

**MEMORANDUM**

**TO:** MAYOR AND CITY COMMISSION

**FROM:** CITY ATTORNEY'S OFFICE

**DATE:** August 1, 2022

**RE: Agreement with Casey Industrial, Inc. for Underground General Work for McIntosh Reciprocating Internal Combustion Engine Project**

Attached hereto for your consideration is a proposed Agreement with Casey Industrial, Inc. (Casey) for underground general work for the McIntosh Reciprocating Internal Combustion Engine (RICE) Project. On September 7, 2021 the City Commission approved an Agreement with MAN Energy Solutions USA, Inc. for the purchase of six (6) RICE generators that will produce approximately 120.2 net megawatts (MW) of generation capacity.

Completion of the RICE Project encompasses a number of phases, including the installation and construction of Lakeland Electric's new electric generation facility. Significant underground work is necessary to prepare the area for the RICE generators by constructing the base foundation and infrastructure for the new Plant. This work includes site grading and digging, installation of electrical duct banks and underground piping, cleaning and testing, pile driving approximately 400 piles to support the foundation, pouring of concrete to support the equipment and the unloading and cataloging of support equipment as it arrives on the Project site.

Accordingly, on April 15, 2022, the City's Purchasing Department issued Invitation to Bid (Bid) No. 2136 seeking qualified contractors for the design, material procurement, material fabrication, delivery, storage and construction/installation for the underground general work. The City received responses from the three (3) companies listed below.

<b>Contractor</b>	<b>Location</b>	<b>Bid Price</b>
Rayco Industrial, Inc.	Selma, AL	\$15,564,447.11
Casey Industrial, Inc.	Louisville, MO	\$16,199,591.00
TEI Construction Services, Inc.	Duncan, SC	\$20,710,609.64

Upon evaluation by Lakeland Electric staff and Sargent & Lundy, LLC, the City's consulting engineer for the Project, Casey was selected as the most qualified responsive, responsible cost-effective bidder capable of best meeting Lakeland Electric's needs in accordance with the City's Bid. Although the bid

submitted by Rayco Industrial, Inc. (Rayco) was the lowest in price, Rayco failed to meet a number of the City's Bid requirements. Specifically, Rayco's price was missing several required scope items and its prices were not firm. Rayco's bid also included unquantified time and materials work for unloading equipment coming to the Project site. In addition, Rayco had very limited experience with RICE installation and power plant construction, whereas Casey's bid was evaluated as having the expertise, manpower and experience to effectively and efficiently complete the work in the required timeline. As such, Casey's bid was ranked higher in all categories of evaluation, with the exception of price.

The term of the Agreement, effective August 1, 2022, subject to City Commission approval, shall continue through the completion of the services, unless otherwise terminated or extended in accordance with the Agreement. Casey will commence work and begin the design and procurement upon City Commission approval. Services are anticipated to be completed by December 23, 2022.

Pursuant to the Agreement, Casey is required to provide a performance bond in the total amount of the contract price, as required by Florida Statute, that will remain in effect through the entire contract term to ensure satisfactory completion of the Project. Given the importance of meeting the schedule for commissioning of the RICE generators, provisions for liquidated damages resulting from delays have been incorporated into the Agreement. Liquidated damages in the Agreement are capped at 5% of the contract price.

The warranty on the work performed by Casey will be for a period of one (1) year from Substantial Completion. In the event that any work performed requires repair, replacement or modification, that work will be subject to a new warranty period from completion, which will not exceed a period of twenty-four (24) months from Substantial Completion. In addition, Casey is required to indemnify and hold the City harmless for any property damage or bodily injury arising from Casey or any of its subcontractors' negligent performance pursuant to the Agreement.

Casey will perform all services in accordance with the terms and conditions set forth in the attached Agreement. Casey's total bid price has been modified by an additional \$637,651.00 based on minor modifications to scope and additional Requests for Clarification submitted by Casey to the City to further clarify specifications/responsibilities of the parties. The contract price for services is \$16,837,242. In addition, City staff is requesting a contingency amount of 3% or \$505,117.00 which will cover minor modifications related to Project scope that may occur. As such, the total cost for the work, as well as the contract contingency is \$17,342,359. This underground work is included in Lakeland Electric's budget for the RICE Project, which will be funded through the City's Energy System Revenue Bond.

It is recommended that the City Commission approve this Agreement with Casey for the Underground General Work for the RICE Project and authorize the appropriate City officials to execute all corresponding documents related to the purchase.

Attachment

## UNDERGROUND GENERAL WORK

### FOR THE MCINTOSH RECIPROCATING ENGINE PROJECT

**THIS GENERAL CONSTRUCTION CONTRACT** (“Contract”), dated and effective as of August 1, 2022, (the “Effective Date”), is entered into by and between the **CITY OF LAKELAND**, a Florida municipality organized and existing in accordance with the laws of the State of Florida, hereinafter referred to as the “City”, located at 228 South Massachusetts Avenue, Lakeland, Florida 33801-5086, and **CASEY INDUSTRIAL, INC.**, hereinafter referred to as the “Contractor”, a Colorado corporation, located at 890 W. Cherry St. Louisville, Colorado 80027. The City and the Contractor are also hereinafter referred to individually as a “Party” or collectively as the “Parties”.

### RECITALS

**WHEREAS**, the City intends to enter into a contract for construction and installation services for the Underground General Work for the McIntosh Power Plant Reciprocating Engine (RICE) Project (“Project”), of which is located in Lakeland, Florida; and

**WHEREAS**, the City issued RFP No. 2136 (“RFP”) soliciting responses from contractors desiring to provide such services; and

**WHEREAS**, Contractor, having been selected as the most qualified firm submitting a response to the City’s RFP, is knowledgeable in providing construction and installation services for the Project and has the requisite expertise and experience for such services; and

**WHEREAS**, the City selected the Contractor to provide certain equipment and services pursuant to the terms and conditions set forth herein.

**NOW THEREFORE**, in consideration of the mutual covenants and agreements hereinafter set forth, the Parties hereto agree as follows:

#### **I. DEFINITIONS**

- A. “Specific Definitions” As used herein, the following terms shall have the meanings set forth below:

“Affiliate” shall mean any corporation or other entity that, directly or indirectly, controls or is controlled by, or is under common control with, another corporation or entity.

“All Risk Builders Insurance” shall have the meaning set forth in Article XV.

“Applicable Laws” shall mean and include the following, as they are in effect from time to time, all federal, state, and local laws, statutes, ordinances, rules, and

regulations; all judgments, decrees injunctions, writs and orders of any court of competent jurisdiction; and all interpretations, permits, and licenses issued by any Governmental Authority having jurisdiction over performance of the Work.

“Business Day” shall mean any weekday with the exception of those weekdays the City is closed for the following holidays. These holidays include but are not limited to: New Year's Day; Martin Luther King Jr. Day; Memorial Day; Independence Day; Veteran's Day; Thanksgiving Day; Day after Thanksgiving, Christmas Eve and Christmas Day.

“Change in Law” shall mean the enactment, adoption, promulgation or modification of any Applicable Law or of any interpretation or amendment thereof, after the Effective Date, which requires a change in the Work or Project Schedule or results in an increase in Contractor's costs.

“City Caused Delay” shall have the meaning as described in Article XIX. D.

“City Furnished Design Documents” or “CFDD” shall mean all specifications and drawings supplied by the City, or the City's Consulting Engineer to Contractor for Contractor's use in performing Contractor's Work.

“City-Furnished Equipment” or “CFE” shall mean the equipment, as more fully identified in Exhibit K, purchased directly by the City and provided to Contractor for installation under this Contract.

“City Furnished Field Technical Support” or “CFFTS” shall mean the field technical support, as more fully identified in Exhibit K, provided by City for use by Contractor for the installation support.

“City Obligations” shall have the meaning set forth in Article V.

“City's Project Manager” shall mean the person designated by City, pursuant to Article III hereof, to administer and manage this Contract on behalf of City.

“City's Site Representative” shall mean the person designated by City, pursuant to Article III hereof, to serve as City's representative for the Project.

“Consulting Engineer” shall mean City's designated engineer for the Project who as of the Effective Date is Sargent & Lundy; as may be amended.

“Contract” shall mean this contract and all exhibits attached hereto, as the same may be amended and supplemented from time to time in accordance with the terms hereof, including without limitation, by executed Scope Changes.

“Contract Price” shall mean the amount set forth in Article VII.

“Contractor's Project Manager” shall mean the person designated by Contractor, pursuant to Article III. hereof, to administer and manage this Contract on behalf of Contractor.

“Contractor’s Site Representative” shall mean the person designated by Contractor, pursuant to Article III hereof, to serve as Contractor’s representative for the Project.

“Contractor’s Proposal” shall mean the proposal dated May 31, 2022 including Request for Clarification 2, (RFC-2), dated July 6, 2022, provided by the Contractor in response to the Request for Proposals.

“Delay Damages” shall have the meaning set forth in Article VI.

“Differing Site Conditions” shall have the meaning set forth in Article XIX. B.

“Effective Date” shall have the meaning set forth in the preamble hereof.

“Final Acceptance” shall have the meaning set forth in Article X. and Exhibit C, Section 017700-1 Subsection 104, Contract Closeout Procedures.

