base shall have fork-lift cut-outs for fork-lift or lifting straps.

E. Each skid shall incorporate spill containment and shall have a sloped floor to a ½" fpt drain connection with valve for complete evacuation of containment. The skids shall be manufactured using continuous welding technology; bolted construction is not acceptable.

F. Non-metallic pedestals shall be provided to elevate the pumps, motors, and electric actuators above the skid containment base. The pedestals shall be bolted to the skid base with non-metallic bolts to allow for future pump/piping modifications.

G. For each chemical metering pump the piping system shall include (1) pressure relief valve; (1) pulsation dampener; (1) diaphragm protected pressure gauge; (1) back-pressure/anti-siphon valve; (1) flushing inlet; (1) flushing outlet and all

required piping, valves and supports. Piping shall include isolation valves and unions for all serviceable components. Chemical supply piping shall feature a y-strainer. CONTRACTOR shall coordinate inlet and outlet piping with manufacturer prior to skid assembly.

H. Provide a design such that each pump is individually bolted to a baseplate. A single common baseplate, or individual pump baseplates, may be provided, but each pump shall be individually bolted so that each pump is removable.

I. Each pump shall be removable by disconnecting motor and piping connected to the inlet and outlet connections. It shall not be necessary to disconnect or remove any adjacent piping or electrical conduit or wiring in order to remove or replace any pump.

J. Piping shall be attached to the chemical metering skid with a non-metallic corrosion resistant support system. All support channels shall be bolted to the skid with non-metallic, corrosion resistant fasteners. Tapped holes shall be provided for the support fasteners (no nuts shall be required), the tapped holes shall not penetrate the skid base in order to maintain containment integrity. The straps shall be removable and reusable to allow for servicing of the system. All inlet/outlet connections, valves and pump accessories shall be clearly labeled on the skid for easy identification.

K. A NEMA 4X terminal box shall be provided on the skid back panel for termination of all wiring. A power outlet with weatherproof cover shall be provided for each metering pump or accessory that requires an outlet. The inside cover of the terminal box shall include a wiring diagram detailing the function of all terminals. A power disconnect switch shall be provided in the terminal junction box. Surge protection shall be provided locally in the skid mounted terminal junction box. Protection shall be provided for the main power supply as well as all analog input and output signals. Surge protection devices shall be as manufactured by EDCO Inc. of Florida.

L. Chemical metering skids shall be completely assembled and tested by the manufacturer prior to delivery to the job site.

M. Skid and system components shall be designed with components designed to provide long life in the intended service and to withstand corrosive atmospheres in either intermittent or continuous duty.

N. Components that will require initial or periodic adjustment shall be easily accessible on the feed systems.

O. Chemical metering pump skid shall match the Mechanical and P&ID drawings for the intended system configuration and include at least the following components on the skid:

Suction header pipe

(1) Skid inlet union with ID label “Skid Inlet”

(2) Skid inlet isolation valve

(3) PVC or PP wye strainer

(4) Calibration column with isolation valves

Suction side of each pump

(1) Pump isolation valve

(2) Flushing/drain connection with male non-metallic quick connect coupling and cap/plug

(3) Pipe coupling within 6 inches of pump head connection

Discharge side of the pump

(1) Pipe coupling within 6 inches of pump head connection

(2) Pulsation dampener (not for peristaltic pumps as shown on drawings)

(3) Pressure relief valve

(4) Discharge isolation valve

(5) Diaphragm protected pressure gauge

(6) Backpressure/anti-siphon valve

(7) Flushing/drain connection with male end non-metallic quick connect coupling and cap/plug

(8) Isolation valve prior to discharge manifold

Number of discharge (outlet) pipes as required for each chemical feed point. Each discharge pipe shall include an outlet union with destination ID label.

2.02 METERING PUMPS

A. Manufacturers:

(1) Grundfos

(2) Or Approved Equal

B. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions** and **Table #1**.

C. Mechanically-Actuated Diaphragm Metering Pumps

(1) Post Chlorination - Two (2) Metering Pumps

(a) The pump shall be reciprocating, positive displacement, mechanically actuated, flat Teflon diaphragm type, motor driven metering pump

(b) Solenoid-driven pumps, hydraulically actuated diaphragm pumps will not be accepted.

(c) Each pump shall have a maximum capacity of 11ghp at 145 psi or as noted in the pump schedule.

(d) Pump shall have a maximum stroking rate of 144 strokes per minute with capabilities of manual stroke length control.

(e) Each unit shall be Grundfos DMH35-10 series.

Pump Construction

A. Pump housing shall be constructed of chemical resistant Noryl.

B. Pump design shall include provisions for optional positioning of the control interface/display, for side or wall mounting. Enclosure shall be IP65/Nema 4 rated.