“Force Majeure Event” shall have the meaning set forth in Article XIX.

“Governmental Authority” shall mean the government of the United States of America, and of any state, municipality, local government or other political subdivisions, instrumentality, department, agency, corporation, court of law or commission under the direct or indirect control of the government of the United States of America, or of any state, municipality, local government or other political subdivision of either thereof.

“Hazardous Waste” (HZW) shall mean any pollutant, contaminant, solid waste, hazardous waste, chemical, hydrocarbon product, toxic or hazardous substance, flammable, explosive or radioactive material, or similar items or material regulated under or subject to any Applicable Law as relevant, or any material derived from such HZW.

“Indemnification” shall have the meaning set forth in Article XII. hereof.

“Interconnection Points” shall have the meaning set forth in CFDD.

“Notice” shall mean provision of notice by one party to the other in accordance with the requirements set forth in Article XXI. E. hereof.

“Proper Invoice” means an invoice submitted to the City, which is marked as "Original Invoice" and contains the following information: invoice date, invoice number, Contractor’s name, contract number, purchase order number, description of payments being requested, correct amount, and payment terms and all supporting documentation as required by the City as set forth in Article VII. B.

“Project Site” means McIntosh RICE Project located at 3030 E. Lake Parker Drive, Lakeland, FL 33805.

“Project Schedule” shall mean the summary schedule of events significant to the construction, and installation of the Work, which schedule is attached hereto as Exhibit G. This Project schedule may be adjusted by the City from time to time in the manner provided for in Article VIII. hereof.

“Prudent Utility Practices” shall mean the prudent utility practices followed from time to time by the electric utility industry in the United States of America having regard to engineering and operational considerations, including manufacture’s recommendations. Prudent Utility Practices are not limited to optimum practices, methods or acts to the exclusion of all others, but rather are a spectrum of possible practices, methods and acts which could have been expected to accomplish the desired result at a reasonable cost consistent with reliability and safety.

“Punch List Items” shall mean the items set forth on a list prepared by Contractor and approved by City, as that list is amended from time to time, which list shall set forth certain items of Work which remain to be performed prior to Final Acceptance.

“Ready for Commissioning” shall mean the City has accepted the Turnover Package for a System and can commence commissioning and start up activities with respect to that System.

“Reliance Material” shall have the meaning ascribed in Article XIX. C.

“RFP” or “Request for Proposal” shall mean the Request for Proposal 2136 dated April 15, 2022, including all addenda thereto.

“Payment Schedule” shall mean the schedule contained in Exhibit D.

“Scope Change” shall mean any change in materials, supplies and/or labor that result in a change in the Work requested by the City or otherwise not either required by or attributable to the fault of the Contractor.

“Subcontractor” shall mean a person or company engaged by Contractor to perform work or services or to provide material or equipment in support of the performance of the Work.

“Substantial Completion” shall have the meaning set forth in Article XIII. and Exhibit C, Section 017700-1 Subsection 103, Contract Closeout Procedures.

“System” shall mean a group of power plant components or equipment, as identified by the City for inclusion into a single turnover package.

“Technical Specification” shall mean the information contained in Exhibit A of the Contract that conforms the scope of the Work as set forth in the Proposal to the Request for Proposals.

“Turnover Package” shall mean the package of information, as more fully described in the City’s Technical Specification, required to be developed and completed by the Contractor documenting that a System is ready for the City to commence commissioning activities.

“Warranty Period” shall have the meaning set forth in Article XI. hereof.

“Work” shall mean all obligations, duties and responsibilities of Contractor in connection with the McIntosh Reciprocating Engine (RICE) project required by this

Contract, including, without limitation, all necessary labor, together with all work, other services, materials, and equipment to be furnished by Contractor to perform this Contract, all as more particularly described in Exhibit B. Work includes any Contractor activities identified by City subsequent to Ready for Commissioning.

- B. “References to Exhibits” All references to exhibits herein shall mean any such exhibit, as amended from time to time.

## **II. CONTRACT CONSTRUCTION AND ORDER OF PRECEDENCE**

In the event of an inconsistency between or among any of the following provisions of this Contract and/or any the Exhibits hereto, the inconsistency shall be resolved by giving precedence in the following order:

- A. This Contract.
- B. Exhibit A – Technical Specification Document M-8537, Amendment 1; Rev D including clarification thereto.
- C. Exhibit B – Contractor’s Proposal
- D. All other Exhibits, Attachments, and Addenda thereto.

No legal comments or clarifications, or any suggestions for additional terms or conditions, set forth in Exhibit B- Contractor’s Proposal, shall be of any force or effect except to the extent that the same are specifically set forth in this Contract; provided, however, that Contractor’s Proposal shall be relevant with respect to technical, scope, quantities, or non-legal terms or conditions.

## **III. GENERAL PROVISIONS AND CONDITIONS**

- A. Independent Contractor. In the conduct and performance of this Contract, Contractor and each Subcontractor shall be regarded as an independent contractor or subcontractor and not as an agent, partner, joint venture, Affiliate, representative, employee or servant of City.
- B. Project Managers and Site Representatives. Within fifteen (15) Business Days of the Effective Date, City and Contractor each shall designate a Project Manager who will have the authority to act on behalf of the respective Party with respect to all matters pertaining to the Work. Prior to any work commencing, each Party shall appoint a Site Representative who will represent the Party in the absence of the Project Manager. The Contractor’s Project Manager and Site Representative (i) must be satisfactory to the City in its reasonable judgment, (ii) shall not be reassigned or replaced by Contractor without City’s prior written approval, such approval shall not be unreasonably withheld, (iii) shall be replaced for cause if reasonably requested by City, and (iv) shall not be given supplemental work assignments without City’s prior written approval, such approval shall not be unreasonably withheld.



C. Contractor's Representations. Contractor represents to City as follows:

1. Contractor is a duly organized, validly existing and in good standing under the laws of its incorporation and the execution, delivery and performance of this Contract has been duly authorized by all requisite corporate action;
2. Contractor is not in violation of any Applicable Laws, which violations, individually or in the aggregate, would affect materially Contractor's performance of its obligations under this Contract;
3. Contractor is qualified to do business in all jurisdictions in which such qualification is required in connection with performance of the Work;
4. Contractor is not a party to any legal, administrative, arbitrable, investigative, or other proceeding or controversy pending, or, to the best of Contractor's knowledge, threatened, which would materially and adversely affect Contractor's ability to perform its obligations under this Contract;
5. Contractor is knowledgeable in providing construction, procurement, installation, testing, commissioning and start-up assistance for power plants, and has adequate staff of properly trained and qualified personnel for the performance of the obligations herein undertaken by Contractor; and
6. This Contract has been duly executed and delivered and constitutes a legal, valid and binding obligation of Contractor enforceable against Contractor in accordance with its terms.

D. City's Representations. City represents to Contractor as follows:

1. City is a municipal corporation duly organized, validly existing and in good standing under the laws of the State of Florida governing its incorporation, and the execution, delivery and performance of this Contract has been duly authorized by all requisite corporate action;
2. City is not in violation of any Applicable Laws, which violations, individually or in the aggregate, would affect materially City's performance of its obligations under this Contract;
3. City is not a party to any legal, administrative, arbitrable, investigative, or other proceeding or controversy pending, or, to the best of City's knowledge, threatened, which would materially and adversely affect City's ability to perform its obligations under this Contract; and
4. This Contract has been duly executed and delivered and constitutes a legal, valid and binding obligation of City enforceable against City in accordance with its terms.

E. Hazardous Waste. If Contractor or any Subcontractor becomes aware of any HZW on or under the Project, whether or not created or brought on by Contractor, Contractor shall report or, as applicable, require each Subcontractor to report, such condition to City in writing and before disturbing (or further disturbing) such HZW. Contractor shall not be liable or responsible for any HZW on or under the Project (other than that brought to the Project by Contractor, Subcontractor, or their agents or representatives) or created or brought to the Project by any party or entity other than Contractor, Subcontractor or their agents or representatives. Notwithstanding anything to the contrary in this Contract, Contractor shall have no obligation to accept or perform any work pursuant to a Change Order or otherwise with respect to HZW except for such HZW as Contractor, Subcontractors, or their agents or representatives created on or brought to the Project. If the discovery of the HZW (other than that brought to the Project by Contractor, Subcontractor, or their agents or representative) shall impact the performance of the Work by the Contractor, any such impacts shall be deemed an event of Force Majeure pursuant to Article XIX hereof, but Contractor shall use all reasonable efforts and shall require all Subcontractors to use reasonable efforts to minimize the effect thereof. City will be liable for and shall indemnify and, to the extent limited by the monetary limitations set forth in Florida Statute §768.28, hold harmless Contractor, its employees, officers, directors, agents and Affiliates against any direct or indirect loss, damage or expense of third parties (including but not limited to costs and reasonable attorney's fees relating to defense of third-party claims) relating to any HZW on or under the Project (other than that brought to the City by Contractor, Subcontractors, or their agents or representatives). Contractor will be liable for any direct loss, damage or expense of the City or third parties (including but not limited to costs and reasonable attorney's fees relating to defense of third-party claims) relating to any HZW that has been created on or brought to the Project by Contractor, Subcontractors, or their agents or representatives. If any third-party loss, damage or expense relating to HZW shall result jointly from acts for which City and Contractor are responsible pursuant to the two immediately preceding sentences, each party will bear its proportionate share of liability according to the degree to which the causes for which it is responsible contributed to the loss, damage or expenses. Prior to bringing hazardous materials or substances (as defined by Occupational Safety and Health Administration, Resource Conservation and Recovery Act and Department of Transportation) on to City's property, Contractor shall provide written notice to City and provide the Safety Data Sheet for all such materials and substances.