Pump Drive

A. A vertically mounted electric 1750 RPM1/8th hp AC motor operating on a 115-volt, 60-hertz single-phase power supply shall drive the pump. The motor shall drive a reducing gear integral to the pump body and transmitted to an eccentric

cam-tappet-spring return system to reciprocate the plunger for diaphragm actuation. The motor shall be integral, supplied with power cord and plug.

B. Drive mechanism shall not require regular field service or external lubrication. Internal gear lubricant shall not require changing for five years or 20,000 operating hours**.** Oiler lubrication, oil bath or oil mist systems are not acceptable.

C. Variable frequency drives shall not be accepted.

Pump Interface

A. Stroke volume shall be freely adjustable between 0 and 100% via a hand micrometer.

B. Automatic stroke length control shall be possible by an actuator or servo motor supplied by the pump manufacturer and controlled by a 4-20mA signal.

C. AR control option

(1) Interface shall provide metered output to be displayed in strokes per minute.

(2) Interface shall include an access code to protect against unauthorized changes. A built in counter shall be included to provide hours of operation.

(3) A priming function shall be provided on the interface that will cycle operating at full capacity without need of attenuating the pumps output setpoint.

(4) A system of red and green and yellow LED lights shall indicate pump status and alarm conditions.

Pump Liquid End

A. Process diaphragm shall be PTFE, fabric reinforced and bonded to pre-formed elastomeric support.

B. Head and valves body material shall be PVC with Glass ball material.

C. Wetted gasket material shall be FKM.

D. Suction and discharge valves are to be cartridge design that thread into the liquid end. Spring-loaded valves shall be available as an option. Direction of flow shall

be clearly marked on each check valve to ensure correct installation.

E. Head design shall incorporate an optional integral pressure relief valve.

F. Liquid end shall be physically separated from the main pump body with an air gap back plate with weep hole.

G. Pump head shall include NPT threaded or tube fitting connectors for suction and discharge connections.

Pump Operation

A. Repeatable metering accuracy shall be ±1.5% within the control range of 1:10 turndown.

B. Pump shall be equipped with input connections for dual level control and alarm outputs for low-level and empty tank warnings and pump alarms.

C. Pumps shall be equipped with optional stroke sensor and contact output signal that can also be used to slave a second pump.

D. Controller shall produce a 4-20mA output as an indication of stroke frequency in all operating modes.

E. A remote start/stop input shall be available that can override all other input signals.

F. An optional diaphragm leak detector shall provide a contact output and local flashing indicator light on the interface LED.

G. An optional dosing controller with proximity sensor shall verify flow and provide contact output with local flashing indicator light on the interface LED.

Pump Control

A. Pump with optional AR control interface shall have four selectable control modes: Manual, analog 0/4-20mA, Contact, or Batch.

(1) Manual Control

(a) Output of pump is displayed in strokes per minute. Pump output adjustment is performed with increase/decrease buttons on the interface.

(2) Automatic Control

(a) Analog: Pump shall include direct interface provisions for analog control with 0/4-20ma inputs. Menu configuration shall permit pump maximum output weighting/scaling at selectable strokes per minute. Pump shall include a local alarm for loss of input signal.

2.03 PULSATION DAMPENERS

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions and Table #1**.

B. Provide pulsation dampeners immediately downstream of each mechanical diaphragm metering pump to dampen pressure spikes and smooth out the flow of chemical.

C. Gas charged pulsation dampeners shall be provided and sized for a minimum of 90% dampening. Pulsation dampeners shall include gas charge fitting and 316SS pressure gauge. Dampeners shall be installed in discharge piping of each metering pump, as close to metering pump discharge check valve as possible. Pulsation dampeners larger than 10 cu. in. shall attach to piping by ANSI 150# flanges with 316SS bolts; threaded connections are not acceptable.

D. A pulsation dampener on the discharge piping shall be provided for each hydraulic diaphragm metering pump. The pulsation dampener will be of the appendage type having a gas-charged bladder in a PVC pressure vessel. The dampener will be a pressure vessel as specified in the ASME Pressure Vessel Code, Section VIII. The minimum air volume will be 1 quart or pint, as determined by the calculations. Pulsation dampeners will be Blacoh Fluid Control, Greer Bladder Accumulator, or approved equal.

E. Provide non-metallic support brackets as required for mounting pulsation dampeners.

2.04 PRESSURE RELIEF VALVES

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions** and **Table #1**.

B. Provide a pressure relief valve shall be provided for each diaphragm metering pump. Provide pressure-relief valve on the discharge piping of the metering pump, prior to any valves, to eliminate the buildup of excess pressure in the

system. Output of the pressure relief valves shall return to the pump suction header. Size valve to match the associated metering pump capacity.

C. Pressure relief valve shall be of the spring actuated type, with an adjusting screw to change the relief setting. Relief pressure shall be field adjustable over a range of 5 to 150 psig with a Teflon diaphragm and have no metal parts in contact with the chemical. Bodies and valve top shall be PVC conforming to ASTM 1784 Type I, Grade 1. Shafts shall be Teflon. Seals shall be Viton. Diaphragm shall be encapsulated by PTFE. Valves shall be Griffco Model PRV or PRT, Plastic-O-matic Type RVT, Harrington, or approved equal.

2.05 DIAPHRAGM PROTECTED PRESSURE GAUGES:

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions** and **Table #1**.

B. Provide 2" liquid filled pressure gauges with isolators for indication of system pressure in the discharge piping of each metering pump. Industrial quality 316 Stainless Steel gauges shall be utilized. The isolators shall have housing compatible with a Teflon diaphragm and suitable liquid fill. A fabricated PVC bracket shall be provided for each pressure gauge to secure the isolator and prevent lateral movement of the pressure gauge.

C. Pressure gauge shall be glycerin filled and diaphragm protected.

D. Meriam Instruments, McDaniel, or Ashcroft shall manufacture gauges.

2.06 BACKPRESSURE VALVES

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions and Table #1**.

B. Provide backpressure valve on the discharge header. Size to match the associated metering pump capacity.

C. Backpressure valves shall use a diaphragm design and be externally adjustable by means of a screwdriver. Valve body shall be constructed of PVC. Diaphragm shall be encapsulated by PTFE. Valve top shall be constructed of rigid PVC or polypropylene. Valve shall be a model BPT or BPV as manufactured by Griffco Valve, or approved equal.

2.07 CALIBRATION COLUMN

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions** and **Table #1**.

B. Provide a clear PVC calibration column for each metering skid as shown on the drawings having engraved graduations and a minimum volume appropriate for the chemical feed pumps.

C. Calibration column shall be located in the piping between the metering pumps and the storage tank as shown on the drawings. Provide isolation valve between the calibration column and the suction piping.

D. Provide one, clear plastic calibration chamber with vent for use in calibrating the metering pumps.

E. Column shall be sized to give adequate capacity for a minimum 30 second draw down test.

F. Chamber shall be piped and valved so that each pump shall be able to use the calibration chamber without interfering with the operation of the other pumps.

G. Top of the chamber shall have a threaded fitting to allow for piping to a common vent.

2.08 FABRICATED PLASTIC SKID AND BASE

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions** and **Table #1**.

B. Assemble and mount components on the fabricated skid or base at the factory. Provide the following minimum clearances around equipment:

(1) Provide 4 inches between adjacent pumps and pipes.

C. Skid and base shall be fabricated of plastic components suitable for use with the chemical application. Use plates or sheets to construct the skid or base. Minimum plate, sheet or member thickness shall be 1/2 inch. Provide reinforcing gussets, as needed, beneath the deck to provide increased stiffness. Plates shall be heat welded to form permanent continuous bond.

D. Fasteners and pipe supports non-metallic. Where it is necessary to use metal fasteners, use 316-stainless steel.

E. Skid and base shall be fabricated such that small drips or leaks of chemical are contained within the skid in a drip pan. The drip pan shall have at least 30 gallons storage capacity. Provide a suitable drain valve to provide a means of draining the drip pan.

F. Provide separate supports for pulsation dampener and calibration tube. Do not mount unsupported devices directly on the piping.

G. Provide polypropylene, or fiberglass supports with nylon or fiberglass fasteners and hardware for the piping. Provide a support for each pipe at its termination point at the edge of the skid, within 3 inches of any isolation valve.

H. Route electrical conduit around the ends and sides of the skid or base. Do not install conduit overhead. Install wiring on the skid or base in the flexible conduit with a minimum size of 3/4 inch. Install power and control wiring in separate conduits. Terminate conduits at the control panel.

I. Provide at least one side (preferably the front) of the skid clear of any piping or conduits to allow for maintenance access to the skid components. This clear access side shall not include any side that is within 3 feet of a wall.

2.09 PIPING

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions** and **Table #1**.

B. Piping for each skid shall be as follows:

(1) Post Chlorine: ½" Schedule 80 PVC

C. This specification covers pipe and fittings for pressurized pipe systems manufactured of Rigid Poly Vinyl Chloride (PVC). Fittings covered under this specification include heavy-duty Schedule 80 fittings molded of the material described below. Fittings covered under this specification are tees, elbows, couplings, reducer bushings, crosses, adapters, plugs, caps and flanges.