#### **IV. OBLIGATIONS OF CONTRACTOR**

- A. Contractor shall be responsible for performing the Work as described herein. All such Work shall be performed with due care and diligence and in accordance with the requirements of this Contract.
- B. Safety and Security.
  - 1. Contractor shall, during performance of the Work, initiate, maintain and supervise all safety and health precautions and programs necessary to comply with Applicable Laws and reasonable requirements of the City. A project health and safety manual will be issued by Contractor prior to commencing on site activities.

2. City shall provide the necessary security at the Project.

C. Supervision of Work.

1. Contractor shall supervise and direct the Work and shall be responsible for (i) all construction means, methods, techniques, sequences and procedures; (ii) coordinating all portions of the Work, (iii) safety; and (iv) the acts and omissions of all its employees and all Subcontractors, their agents and employees and all other persons performing any of the Work.
2. Contractor shall use reasonable efforts to preserve and protect the Work and to prevent injuries to persons in connection with the Work at the Project.

D. City Access. City and Contractor recognize that the Project is located within a joint-use area. Contractor shall provide City with unrestricted access to the Project Site throughout the period of construction to enable City to operate existing facilities and City will provide Contractor with reasonable access to perform the Work and shall not hinder, impact, or interfere in Contractor's ability to progress the Work. However, Contractor's access to the Project Site will be subject to appropriate restrictions concerning security and safety. City and Contractor shall advise the other Party upon receipt of any notice of or request for inspection by any Governmental Authority responsible for application or enforcement of any Applicable Laws with access to the designated Project Site areas throughout the term of this Agreement.

E. Laws and Regulations. City and Contractor, as required for each to perform its respective obligations hereunder, shall comply with all Applicable Laws.

F. Emergencies. In the event of any emergency endangering life or property, Contractor shall take such immediate action as may be reasonable and necessary to prevent, avoid or mitigate damage, injury or loss, and shall report to City as soon as possible any such incidents or exposures, including Contractor's response thereto. Contractor shall provide training to its Site Representative and staff as reasonably required to prepare them to deal with emergencies in accordance with the Contractor's safety program. When Contractor or its authorized representative is not present to give direction during an emergency, instructions may be given by City and shall be received and carried out by the person(s) in charge of the particular part of the Work affected thereby. Contractor shall be liable for the reasonable attendant costs associated with such emergency.

G. Housekeeping. Contractor shall keep the Project reasonably free from accumulation of waste materials or rubbish caused by Contractor's operations. At the completion of the Work, Contractor shall remove from and about the Sites, Contractor's temporary construction facilities, tools, construction equipment, machinery, surplus materials, waste materials and rubbish. If at any time City requests Contractor to take remedial action to comply with this provision and Contractor fails to commence such remedial action within five (5) business days after written Notice to the Contractor, City may take remedial action and any reasonable cost incurred for such remediation shall be charged to the Contractor.

#### H. Storm Water Erosion and Sedimentation Control.

1. Contractor shall be responsible for the prompt and proper control of storm water, erosion, and sedimentation across, on, and from the Project Site and shall ensure that all related control devices installed by Contractor remain intact and maintained through Substantial Completion in accordance with the issued permit.
2. With respect to the storm water erosion and sedimentation control, Contractor shall be entitled to a Change Order in accordance with Article VIII for any costs or schedule impacts incurred as a result of complying with additional or more burdensome requirements in the permit to be provided by the City and not specifically included in the City's original Technical Specifications set forth in Exhibit A.
3. Contractor shall be liable for any and all penalties, fines, damages, and restitution payments which are assessed against the City by any federal, state, or local governmental entity or by any court of proper jurisdiction resulting or arising from failure to properly control storm water, erosion, or sedimentation across, on, or from the Project Site to the extent caused by Contractor.

#### I. Contractor Responsibility for the Work and CFE.

1. Commencing on the date of Contractor's initial mobilization to the Project, the Contractor shall assume responsibility for the unloading of all CFE subsequently delivered to that Site. Subject to sub-section 2 below, all such CFE shall be under the charge, custody, and care of the Contractor. Contractor shall take every precaution to preserve the material condition of the CFE and to protect the Work and the CFE from damage by the elements or from any cause whatsoever and shall repair and make good at Contractor's own expense any damage caused by Contractor, provided however, should any damage to CFE be covered by the All Risk Builders Insurance, Contractor shall obtain written approval from the City prior to commencement of such repairs.
2. Prior to taking receipt of the CFE, the City's Site Representative, in the company of the Contractor's Site Representative, shall be afforded an opportunity to view and inspect such CFE; and such Representatives shall make note, on a form to be provided by the City, of any visually apparent existing damage to, or irregularities in, the material condition of, the CFE, which damage or irregularities shall not be the responsibility of Contractor. Contractor shall not be responsible for any damage or irregularities which would not have been revealed by visual inspection. The City's Site Representative may elect to open any CFE shipments to allow further inspection of the contents.
3. Title to all or a portion of the materials, equipment, and supplies provided by the Contractor and other components of the Work shall pass to City upon Substantial Completion. Contractor shall retain care, custody and control of such materials,

equipment, supplies and components until Substantial Completion of the Work or until Partial Occupancy as defined below, whichever occurs first. Such transfer of title shall in no way affect City's and Contractor's rights as set forth in other provisions of this Contract. Risk of loss of the Work will transfer to City as provided herein upon Substantial Completion, or, if any portion of the Project is earlier occupied by City ("Partial Occupancy"), then the risk of loss of the applicable portion of the Project shall pass to City on the date of Partial Occupancy. Notwithstanding the foregoing, if any loss or damage is covered by builder's risk or other property insurance maintained or required to be maintained by City pursuant to this Contract, then any insurance proceeds paid on account of such loss or damage shall be applied to the cost of repair or replacement of such loss or damage.

J. Field Technical Support and CFFTS.

1. The City, under the terms and conditions of contracts between the City and suppliers of CFE, will provide certain CFFTS for use by Contractor. Exhibit K outlines the CFFTS allocated for Contractor's use and the terms and conditions of the CFFTS.
2. CFFTS will be available and provide supervision at the Project Site during the delivery and off-loading of the MAN Engines and Generators, ensuring the required storage procedures are properly implemented by the Parties.
3. Contractor shall cooperate with City in coordinating the use of CFFTS to ensure that the CFFTS is efficiently utilized so as to remain at or below the allocation that has been identified. However, should the allocation of CFFTS be exceeded through no fault of Contractor, Contractor shall have no liability for any extra cost incurred by City.

K. Cooperation and Collateral Work. Contractor shall be responsible for coordinating the nature and extent of any simultaneous, collateral, and essential work at or adjacent to the Project by others that may impact performance or completion of the Work by Contractor. City, its workers and contractors, and others shall have the right to operate within or adjacent to the Project during the performance of such work. The City, the Contractor, and each of such workers, contractors and others, shall coordinate their operations and cooperate to minimize interference. Contractor will be entitled to additional compensation and/or extension of time from City resulting from simultaneous, collateral, essential, or additional work, or additional time, expended as a result of, or caused by, such work by others that impacts Contractor's Work, which was not planned for as part of Contractor's Proposal.

L. Periodic Reports. The Contractor shall attend weekly on-site progress meetings, conducted by the City, to discuss current and future Work items and schedules, as well as critical issues, that could affect the cost or progress of the Work. Contractor shall furnish to the City all data that it has available that is necessary or desirable to allow City to be fully apprised of the status of the Work.

M. Safety Data Sheets. Prior to bringing any chemicals/substances on the Site(s), Contractor shall provide City with copies of current Safety Data Sheets (SDS).

N. Miscellaneous.

1. Contractor shall, if reasonably requested to do so by City for cause, remove or cause to be removed from a Site any employee of Contractor or of a Subcontractor.
2. Contractor shall use all reasonable efforts to maximize its purchases of materials and supplies for the Work from vendors and suppliers based in the City and surrounding service areas and shall outline such efforts as part of Contractor's monthly report.

## V. **OBLIGATIONS OF CITY**

A. Access to Site. City shall furnish or cause to be furnished to Contractor full and legal access to and use of the Project and all necessary rights of way and easements, and reasonable access in order to perform the Work. City shall also ensure that other persons allowed access by City (other than Contractor, its Subcontractor, and its representatives and agents) do not interfere with the progress of the Work.

B. City Permits. City shall obtain all environmental and building permits or certifications required for the Work. Contractor to obtain the Soil Erosion Control Permit, as designed by the City's engineer.