D. All fittings shall be injection molded of PVC fitting compound of cell classification 12454-B as described in ASTM D-1784 Standard Specification.

E. All material used in pipe and fittings for potable water supply shall be listed for such applications by National Sanitation Foundation Laboratories, Inc. (NSF). Workmanship shall be in accordance with good commercial practice. Fittings

shall be homogeneous throughout and free from visible cracks holes, foreign inclusions or other injurious defects. The fittings shall be commercially uniform in color, opacity, density and other physical properties.

F. All molded threads, internal or external, shall be “blunt start” threads. All threads shall conform to thread standard ANSI/ASME B1 .20.1 for tapered pipe threads. Threads shall measure not more than 11/2 threads large or small when checked with a plug gauge or ring gauge.

G. Dimensions and tolerances of sockets shall conform to PVC IPS Schedule 80 Socket Dimensions. All reducer bushings shall be designed so as to provide for a positive and sufficient grip for cementing bushings in place. Waterways shall be smooth and commercially free of flash and irregularities. On tees and 90° elbows, bond lines shall not coincide with the maximum stress area (crotch).

H. Assembly shall be performed in a controlled shop environment by the skid manufacturer. All pipe shall be squarely cut on precision equipment with the ends chamfered and deburred. All socket welded connections shall follow the guidelines set by the pipe/fitting manufacturer for proper cleaning, priming and gluing procedures. A heavy bodied solvent suitable for use with all chemicals as listed under **Section 1.04 Service Conditions** and **Table #1** shall be used. All threaded connections will utilize Teflon tape, a suitable thread sealant or a combination of both. Threaded connections shall utilize stainless steel reinforcement rings where applicable to reduce the risk of cracking.

2.010 ISOLATION VALVES

A. All materials shall be compatible with chemicals as listed under **Section 1.04 Service Conditions** and **Table #1.**

B. Ball Valves

(1) Ball Valves, sizes ½” to 4”, shall be of true union design with two-way blocking capability. All O-rings shall be Viton with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall be double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. The ball valves shall have a pressure rating of 230 psi for sizes ½” to 3”

and 150 psi for 4” at 70° F. Type 21 Ball Valves must carry a two-year guarantee, as manufactured by Asahi/America, Inc.

(2) All ball valves used for chemicals prone to “off-gassing” (e.g. sodium hypochlorite, etc.) shall be vented to avoid entrapment of vapors.

C. Provide isolation valves on the suction and discharge piping as shown in the drawings.

(1) Inlet connection to each pump.

(2) Outlet connection from each pump.

(3) Connection to water supply quick connect coupling.

(4) Connection to drain quick connect coupling.

(5) Outlet connection from each tank. Do not provide valves on vent pipe connections.

2.011 ELECTRICAL

A. All electrical connections shall be terminated in the skid mounted NEMA 4X terminal junction box.

B. Wire all power, control and signals to a single junction box, one for each skid. Terminate wires on terminal blocks in accordance with requirements of Section 26 05 34 Conduit, Boxes, and Fittings. Clearly label the terminal block to facilitate field wiring to an external source.

C. Color-code control wiring in switching and control assemblies per ICEA Method 1, NEC applications, Option A. Jacket shall be black PVC. Lay out conductors neatly so they may be followed by eye form one terminal to another. Wiring shall be vertical or horizontal. Color-coding shall be such that electrically common interconnections of devices are the same color. The colors may be used more than once but not in the same circuit or cable grouping.

D. Power, control, and signal wiring shall comply with requirements of Section 26 05 19 Wires and Cables Less Than 600 Volts.

E. Conduits and Boxes shall comply with requirements of Section 26 05 34 Conduit, Boxes, and Fittings.

F. Conduits shall be rigid, non-metallic. Liquid-tight, flexible, non-metallic in

lengths 3-foot or less, may be used for equipment connections.

G. Junction and pull boxes shall be NEMA 4X rated, non-metallic.

H. Install signal wires in conduits separate from those used for power or control wires.

I. Provide 4-inch minimum separation between signal wires and power or control wires when routed parallel to each other inside a junction box. Make perpendicular crossings between signal wires and power or control wires.

J. Size power wiring and conduits for 480-volt circuits in accordance with the NEC.

K. Power wiring for 120-volt circuits shall be No. 12 AWG with No. 12 AWG ground. Wiring for control circuits shall be No. 14 AWG. Install wiring per the NEC.

2.012 PAINTING AND COATING

A. Coat pump, frame, pulsation dampeners, and motor exposed metal parts with factory recommended chemical resistant coating for the service conditions.