C. City shall provide the following:

1. Reasonable amounts of service water and potable water at the pressures and volumes available at the Site.
2. Temporary construction power in accordance with the City's Technical Specification and drawings.
3. City Furnished Equipment (CFE), in accordance with Exhibit K and the Project Schedule.
4. City Furnished Design Documents (CFDD), in accordance with the Project Schedule.
5. Site Security
6. Clear access to the Work tie-in points (reference drawing 30-0000-4001\_C)

## VI. **TIME OF PERFORMANCE and DELAY DAMAGES**

- A. Contractor shall promptly perform the Work in accordance with the Project Schedule, as the same may be amended by the Parties. The date of achieving Substantial Completion shall be of the essence in the performance of each Party's obligations under this Contract. The Project Schedule provides for achieving Substantial Completion on or before December 23, 2022.
- B. The Parties agree that the damages sustained by City in the event that Contractor fails to achieve Substantial Completion in accordance with the Project Schedule would be difficult, if not impossible, to ascertain. Therefore, the Parties agree that if the Contractor fails to achieve Substantial Completion on or before the applicable dates set forth in the Project Schedule, Contractor shall pay to City, as liquidated damages and not as a penalty, liquidated damages for each day, or portion thereof, after the scheduled date of Substantial Completion is achieved:
- An amount equal to Thirty-Five Thousand Five Hundred Dollars and 00/100 (\$35,500.00) for each day after the scheduled date of Substantial Completion ("Delay Damages"); provided, however, that Delay Damages shall not start to accrue until January 6, 2023.
- C. Delay Damages shall be the sole and exclusive remedy of the City for any delay of the Contractor.
- D. At such time as Contractor has determined that a System is ready for the City to commence commissioning activities, Contractor shall submit a full and complete Turnover Package for that System to the City. The City shall review each Turnover Package and, within five (5) business days following delivery to the City, shall, in writing, either (i) accept the Turnover Package, (ii) conditionally accept the Turnover Package pending correction of defective, non-conforming or incomplete Work, that does not preclude commencement of commissioning activities, or (iii) reject the Turnover Package. If the City conditionally accepts or rejects the Turnover Package, it shall provide written notice to Contractor identifying the defective, non-conforming or incomplete Work at issue. Contractor shall thereafter promptly correct all such defective, non-conforming, or incomplete Work and shall resubmit the Turnover Package to the City. After such resubmission, the foregoing review and notice process shall be followed. If the City conditionally accepts or rejects a resubmitted Turnover Package, this resubmission process shall continue until the Turnover Package is accepted by the City.
- E. Subject to Article VI. F., a System shall be deemed Substantially Complete at such time as the City, in writing, accepts or conditionally accepts the related Turnover Package. At that time, Contractor shall relinquish and grant to City, and City shall accept, full and exclusive custody and control of that System, responsibility for operation of that System, and risk of loss in relation to that System.
- F. Should the City determine, after the Site is deemed to have achieved Substantial Completion, that, as a result of Contractor's fault, there is defective, non-conforming or incomplete Work with respect to a System at that Site that impacts the ability to commence

and prosecute commissioning and start up activities in a timely manner, the following shall occur with respect to that System: (i) the City shall provide written notice of that determination to Contractor and Substantial Completion status will be deemed revoked; (ii) the Site will no longer be deemed to have achieved Substantial Completion; and, (iii) exclusive custody and control, responsibility for operation, and risk of loss subject to limitations described in Article XV. shall revert to the Contractor. Contractor shall then promptly correct all such defective, non-conforming, or incomplete Work and shall resubmit the affected Turnover Package to the City. Thereafter, the review process set forth in Article VI. D. with respect to resubmission of Turnover Packages shall be followed until the City has accepted the Turnover Package.

G. In no event, shall Delay Damages exceed five percent (5%) of the Contract Price.

## **VII. PRICE and PAYMENTS**

- A. City shall pay Contractor Sixteen Million Eight Hundred Thirty-Seven Thousand Two Hundred Forty-Two Dollars and 00/100, (\$16,837,242.00), (“Contract Price”) for performance of the Work in accordance with the requirements of the Contract. City shall pay Contractor milestone payments in accordance with the Payment Schedule set forth in Exhibit D for performance of the Work strictly in accordance with the requirements of the Contract. Contractor’s price does not include any state or local sales, use, excise, or other taxes of like nature.
- B. Contractor shall submit Proper Invoices no later than the 10<sup>th</sup> day of each month, covering Work performed during the prior month based on percentage completion of items set forth in the Payment Schedule. City shall pay all such Proper Invoices in accordance with the Local Government Prompt Payment Act, Section 218.70, et seq., Florida Statutes, unless otherwise provided in this Article. All payments shall be made in available funds in US Dollars, and shall be made by electronic transfer to Contractor’s designated bank in accordance with such payment instructions attached hereto as Exhibit C and as may be amended by Contractor from time to time, subject to prior written notice to City. If City fails to pay invoiced amounts within forty-five (45) days after delivery of invoice, Contractor, at its sole discretion, may suspend Work hereunder or may initiate collections proceedings, without incurring any liability or waiving any right established hereunder or by law.
- C. Contractor shall be responsible for payment of all taxes and governmental fees, if any, associated with provision by the Contractor of the equipment or materials and supplies, any services, and any Work in accordance with the Contract.
- D. City shall have the right to deduct, offset against, or withhold from sums or payments otherwise due Contractor any reasonable sums or amounts which Contractor may owe to the City pursuant to the terms and conditions of the Contract, as a result of breach or termination of this Contract.



- E. At such time that Contractor has achieved Final Acceptance, as more fully described in Article X hereof, Contractor may submit an invoice for final payment.
- F. The City will pay, via electronic means, all Proper Invoices within ten (10) Business Days of receipt. Such payments will be subject to audit by the City following payment. Payments by the City will be net of the amounts invoiced for any payment items disputed by the City and any adjustments as a result of invoice audits. Should either Party fail to make timely reimbursement, all amounts due will be subject to interest at the rates set forth in the Florida Prompt Payment Act, Section 218.70, et seq, Florida Statutes.

## **VIII. SCOPE CHANGES**

- A. City may, at any time by written Notice to Contractor, order a Scope Change. Such Notice shall provide a detailed summary of the subject Scope Change(s). Upon receipt of such Notice, the Contractor shall prepare an estimate of the impact of such Scope Change(s), including any associated adjustment of the Contract Price, adjustment of the Project Schedule, and any other required changes to the Contract. All agreed Scope Changes shall be set forth in adequate detail, in an amendment to the Contract; provided, however, that Scope Changes totaling an amount of Two Hundred Thousand Dollars and 00/100 (\$200,000.00) or less may be aggregated into a single amendment to the Contract to be executed by the Parties prior to Final Acceptance.
- B. Contractor may request a Scope Change, in writing, if it believes a failure of the City to perform its obligations under the terms of this Contract, including but not limited to delivery of CFE and CFDD, a City Caused Delay, Differing Site Conditions, Force Majeure, or errors, defects, discrepancies, omissions or changes to Reliance Material, will require increased cost and/or additional time for the completion of the Work. Contractor shall be entitled to a Scope Change with respect to its Work, including without limitation its obligation to achieve Substantial Completion, and shall be relieved of its applicable obligations hereunder, if and to the extent that the Project fails to comply with any performance guarantees or otherwise fails to satisfy any specifications or requirements contained herein as a result of defects or deficiencies in the CFDD. Notwithstanding any other provision of this Contract, Contractor shall not be responsible for, nor have any obligations, responsibilities or liabilities to City for, any delays or deficiencies in the Work, the Project or the performance thereof to the extent such delays, defects or deficiencies arise out of the CFDD. To the extent that CFDD causes a material change in the scope of Work to be provided, Contractor shall not be required to perform such additional work or incur such additional costs unless a Scope Change is agreed to by the Parties. To the extent permitted by law, City shall indemnify, defend and hold Contractor and its subcontractors harmless from any claims, loss, liability, or damage (including reasonable attorneys' fees, costs, expenses, and expert fees) to the extent caused by or arising from the CFDD.
- C. All Scope Changes shall be documented in a manner acceptable to the City. No Work shall commence on any requested change until such time as both Parties have fully executed the applicable Change Order(s).

## **IX. PERFORMANCE BOND**

- A. At the time of execution of this Contract, Contractor shall deliver to the City a Performance and Payment bond to secure the strict and faithful performance by the Contractor, and its Subcontractors, of all the terms, covenants, and conditions of this Contract and the prompt payment of amounts due all persons supplying labor, services, equipment, or material used in performance of the Work, including any and all duly authorized modifications thereof. Such bond shall be issued in the amount of 100% of the Contract Price, without any deduction therefrom, and shall be issued in a form and by a surety acceptable to the City, all signed or countersigned by a registered Florida agent. The Contract Bond form of the City which has been reviewed by Contractor is acceptable for this purpose with the understanding that it, or any bond form used, will be revised (if necessary) to include the following provision:

**“This Bond is given to comply with Florida Statute §255.05, and any action instituted by a claimant under this Bond for payment must be in accordance with the notice and time limitation provisions in Florida Statute §255.05 (2).”**

- B. If notice of any change affecting the general scope of the Work or the provisions of the Contract (including, but not limited to, the Contract Price or the Project Schedule) is required, by the provisions of any bond or other performance security, to be given to a surety or other entity, the giving of any such notice will be the Contractor's responsibility, and the amount of each applicable bond or other performance security will be adjusted accordingly.