B. Skid piping shall not be coated.

C. Apply the specified prime coat, intermediate, and finish coats at the place of manufacture.

D. Color of finish coat shall match the color of the connecting piping.

2.013 FACTORY TESTING

A. Pressure test skid piping (except for overflow and vent piping) to a pressure of 100 psi for duration of three hours. There shall be no leakage at any pipe joint or connection to any valve or piece of equipment. Repair or replace any defective pipe joint or connection and retest.

B. Verify that each metering pump responds to the external control signals. Demonstrate the pumps will start/stop, vary stoke rate (25, 50, 75, and 100 percent of speed), and for the mechanical diaphragm metering pumps vary the stroke length (25, 50, 75, and 100 percent length).

C. Owner or Owner’s Representative may elect to witness one or all of the factory tests on the chemical feed skid. Notify the Owner at least 30 days in advance of factory tests to enable Owner time to schedule the witnessing of the test.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the chemical metering skids as indicated on the drawings and specified and in compliance with the manufacturer's instructions.

3.02 STORAGE & DELIVERY – See Section 01 11 00 1.12

3.03 MANUFACTURER'S SERVICES

A. Manufacturer shall provide the following services as specified.

(1) Mechanical Start-Up Services

(a) Provide one (1) 8-hour working day of mechanical start-up services for each skid.

(2) Process Start-Up Services

(a) Provide one (1) 8-hour working day of process start-up services for each chemical system.

(3) Operating Training Services

(a) Provide one (1) 8-hour working day to instruct operating personnel on the operation and maintenance of the system.

3.04 DEMOLITION AND STAGING OF THE WORK

A. Schedule and plan the work for the demolition of the existing sodium hypochlorite feed and storage system such that the Owner has a means of primary disinfection at all times.

B. Submit a schedule and written procedure for demolition and reconstruction work to the Owner at least 30 calendar days in advance of performing the demolition work.

C. Protect existing facilities not scheduled for demolition during demolition work.

D. Remove existing sodium hypochlorite metering pumps, valves and pulsation dampeners and provide these to the Owner. The Contractor may relocate and use the existing pumps and components during demolition and installation on a temporary basis and then provide to the Owner following temporary use.

E. Contractor to coordinate with Owner location of temporary chemical feed systems.

3.05 SERVICE CONDITIONS

Pump hydraulic performance conditions and design data shall be as shown below.

A. Sodium Hypochlorite Pumps (Primary Disinfection)

Location:	Sodium Hypochlorite Room
Liquid pumped:	12.5% Sodium Hypochlorite
Pump Type	Mechanical Diaphragm Metering
Backpressure valve pressure setting:	55 psig
Pressure relief valve pressure setting:	85 psig

3.06 FIELD TESTING

A. Upon completion of installation, a full operating test shall be performed in the presence of ENGINEER and a qualified direct company employed manufacturer's representative. CONTRACTOR shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted.

B. Duplicate the testing procedures specified under Factory Testing. Assure that diaphragms do not leak or tear. Repair or replace any leaking diaphragms. Assure that backpressure and pressure-relief valves have been adjusted as recommended by the manufacturer. Repair or replace any valves not set or operating as specified

C. Operate each chemical metering pump using the fluid they are to normally pump, for five consecutive days during which time no repairs shall be required. Assure automatic adjustment controls using the electronic positioners (diaphragm pumps) on the pumps perform over the specified 0% to 100% adjustment range. Assure that the drives control the pump motor speed over full range of the drives.

3.07 CERTIFICATION

A. Provide written certifications from the packaged skids system manufacturer and integrator that the modifications to the chemical systems and the packaged skids have been properly installed according to the drawings, specifications and manufacturer's specifications, and that the equipment is operating normally.

Make all necessary corrections and adjustments including but not limited to labor, parts or freight at no additional cost to the OWNER.

END OF SECTION

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SECTION 43 41 27

POLYETHYLENE STORAGE TANKS

PART 1 GENERAL

This section includes materials and installation of vertical high-density linear double wall polyethylene tanks for aboveground chemical storage service. The exterior double wall contains 1.15 x the interior tank volume.

1.01 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 00.

B. Submit tank layout drawings showing dimensions, wall thicknesses, mounting brackets, knuckle radii, nozzle locations and orientation, and nozzle and gasket construction.

C. Submit manufacturer's data showing materials of construction and chemical resistance. Submit a certificate listing the type of resin to be used, describing the manufacturer's brand name or designation, composition, chemical resistance, and characteristics.

D. Submit installation instructions for installing tank on a concrete slab.

E. Submit tank manufacturer's recommended bolt torques for flanges.

F. Submit design calculations for structural tie-down system (number, size, and embedment length of anchor bolts) signed and stamped by an engineer registered in the state of Florida.

G. Submit manufacturer's certification that tank construction complies with ASTM D1998, Type II, and these specifications.

H. Provide O&M manual with information on removal and replacement requirements for tank including weight and lifting equipment requirements.

PART 2 MATERIALS

2.01 MANUFACTURERS

Polyethylene tanks shall be manufactured or supplied by Snyder Industries, Inc.; or equal.

2.02 TANK CONSTRUCTION

Polyethylene tanks shall be rotationally molded polyolefin. Tanks shall be vertical, flat bottom with domed top. Provide minimum 18-inch manway with 15” access port on top. Provide molded-in lifting lugs. Provide fittings and accessories indicated in the drawings.

2.03 DESIGN CRITERIA

A. Volume shown in the drawings is measured from the tank bottom to the invert of the overflow nozzle.

B. High-density linear polyethylene tanks shall comply with ASTM D1998, Type II. Resin used in linear polyethylene shall be ExxonMobil Chemical, UV stabilized.

C. Polyethylene resin material shall contain an ultraviolet stabilizer as compounded by the resin manufacturer. Pigments shall not exceed 0.25% (dry blended) of the total weight.

D. Mechanical properties of tank material shall be as follows:

Property	ASTM	Value
Density (Resin)	D1505	0.941-0.945 g/cc
Tensile (Yield Stress 2 inches/minimum)	D638	2700-2900 psi
Elongation at Break (2 inches/minimum)	D638	10%
ESCR (100% Igepal, Cond. A, F50)	D1693	1,000 hours minimum
ESCR (10% Igepal, Cond. A, F50)	D1693	1,000 hours minimum
Vicat Softening Degrees F Temperature	D1525	248 minimum
Flexural Modulus	D790	110,000 psi

E. The top head shall be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall. Design the top head of tanks to accommodate the fittings and nozzles indicated.

2.04 STRUCTURAL DESIGN AND SUPPORTS

Design lugs, anchors, and anchor bolts per the following requirements:

A. Design the tank and anchorage system per the FBC 2010 requirements supplemented by ASCE 7-10 for wind loading requirements:

1. Basic Wind Speed, mph: 150 mph
2. Risk Category: IV
3. Exposure: C

B. See subsection on "Liquids Stored" herein for the specific gravities of the tank contents.

C. An unreinforced concrete housekeeping pad above the reinforced concrete structural slab shall not be considered to have structural value in the design of the anchor bolts. Tension and shear values for drilled or epoxied anchor shall be FBC approved.

2.05 WALL THICKNESS

A. Determine wall thickness per ASTM D1998, Section 6, assuming a fluid specific gravity as described in the subsection on "Service Conditions" with a minimum specific gravity of 1.5. Minimum total wall thickness shall be 3/8 inch for tanks having a diameter 4 feet 0 inches or less and a height of 8 feet 0 inches or less. Wall thickness for larger tanks (in either diameter or height dimension) shall be at least 1/2 inch. The minimum required wall thickness for the cylinder straight shell shall be sufficient to support its own weight in an upright position without any external support.

B. Provide flat areas to allow the attachment of fittings on the cylinder straight shell.

2.06 TIE-DOWN SYSTEM

The tie down system shall be designed to withstand 150 mph wind loads. Anchor bolts shall be provided by the contractor as per the calculations and the base plates for the system. The tie down system shall be provided as 316 stainless steel. A registered engineer’s wet stamped calculation is required for tie down system.

2.07 FITTINGS--GENERAL REQUIREMENTS

A. Place fittings at least 6 inches away from tank knuckle radius and flange lines.

B. Orientation of flange fittings shall have bolt holes straddling the principal centerline of

the tank in accordance with ANSI/ASME B16.5.

C. Flange dimensions to conform to ASME B16.5, Class 150. Flanges shall be flat faced. The flange face shall be 4 to 6 inches from the tank shell.

2.08 FITTINGS FOR POLYETHYLENE TANKS

A. Provide threaded bulkhead fittings where shown in the drawings. The maximum allowable size for threaded fittings shall be 1 inch. The maximum wall thicknesses for each fitting size shall be as shown below.

Fitting Size (inches)	Maximum Wall Thickness (inches)
1/2	0.75
3/4	0.875
1	0.875

Construct threaded bulkhead fittings of PVC or polypropylene.

B. Provide bolted double flange fittings for below liquid level installation where shown in the drawings.

C. Allowable flanged fitting sizes based on tank diameter for curved surfaces are shown below.

Tank Diameter (inches)	Maximum Bolted Fitting Size Allowable for PVC, CPVC, or Polypropylene Construction (inches)
48 to 86	3
90 to 102	6
120 to 142	8

Tank Diameter (inches)	Maximum Bolted Fitting Size Allowable for Stainless Steel Construction (inches)
48	3
64 to 142	4

The bolted double flange fittings shall allow tank wall thickness up to 2 1/2 inches.