## **X. FINAL ACCEPTANCE**

- A. Final Acceptance shall be deemed to have occurred when:
1. Contractor has satisfactorily completed the Work in accordance with the terms of this Contract;
  2. All Punch List items have been completed and accepted by the City;
  3. Contractor has provided evidence satisfactory to City that all payrolls, equipment bills and other costs and expenses connected with or related to the Work have been paid or otherwise satisfied. Such evidence shall include, but may not be limited to, conditional lien waivers and general releases reasonably acceptable to the City. If Contractor is unable to obtain the necessary lien waivers and releases, Contractor, at the request of the City, agrees to promptly post additional bond or security acceptable to the City to cover any unpaid Subcontractor or Supplier payments, claims or disputes; and
  4. A Release of Claim substantially in the form contained in Exhibit J, Final Invoice, has been duly executed and acknowledged by Contractor and delivered to, and found to be acceptable by, the City.

## **XI. WARRANTIES**

- A. Contractor warrants and represents to City as follows:
1. The Work shall have been carried out in accordance with the Contractor's obligations under this Contract and shall be free from defects in workmanship and material for a period of one (1) year (the "Warranty Period") from the date of Substantial Completion; and
  2. Where the Work, or part thereof, is repaired, replaced or modified pursuant to this Article, said item or part shall be further warranted to be free from defects in workmanship and material until the expiration of a new Warranty Period from the date of completion of the remedy; provided however, in no event shall Contractor have any warranty obligations beyond twenty-four (24) months following the date of Substantial Completion; and
  3. That the Work is in compliance with Applicable Law.
- B. The City shall promptly notify Contractor in writing of any non-conformance in the Work. Upon City making the nonconforming work available to Contractor, Contractor shall promptly investigate and, if Contractor confirms that a warranty claim by City is supported, commence a remedy at Contractor's sole expense, by either repairing or replacing any defective or non-conforming portion of the Work.
- C. THERE ARE NO IMPLIED WARRANTIES APPLICABLE TO THE SERVICES, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ALL IMPLIED WARRANTIES ARE EXPRESSLY DISCLAIMED.
- D. It is expressly understood that the warranties contained herein shall not limit or waive Contractor's other obligations under this Contract.
- E. The Contractor shall not be held responsible for defects caused by lack of maintenance, unintended use, misuse, abuse, external accidents, alterations or repairs made or performed by any person or entity not under the control of Contractor, or other causes beyond the reasonable control of the Contractor. The warranty obligations of Contractor do not extend to any portion of the Work that is in an incomplete state at the time of any termination of this Contract. City understands that Contractor may challenge the existence of a defect or nonconformity requiring repairs or corrections covered by the Warranty provided under this Contract.
- F. If within the Warranty Period the City discovers and does not promptly notify the Contractor or give the Contractor an opportunity to test or correct defective or nonconforming Work, the City waives the Contractor's obligation to correct that defective

or nonconforming Work as well as the City's right to claim a breach of the warranty with respect to that defective or nonconforming Work. .

## **XII. INDEMNIFICATION**

Please see Exhibit F.

## **XIII. SUBSTANTIAL COMPLETION**

- A. When the Contractor considers the Work is substantially complete, the Contractor shall submit to the City the following:
  - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
  - 2. A list of remaining items to be completed or corrected. ("Punchlist").
- B. Within a reasonable time after receipt of such notice, the City will make an inspection to determine the status of completion.
- C. Should the City determine that the Work is not substantially complete:
  - 1. The City will promptly notify the Contractor in writing, giving the reasons, therefore.
  - 2. Contractor shall remedy the deficiencies in the Work and send a second written notice of Substantial Completion to the City.
  - 3. The City will re-inspect the Work to validate Substantial Completion has been achieved.

## **XIV. INSURANCE**

Please see Exhibit E.

## **XV. ALL RISK BUILDERS INSURANCE**

- A. The City shall maintain All-Risk Builders Risk Insurance on a standard "all-risk basis" (including, but not limited to, perils such as fire, collapse, flood, vandalism, weather, and earthquake) covering the Work (including, but not limited to, all associated real and personal property and all commissioning, start up and testing services) at a value equal to at least one hundred percent (100%) of the replacement value of the Work, CFE and CFFTS. Contractor shall be included as an additional named insured on such policy. Contractor and all subcontractors shall be a named insured under this policy and such policy shall contain waivers of subrogation in the benefit of all parties regardless of fault and all deductibles shall be paid by City. Contractor shall be given a copy of such policy for review upon request.
- B. Contractor shall immediately notify City if there are any damages sustained to CFE or the Work. Prior to Contractor initiating any repairs, Contractor shall consult with City and

obtain authorization for the required repairs. Contractor shall ensure adequate record keeping is maintained to demonstrate the full cost for any required repairs.

- C. Contractor agrees to cooperate with the City and its insurance companies in any investigation or review of any damages to CFE or to the Work, and any related claims, resulting from any risk described in Section XV. A. above.
- D. The All Risk Builders Risk Insurance shall include a waiver of subrogation in favor of the City, Contractor and all sub-contractors.
- E. Contractor provides All Risk Builders Risk Insurance as an Option to this Agreement for One Hundred Twenty-Five Thousand Dollars and 00/100 (\$125,000.00). If City elects this option, it will be executed under the Change Order terms set forth in Article VIII., Scope Change.

## **XVI. LIMITATION OF LIABILITY**

- A. Notwithstanding any other provision in the Contract, the total cumulative aggregate liability of Contractor, Subcontractors and their respective Affiliates, agents, and employees, arising out of the performance or non-performance of the Work whether based in contract, tort, negligence, strict liability, warranty, error or omission, shall in no event exceed one hundred percent (100%) of the Contract Price; provided, however, that such limitation shall not extend to any liability of Contractor for third party claims under Article XII.
- B. No Consequential Damages to City. In no event, whether based on breach of contract, warranty, tort, negligence, error or omission, strict liability or otherwise, shall Contractor, Subcontractors, or their respective Affiliates, officers, directors, agents or employees, be liable for any loss of profits or revenue, loss of use of any equipment, cost of substitute equipment, facilities or services, loss of power, cost of purchase power, loss of tax incentives or other tax benefits, inefficiency, downtime costs, or claims of customers of City for such damages, or for any other special, indirect, incidental, exemplary, or consequential loss or damages.
- C. No Consequential Damages to Contractor. In no event, whether based on breach of contract, warranty, tort, negligence, error or omission, indemnity, strict liability or otherwise, shall City, or its agents or employees, be liable for any loss of profits (other than loss of profits otherwise payable to Contractor under this Contract) or revenues, loss of use of any equipment, cost of substitute equipment, facilities or services, downtime costs, claims of Subcontractors of Contractor for such damages, or for any other special, indirect, incidental, exemplary, punitive or consequential loss or damages.
- D. Property Damage Limitation. Notwithstanding any other provision in the Contract, Contractor shall not be liable for damage to City property or existing City facilities except (i) to the extent such loss or damage results from Contractor's negligence or willful misconduct, and (ii) to a maximum aggregate amount, exclusive of proceeds from All Risk Builders Insurance, of Fifty Percent (50%) of the Contract value. City assumes all risk of

loss in excess of such amount and waives its rights of recovery and its insurer's right of subrogation in excess thereof.

- E. Supremacy. The provisions of this Article shall prevail over any conflicting or inconsistent provision(s) contained elsewhere in this Contract, except to the extent that such conflicting or inconsistent provision(s) further restrict or reduce the liabilities of the respective parties under this Contract.

## **XVII. TERMINATION FOR DEFAULT**

- A. City at its election and without prejudice to any other right or remedy, may notify Contractor to discontinue all Work under this Contract by delivery of Notice to Contractor in the event that:
  - 1. This Contract is assigned by Contractor without the written consent of the City; or,
  - 2. Contractor is insolvent or generally unable to pay its debts as they become due (or admits in writing that it is generally unable to pay its debt as they become due), makes a general assignment for the benefit of creditors, or in any way becomes subject (as debtor) to an order entered by a bankruptcy court for relief from creditors or to the appointment of a trustee or a receiver for a substantial portion of its assets; or,
  - 3. Contractor, at any time, has materially and repeatedly failed to comply with any terms or conditions of this Contract, provided that the City has previously delivered Notice of such failure to Contractor and Contractor either has failed to commence cure within ten (10) days after delivery of such Notice or has failed to thereafter diligently prosecute such cure within thirty (30) days after delivery of Notice by the City unless otherwise agreed by the Parties.
- B. Should City terminate this Contract pursuant to this Article, City shall pay Contractor for any portion of the Work performed prior to delivery of the initial Notice to Contractor, provided that such Work meets all requirements of the Contract. To the extent that City has paid for any portion of the Work that has not been delivered to City or otherwise performed by Contractor prior to the date of the Notice of termination, City, at its discretion, may elect to either (a) continue to receive delivery or performance of the Work upon full and complete payment for the Work, or (b) forego delivery or performance of the Work in return for a refund of the portion of the Contract Price attributed to such portion of the Work.

## **XVIII. TERMINATION FOR CONVENIENCE**

- A. City has the absolute right to terminate the Work or any portion thereof, at any time and for any reason, by giving thirty (30) Business Days' Notice to Contractor specifying the portion(s) to be so terminated and the effective date of termination. Contractor shall cease work on said portion of the Work on the effective date of such termination but shall continue to perform any unterminated portion (s) of the Work.

- B. If all of the Work is terminated for the City's convenience, Contractor shall, as agreed with City, take all actions reasonably required to protect and preserve the incomplete Work, remove from the Work Contractor's and Subcontractors' personnel, construction equipment and other temporary facilities, cancel purchase orders for and shipment to the Site of any then undelivered materials, terminate subcontracts, and diligently take all other actions required to minimize or eliminate expenditures for the terminated Work or portion(s) thereof. Such activities shall be completed within the shortest reasonable period after the effective date of the termination.
- C. If the Work is terminated for convenience in accordance with this Article, Contractor shall be entitled to compensation for the value of the Work performed at the date of the termination, in addition to any expense reasonably incurred by reason of termination of Contractor's activities, including but not limited to, the cost of terminating subcontractors, purchase orders or Contractor's demobilization costs. However, in accordance with Article XVI. B., the City shall not be liable for any consequential damages if the Work is terminated for convenience.

## **XIX. Change Events**

- A. "Force Majeure Event" means any cause which is beyond the reasonable control of either Party, including, but not limited to: delays that are not the result of either Party or its agents exercising rights under this Contract; natural disasters; fire; hurricanes; abnormally severe rain, snow or other inclement weather; tornadoes; extreme high winds; dust or sand storms; mudslides; lightning; flood; earthquake; explosions; acts of God; terrorism; epidemics or pandemics (including future impacts from COVID-19 or any variant thereof), acts of a public enemy; accidents; casualties; strikes, lockouts, or other labor disturbances; vandalism; public disorder or civil disturbance; blockages; insurrections; riots; war (whether or not declared); hostilities; sabotage; embargo; material shortages or unavailability; unusual delays in delivery; expropriation or confiscation; epidemic or quarantine or any other action or inaction by any governmental authority, including, but not limited to, the imposition of tariffs, and delays in processing or granting Contractor's permits. It is hereby expressly agreed that any action, inaction or omission by any utility or Government Authority preventing or delaying the granting of resolutions or permits or approvals which are necessary for the performance of the Work, shall be deemed a Force Majeure Event, provided that the affected Party has acted diligently in due time and manner with respect to such resolutions, permits or approvals and provided that such delay is not due to the fault of the either Party or its subcontractors. In the event either Party is impacted by an event of Force Majeure, the Project Schedule will be equitably adjusted and the Contract Price may also be equitably adjusted.
- B. Differing Site Conditions: Contractor shall promptly and, if feasible, before such conditions are disturbed, notify the City in writing of: (i) above ground, subsurface or latent physical conditions differing materially from those indicated in the Contract, or (ii) unknown physical conditions, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inhering in the work of the character

provided for in the Contract, or (iii) any unmarked or incorrectly marked underground utilities or facilities not correctly identified through the local one-call service or the Contract (collectively, "Differing Site Conditions"). The City shall promptly investigate the conditions. If it is determined that such conditions do materially differ and cause an increase in Contractor's cost of, and/or the time required for, performance of any part of the Work under the Contract, an equitable adjustment in price and time of performance shall be made and the Contract modified in writing accordingly.

- C. "Reliance Material" means documents or information supplied by City to Contractor, including the geotechnical report included in Exhibit A, at Attachment 3 thereto, and Contractor shall be entitled to rely upon such documents or information in Contractor's performance of the Work and which City represents to Contractor that Contractor will not be held liable and will be entitled to a Change Order adjusting the schedule and cost for any issue, delay or damage arising from errors, defects, discrepancies, omissions or changes of these documents or information. Contractor shall be entitled to a Scope Change equitably adjusting the time and cost of performance of the Work to the extent there is any error, defect, discrepancies, omission or change to the Reliance Material.
- D. "City Caused Delay" means delays or interference with the Work resulting from the acts or omissions of City, its separate suppliers or contractors, their subcontractors and employees or other parties for whom City may be liable, including City's Consulting Engineer or designers; the failure of City to acquire any of the permits or access and use rights for the site, which City is required to obtain pursuant to this Contract, including, without limitation, the failure to acquire such permits in a timely fashion so that Contractor may perform the Work; the suspension of the Work in whole or in part by City, except where such suspension is caused by the Contractor's failure to perform in accordance with this Contract; or the failure by City to complete its obligations in accordance with the Project Schedule, City's breach of this Agreement, or any other events or circumstances for which this Contract provides that Contractor is entitled to a change order. Contractor shall be entitled to a Scope Change equitably adjusting the time and cost of performance of the Work to the extent Contractor is impacted by one or more City Caused Delay(s).

## **XX. NOTICE OF CHANGE IN OWNERSHIP AND BANKRUPTCY**

- A. Contractor shall provide written Notice to the City of any ownership changes within ten (10) days of the time Contractor becomes aware that a change in ownership has occurred or is certain to occur.
- B. Contractor shall deliver written Notice to the City within five (5) days of the initiation of any bankruptcy proceedings. This Notice shall include a copy of the petition, the date on which the petition was filed, the identity of the court in which the petition was filed, and a listing of City contract numbers for all City contracts against which final payment has not been made.



## **XXI. MISCELLANEOUS**

- A. Assignment. Contactor shall not assign its rights and obligations under this Contract without the prior written consent of the City, which shall not be unreasonably withheld, but shall be free to subcontract any of the Work to others.
- B. Governing Law and Construction. The construction, validity and performance of this Contract shall be exclusively governed by the laws of the State of Florida, without giving effect to any conflicts-of-law rules requiring the application of the substantive laws of other jurisdictions. All titles or subtitles appearing herein have been inserted for convenience and shall not be deemed to affect the meaning or construction of any of the terms or provisions hereof. The language of this Contract shall be construed according to its fair meaning, not strictly for or against the City or Contractor, and not against either party as its drafter since both parties agree they had an equal hand in drafting this Contract. The singular shall include the plural; use of the feminine, masculine, or neuter genders shall be deemed to include the genders not used.
- C. Severability. The invalidity or unenforceability of any portion or provision of this Contract shall in no way affect the validity or enforceability of any other portion or provision hereof. Any invalid or unenforceable portion or provision shall be deemed severed from this Contract and the balance of the Contract shall be construed and enforced as if this Contract did not contain such invalid or unenforceable provision; provided, however, if any provision dealing with limitation of liability or exclusion of any remedy is held to be unenforceable or invalid, the Parties agree to renegotiate this Contract in good faith to give proper effect to the intention of the Parties as set forth in those provisions.
- D. Waiver. No failure by Contractor or City to insist upon strict performance of any term, covenant or condition of this Contract, or to exercise any right or remedy upon breach of any provision of this Contract, and no payment, acceptance of payment, performance, or acceptance of performance during the continuation of any such breach, shall constitute a waiver of any term, covenant or condition herein or a waiver of any subsequent breach or fault in the performance of any term, covenant or condition herein.
- E. Notices. All Notices to be given hereunder shall be in writing with delivery confirmed, and may be sent by registered mail, postage prepaid, or by hand delivery with signed acceptance, or by recognized overnight courier, or by facsimile transmission, confirmed by registered mail, hand delivery or recognized overnight courier, to the Parties as follows:

If to City:

Lakeland Electric  
3030 East Lake Parker Drive  
Lakeland, Florida 33805-9513  
Attn: Project Manager; David Holdener  
863-834-6649  
C 863-242-0202  
[David.holdener@lakelandelectric.com](mailto:David.holdener@lakelandelectric.com)

If to Contractor:

Casey Industrial, Inc.  
890 W. Cherry St.  
Louisville, Colorado 80027  
Attention: Keith Newell, Sr Director of Operations  
[knewell@caseyind.com](mailto:knewell@caseyind.com)

cc: [legal@wanzek.com](mailto:legal@wanzek.com)

Notices shall be effective when first received by the other Party (including but not limited to the time of facsimile transmission), so long as such receipt is subsequently confirmed. Either Party may, from time to time, by Notice sent or delivered in the manner provided above, specify a different address for Notices to it, and such change of address shall take effect upon such other Party's receipt of said Notice.

- F. Entire Contract. This Contract constitutes the entire agreement between the Parties with respect to the matters contained herein and all prior contract or arrangements between them with respect to such matters are superseded. Any oral or written representation, warranty, course of dealing or trade usage not contained or referenced herein will not be binding on the Parties. No amendment, modification or change of any of the provisions of this Contract shall be of any force or effect unless set forth in writing duly executed by the respective Parties hereto.
- G. Exclusive Representations and Interests. Neither City nor Contractor has made any representations, warranties or covenants with respect to the Work or otherwise except as expressly set forth herein.
- H. Public Records. The Parties acknowledge that the City is a governmental entity subject to the Florida Public Records Law (Chapter 119, Florida Statutes). The Parties further acknowledge that some, or all, of the materials or information provided by Contractor to the City will be considered a "public record" which the City, by law, is obligated to disclose upon request of any person for inspection and copying, unless the public record or the information is otherwise specifically exempt by statute. Should Contractor provide City with any materials which it believes, in good faith, contain information which would be exempt from disclosure or copying under Florida law, Contractor shall indicate that belief by typing or printing, in bold letters, the phrase "Proprietary Information" both on the initial page and on the face of each affected page of such material and shall submit to City both a complete and a redacted version of such material. Should any person request to examine or copy any material so designated, City will produce for that person only the redacted version of the affected material or page(s) thereof. If the person requests to examine or copy the complete version of the affected material or page(s), City shall notify Contractor of that request, and Contractor, within thirty-six (36) hours of receiving such notification, shall either permit or refuse to permit such disclosure or copying. If Contractor refuses to permit disclosure or copying, Contractor agrees to, and shall, hold

harmless and indemnify City for all expenses, costs, damages, and penalties of any kind whatsoever which may be incurred by City, or assessed or awarded against City, in regard to City's refusal to permit disclosure or copying of such material. If litigation is filed in relation to such request and Contractor is not initially named as a party, Contractor shall promptly seek to intervene as a defendant in such litigation to defend its claim regarding the confidentiality of such material. This provision shall take precedence over any provisions or conditions of the Contractor's Proposal and any provision of any other document relating to the disclosure of materials or information considered by the provider to be confidential or proprietary and shall constitute City's sole obligation with regard to maintaining confidentiality of material or documents, of any kind, or any other information provided by Contractor or its Affiliates or Subcontractors.