D. Each bolted double flange fitting shall consist of one flange each on the inner and outer shell surfaces and shall be constructed with two each 150-pound flanges, two each 150-pound flange Viton gaskets, and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer. Construct the fittings of PVC Type I. Provide a minimum of four each all-thread bolts. The bolts may have Viton gasketed flanged metal heads or bolt heads encapsulated in Type II polyethylene material. Design the encapsulated bolt to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4 inch of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material. Each encapsulated bolt shall have a Viton gasket to provide a bolt sealing surface against the inner flange.

E. Flexible Connection. Tank outlet shall be equipped with a flexible connector to allow deflection based upon tank loading and thermal expansion/contraction. Tank piping flex connector shall be designed to allow for 4% design movement. The flexible connector shall be flanged in design and manufactured of the same material as the tank. Piping connections to tank shall include flexible connections where piping is anchored and doesn't allow for expansion and contraction of the tank.

F. Vents. To avoid the air surge and over pressurization from a tank being filled from a pressurized tanker truck, the tank shall be provided with an 18" (26" x 11.7") polyethylene mushroom vent. The mushroom vent is rotationally molded with Type II HDLPE and attached to the tank with (8) screws and a bead of silicone sealant. The underside of the vent has a 1/8" poly mesh insect screen.

2.09 GASKETS FOR NOZZLES AND MANWAYS

Provide 1/4-inch-thick fullface 60 to 70 durometer Viton® for flanged nozzles and

manways. When the mating flange has a raised face, remove the raised face.

2.10 BOLTS AND NUTS FOR FLANGED NOZZLES AND MANWAYS FOR TANKS IN SODIUM HYPOCHLORITE SERVICE

Bolts shall be titanium, per ASTM F468, Grade Ti1, Ti2, or Ti7. Nuts shall conform to ASTM F467, same material as the bolts.

2.11 SIGHT LEVEL GAUGE

A. Construct sight level gauge of PVC tubing to allow for tank contraction and expansion due to loading and temperature changes. Connect the level gauge to the tank with two 3/4-inch fittings. Provide each fitting with a right-angle isolation valve.

B. Construct the sight level gauge fittings and valves of PVC. Gaskets shall be Viton®.

2.12 FILL PIPES AND INTERNAL DIP TUBES

Fill pipes and dip tubes shall be supported at 4-foot-maximum intervals with support structures. Down pipes and fill pipes shall be Schedule 80 PVC.

2.13 LIQUIDS STORED

Liquids stored within the tanks are described below. See the subsection on "Service Conditions" to determine which tanks contain the particular liquid described.

Liquid	**12% sodium hypochlorite solution**
Specific gravity	1.0 to 1.2
Viscosity	1 centipoise
Temperature	45°F to 120°F

2.14 QUALITY ASSURANCE & TEST METHODS

Tank test specimens shall be taken from fitting location area and conditioned at (-40) degrees Fahrenheit for a minimum of 2 hours. They shall then be impacted in accordance with the standard testing methods found in ASTM D 1998. Test specimens <1/2” thickness shall be tested at 100 ft. lb. Test specimens >1/2” thinness shall be tested at 200 ft lb.

2.15 FACTORY LEAKAGE TESTING

Test each tank at the factory or place of manufacture by filling with water. Allow the water to stay in the tanks for at least 12 hours. Check tank and nozzles and knuckles for leaks. Repair leaks and retest the tank until no leaks are observed.

PART 3 EXECUTION

3.01 FACTORY CLEANING

Remove dirt, chips, and debris from interior surfaces. Rinse with clean water. Rinse and dry exterior with clean water.

3.02 SHIPPING

Ship per ASTM D1998, Section 14 except delete paragraph 14.5, and the following. Wrap tanks with protective polyethylene sheet and protective tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit. Cover or plug fittings and flange faces with weatherproof metal covers.

3.03 TANK INSTALLATION

Install tanks level as shown in the drawings. Provide a rubber pad or provide layers of roofing felt between the tank bottom and the underlying slab as recommended by the tank manufacturer.

3.04 INSTALLATION VERIFICATION

A. Prior to checking final piping alignment to the tank, the piping system shall be complete as follows.

B. Complete pipe pressure testing, dry out the system, and remove hydrotest blind flanges.

C. Install and adjust permanent supports and hangers.

D. Remove temporary supports and hangers.

E. The system piping components and tank shall be at the same ambient temperature within a range of 10°F before starting final piping alignment checks.