**IF THE CONTRACTOR 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: KEVIN COOK - DIRECTOR OF COMMUNICATIONS AT: PHONE: 863-834-6264, E-MAIL: KEVIN.COOK@LAKELANDGOV.NET, ADDRESS: ATTN: COMMUNICATIONS DEPARTMENT, 228 S. MASSACHUSETTS AVE., LAKELAND, FLORIDA 33801.**

In accordance with Florida Statute §119.0701, the Contractor shall keep and maintain public records required by the City in performance of services pursuant to the Contract. Upon request from the City's custodian of public records, Contractor shall provide the City with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided pursuant to Florida Statute Chapter 119 or as otherwise provided by law. Contractor shall ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the Contractor does not transfer the records to the City. Contractor shall, upon completion of the Contract, transfer, at no cost, to the City all public records in possession of the Contractor or keep and maintain public records required by the City to perform services pursuant to the Contract. If the Contractor transfers all public records to the City upon completion of the Contract, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of the Contract, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the City, upon request from the City's custodian of public records, in a format that is compatible with the information technology systems of the City.

- I. Venue and Jurisdiction. Any and all suits for any and every breach of this Contract shall be instituted and maintained in a court of competent jurisdiction in the County of Polk, State

of Florida or the U.S. District Court in and for the Middle District of Florida, Tampa Division.

- J. Dispute Resolution. In the event that a dispute arises between the Parties regarding the application or interpretation of any provisions of this Contract (including but not limited to whether or not an alleged default exists), the aggrieved party shall promptly provide Notice of the dispute to the other Party. The respective Project Manager's shall undertake in good faith to resolve the dispute. If they cannot resolve the dispute within ten (10) Business Days after delivery of such Notice, each Party shall cause representatives, senior to the Project Managers, to attempt to resolve the dispute. In the event the dispute cannot be resolved within twenty (20) Business Days after the Notice of the dispute was first given, the Parties may utilize a mutually agreeable independent third party, with expertise in the area of dispute, to assist in resolving the dispute. If the Parties are unable to resolve the dispute within forty (40) Business Days after Notice of dispute was first given, each Party may then pursue all rights and remedies available under this Contract, in equity, or at law.
- K. Trade Usage. Words, terms and abbreviations which are not otherwise defined herein and have well-known technical, trade or industry meanings are used in the Contract in accordance with such established meanings. References to the plural include the singular and references to the singular include the plural.
- L. Reasonableness Standard. All determinations, consents, reviews and approvals to be granted and conducted by the Parties under this Contract and any other acts calling for the exercise of discretion shall be performed in good faith and, unless otherwise so specified, under a standard of reasonableness that is consistent with normal industry practices for the type of work involved. Where time periods are not specified, a reasonable period of time shall be allowed.
- M. No Third Party Beneficiary. It is the intent of the parties hereto that this Contract is solely between the parties hereto, and no member of the public or any person or entity not a party to this Contract shall have any rights or privileges hereunder as a third party beneficiary or otherwise.

*[REMAINDER OF PAGE INTENTIONALLY LEFT BLANK]*

IN WITNESS WHEREOF, the Parties hereto have caused this Contract to be duly executed by their duly authorized representatives as of the day and year first mentioned above.

**CITY OF LAKELAND**

Attest:

By: \_\_\_\_\_  
Kelly S. Koos, City Clerk

By: \_\_\_\_\_  
H. William Mutz, Mayor

Approved as to form and correctness:

By: \_\_\_\_\_  
Palmer C. Davis, City Attorney

**CASEY INDUSTRIAL, INC.**

Attest:

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

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

Name: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

## **EXHIBITS**

**EXHIBIT A**

**TECHNICAL SPECIFICATION M-8537**

CASEY INDUSTRIAL, INC. (Contractor) proposal for  
RFP No. 2136 is modified as follows:



**McIntosh Power Plant  
McIntosh Reciprocating Engine (RICE) Project**

**Specification M-8537**

**Underground General Work Contract**

**Issue Purpose: Conformed**

**Revision D**

**Issue Date: July 29, 2022**

**Project No.: A14166.002**

TECHNICAL SPECIFICATION PREPARED BY:







**SECTION 000106**  
**ISSUE SUMMARY AND APPROVAL PAGE**  
**UNDERGROUND WORK SPECIFICATION**  
**FOR THE MCINTOSH RECIPROCATING ENGINE PROJECT**  
**AT THE MCINTOSH POWER STATION**

<u>Rev.</u>	<u>Purpose of Issue</u>	<u>Date</u>	<u>Sections Affected</u>
A	Review	03-10-2022	All
B	Bid	04-14-2022	All
C	Bid	06-23-2022	Attachments 4, 5, 6 and 9
D	Conformed	07-29-2022	ALL

This is to confirm that this Specification has been prepared, reviewed, and approved in accordance with Sargent & Lundy’s Standard Operating Procedure SOP-0407, Specifications, which is part of our Quality Management System.

**Mechanical Sections**

<u>Rev.</u>	<u>Prepared By</u>	<u>Reviewed By</u>	<u>Approved By</u>
D	William Sheeren	Noah Kadera	

\_\_\_\_\_

**Structural Sections**

<u>Rev.</u>	<u>Prepared By</u>	<u>Reviewed By</u>
D	Joanna Marszalek	Matthew Rosecrans

\_\_\_\_\_

**Civil Sections**

Lauren Circolone

<u>Rev.</u>	<u>Prepared By</u>	<u>Reviewed By</u>
D	Vasu Patel	Michael Turner

\_\_\_\_\_

**Geotechnical Sections**

<u>Rev.</u>	<u>Prepared By</u>	<u>Reviewed By</u>
D	Travis Constantine	Roger Wu

\_\_\_\_\_

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**Electrical Sections**

<b><u>Rev.</u></b>	<b><u>Prepared By</u></b>	<b><u>Reviewed By</u></b>
D	Scarlett Ta	Russell Kalins

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**SECTION 000107**

**CERTIFICATION OF SPECIFICATION PAGE**

**UNDERGROUND GENERAL WORK CONTRACT**

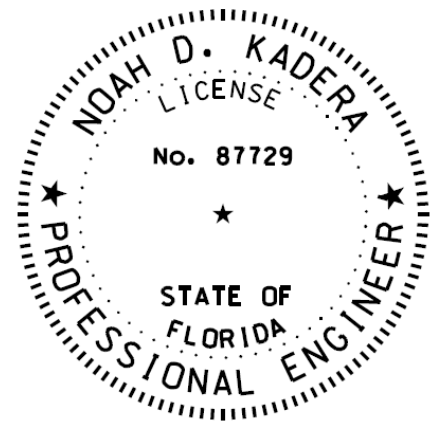
**FOR THE MCINTOSH RECIPROCATING ENGINE PROJECT  
AT THE MCINTOSH POWER STATION**

Sargent & Lundy, L.L.C. is registered in the State of Florida to practice engineering.  
The registration number is CA-6938.

I certify that the Mechanical Sections (Division 00, 01, 09, 40 and Sections 330302, 330303, and 337119) of this Specification were prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Florida.

Certified By: \_\_\_\_\_ Date: \_\_\_\_\_

Seal



This item has been digitally signed and sealed by Noah D. Kadera on the date adjacent to the seal.

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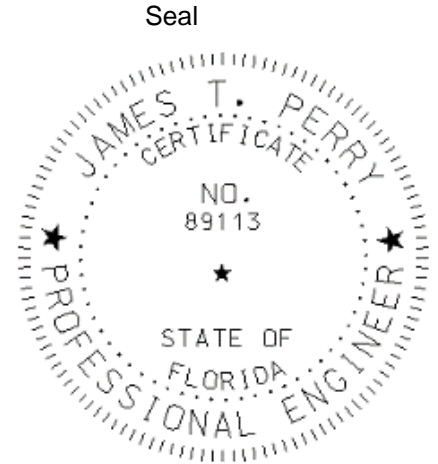


I certify that the Civil Sections (Division 00, 01, 31, and Sections 330301) of this Specification were prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Florida.

Certified By: \_\_\_\_\_ Date: \_\_\_\_\_

This item has been digitally signed and sealed by James T. Perry on the date adjacent to the seal.