F. Verify that the connecting tank piping is properly constructed. This inspection shall include verification of gasket material, gasket size, and the material, size, and length of flange bolts, studs, and nuts.

3.05 FLANGE AND PIPING ALIGNMENT REQUIREMENTS

A. Do not spring flanges of connecting piping into position.

B. Line up pipe flange bolt holes with tank nozzle bolt holes within 1/16 inch maximum offset from the center of the bolt hole to permit insertion of bolts without applying any external force to the piping.

C. The tank and piping flange faces shall be parallel to less than 0.001 inch per inch of pipe flange outer diameter up to a maximum of 0.030 inch. For piping flange outer diameters smaller than 10 inches, the flanges shall be parallel to 0.010 inch or less.

D. Flange face separation shall be within the gasket spacing ±1/16 inch. Use only one gasket per flanged connection.

E. Separately work connecting piping systems into position to bring the piping flanges into alignment with the matching tank flanges. Do not move tank to achieve piping alignment.

3.06 FIELD TESTING

A. Fill each tank with water and allow tank to set for seven days. Do not attach connecting piping until after the test period to allow for any differential settlement. Check for leaks and correct or repair any leaking areas.

B. During the tank filling, check that liquid level gauges operate smoothly without binding. Assure that floats and targets move up and down without sticking.

END OF SECTION

APPENDIX B-LIST OF SUBCONTRACTORS FORM

130-17- Construction Services for Otter Run Water Treatment Plant Renewal and Replacement

JEA Solicitation Number 130-17 requires certain major Subcontractors be listed on this form, unless the work will be self-performed by the Company.

The undersigned understands that failure to submit the required Subcontractor information on this form will result in bid rejection, and the Company agrees to employ the Subcontractors specified below: (Use additional sheets as necessary)

Note: This list of Subcontractors shall not be modified subsequent to bid opening, without a showing of good cause and the written consent of JEA.

Type of Work	Corporate Name of Subcontractor (If work will be self-performed list "Self-performed" below)	Subcontractor Primary Contact Person & Telephone Number	Subcontractor's License Number (if applicable)	Percentage of Work or Dollar Amount
1. Tank Construction				
2. Electrical				
3. I&C				

Signed:_____

Company:_____

Address:_____

Date:_____

APPENDIX B-BID FORM

130-17 Construction Services for Otter Run Water Treatment Plant Renewal and Replacement

Submit an **original, two (2) copies and one (1) CD or thumb drive** along with other required forms in a sealed envelope to: JEA Procurement Dept., 21 W. Church St., Bid Office, Customer Center, 1st Floor, Room 002, Jacksonville, FL 32202-3139.

Company Name: _____

Company's Address _____

License Number (if applicable) _____

Phone Number: _____ FAX No: _____ Email Address: _____

BID SECURITY REQUIREMENTS
☐ None required
☒ Certified Check or Bond Five Percent (5%)

TERM OF CONTRACT
☐ One-Time Purchase
☐ Annual Requirements
☒ Other, Specify- Project Completion

SAMPLE REQUIREMENTS
☒ None required
☐ Samples required prior to Response Opening
☐ Samples may be required subsequent to Bid Opening

SECTION 255.05, FLORIDA STATUTES CONTRACT BOND
☐ None required
☒ Bond required 100% of Bid Award

QUANTITIES
☐ Quantities indicated are exacting
☒ Quantities indicated reflect the approximate quantities to be purchased Throughout the Contract period and are subject to fluctuation in accordance with actual requirements.

INSURANCE REQUIREMENTS

Insurance required

PAYMENT DISCOUNTS
☐ 1% 20, net 30
☐ 2% 10, net 30
☐ Other _____
☐ None Offered

Item No.	ENTER YOUR BID FOR THE FOLLOWING DESCRIBED ARTICLES OR SERVICES	TOTAL BID PRICE
1	Total Construction Services for Otter Run Water Treatment Plant Renewal and Replacement	$
2	Supplemental Work Allowance (SWA)	$110,000.00
3	Total Bid Price (Include the SWA amount)	$

BIDDER CERTIFICATION

By submitting this Bid, the Bidder certifies that it has read and reviewed all of the documents pertaining to this Solicitation, that the person signing below is an authorized representative of the Bidding Company, that the Company is legally authorized to do business in the State of Florida, and that the Company maintains in active status an appropriate contractor's license for the work (if applicable). The Bidder also certifies that it complies with all sections (including but not limited to Conflict Of Interest and Ethics) of this Solicitation.

We have received addenda _____ through _____

_____

Handwritten Signature of Authorized Officer of Company or Agent Date

_____

Printed Name and Title