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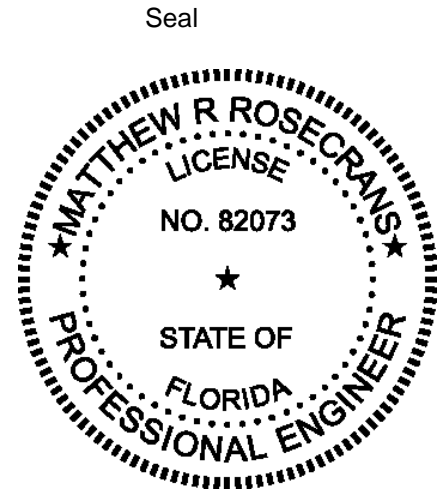


I certify that the Structural Sections (Division 00, 01, 03, 05, 07, and 09) of this Specification were prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Florida.

Certified By: \_\_\_\_\_ Date: \_\_\_\_\_

This item has been digitally signed and sealed by Matthew Robert Rosecrans on the date adjacent to the seal.

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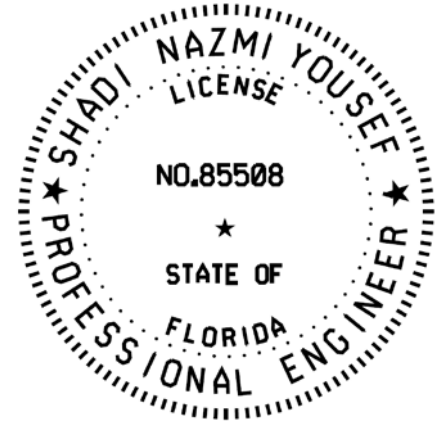




I certify that the Electrical Sections (Division 00, 01, 26 and Section 337119) of this Specification were prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Florida.

Seal

Certified By: \_\_\_\_\_ Date: \_\_\_\_\_



This item has been digitally signed and sealed by Shadi Nazmi Yousef on the date adjacent to the seal.

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**TECHNICAL SPECIFICATION FOR  
UNDERGROUND GENERAL WORK**

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END OF SECTION 000110

000110-2



**SECTION 011100**  
**SUMMARY OF WORK**

**PART 1 - GENERAL**

101. **PROJECT INFORMATION**

- 101.1 Owner: The City of Lakeland, on behalf of its municipal utility, Lakeland Electric
- 101.2 Consulting Engineer: Sargent & Lundy L.L.C. (S&L)
- 101.3 Project Name: McIntosh Reciprocating Engine (RICE) Project
- 101.4 Project Location: 3030 E Lake Parker Dr., Lakeland, FL 33805

102. **DESCRIPTION OF THE PROJECT AND GENERAL BACKGROUND**

- 102.1 The City of Lakeland, on behalf of its municipal entity, Lakeland Electric, is installing a new 120MW reciprocating internal combustion engine (RICE) plant at the existing C.D. McIntosh Jr. Power Plant (McIntosh Plant) brownfield site located at 3030 E Lake Parker Drive, Lakeland, FL 33805. The project includes detailed design, procurement and construction of a complete natural gas fired RICE generation facility. Six (6) reciprocating engines will be installed for this project and the project will include the installation of ancillary buildings and equipment.
- 102.2 In general, this Specification and the drawings referenced herein cover the technical requirements for the underground general work contract.

103. **SCOPE OF WORK**

- 103.1 The Work shall include the tasks identified in the Division of Responsibility (DOR) Matrix included in Attachment 9 complete (i.e., design, procure material, fabricate as necessary, deliver, store and construct or install) as specified herein for the underground general work contract.
  - a. Underground Process Piping
  - b. Underground Storm Sewers
  - c. Electrical Duct Banks
  - d. Rough Grading- per Approved FDEP permit drawings
  - e. Piling – Precast Concrete
  - f. Concrete Foundations
  - g. Anchor Bolts
  - h. Grounding and Cathodic Protection
  - i. Unloading and site storage of Engine OEM shipments in 2022 (containers and crates).





- 103.2 Contractor shall perform all Work specified herein, and all work which is normally considered part of the type of work covered by this specification, whether or not such work is specified herein. In addition, the work shall include but not be limited to the following:
- a. Receive, checking of packing list for completeness of shipment, checking labeling for completeness, unload, store and/or remove from storage as required, transport and handle as required, and erect in a neat and workmanlike manner, including making ready for successful service at the above project, and material as hereinafter specified, complete with all appurtenances and accessories furnished as an integral part of or shipped loose with the equipment, except where otherwise indicated herein as per the Division of Responsibility.
  - b. For the engine OEM equipment being delivered in 2022, Contractor shall receive, check the packing list for completeness of shipment, check labeling for completeness, unload, store and/or remove from storage as required, transport and handle as required, in a neat, organized and workmanlike manner. Contractor shall store the received materials in an orderly fashion to prepare for turnover to the above grade contractor. See Attachment 10 for a list of types of containers and boxes to be delivered from July 2022 to December 2022 from the engine OEM. Contractor shall perform all required preventative maintenance to store the materials per the engine OEM's direction during storage, including energizing electrical motors to prevent condensation during storage.
  - c. Exception: The engines, turbochargers, and generators will be unloaded and stored by the OEM heavy haul contractor.
  - d. Construction engineering and construction services required to perform or install the Work.
  - e. Surveying to ensure the Work is located as indicated on the design drawings.
  - f. Furnishing all special erection and installation equipment and tools including any calibrated instruments required for monitoring and testing.
  - g. Maintaining the project site in a dry condition that includes dewatering of all excavations performed by the Contractor, redirecting any surface water as a result of rainfall or water generated by the installation Work. Any ground-water and/or surface water which requires removal from the area of work shall be disposed of in compliance with the zero discharge permit that is in place for the project site. The methods and proposed place of discharge shall be approved by the Owner prior to disposing of the water.
  - h. Excess excavated material shall be disposed of on site in a location designated by the Owner.
  - i. Any contaminated/hazardous materials found in the soil will be remediated by the Owner.
  - j. Construction fencing delineating the construction area (limits of impact) with orange construction fence along the perimeter of the construction limits consistent with 30-0500-3025.
  - k. Aggregate surfacing as required in laydown and parking areas indicated on 30-0500-3025.

011100-2



- I. Owner will provide trash receptacles at designated areas on site. Contractor to facilitate housekeeping and separating as necessary.
- m. Maintaining a record of the installation (i.e., as-built drawings) in accordance with the technical requirements of this specification.
- n. Furnishing the services of qualified personnel at the project site to perform field services, such as inspection, welding, and testing.
- o. Providing a qualified third party inspection service to monitor the quality of the work as indicated in Section 014500 of this Specification.
- p. Progress reporting as specified in the commercial terms and conditions.
- q. Daily site cleanup and disposal of waste and debris.
- 103.3 Contractor shall take all appropriate precautions to ensure the safety of all people working on site or visiting Contractor's fabrication shops. Contractor shall:
  - a. Comply with Owner's safety rules.
  - b. Submit a site-specific safety plan.
  - c. Submit a plan for maintaining adequate craft to safety professionals ratio.
  - d. Participate in safety committees and walkdowns as required by Owner.
- 103.4 Contractor is responsible for supplying their own temporary construction facilities, including offices, lunch rooms, change rooms, etc.
- 103.5 Interface and cooperatively work with Above Grade General Work Contractor (M-8538) after their mobilization late in 2022.
  - a. A Turnover meeting is required unless Contractor is also awarded M-8538 contract.
  - b. A detailed laydown plan of the OEM provided containers and boxes on the six engines is to be included in the Turnover meeting. Any shipments that have been identified as damaged shall be reported to the engine OEM at time of receipt. The damage report must be provided in the Turnover package, along with the actions by the OEM to resolve.
  - c. Owner supplied equipment that is not being erected by the Contractor shall also be included in the laydown plan.
- 103.6 Interface and cooperatively work with Coal Plant Demolition Contractor after their mobilization
  - a. During the 2022 work activities, the Coal Plant Demolition contractor will be working East of the project site and at the U3 cooling tower. Details to be provided at the pre-bid meeting by Owner.
  - b. These work areas are separated by temporary barricades to be provided by Owner along the East and North side of the MREP site.
- 103.7 Participate in Project Meetings, including but not limited to:



- a. Schedule and administer a pre-construction (prior to the start of work) and progress meetings.
  - a1. Agendas shall be prepared for meetings and shall be distributed four days in advance of meeting date.
  - a2. Minutes, including significant proceedings and decisions, shall be recorded and copies of minutes distributed to participants within four days after meetings
  - b. Weekly progress meetings and/or weblink meetings as progress of work dictates, but not fewer than two progress meetings per month
  - c. The Contractor and subcontractors will be required to attend a monthly progress meeting when called by the Owner to discuss work progress, coordinating, expediting, scheduling, and any problems.
- 103.8 The Work shall conform to the requirements of these specifications and shall be performed and supervised by personnel who are experienced and knowledgeable in the crafts and trades required by the Scope of Work. The Work shall be performed exclusively by the Contractor's trained and competent personnel or, where permitted, that of its subcontractor(s); and shall comply with all applicable safety laws, regulations, programs, and practices to ensure the safety of all people located on the work site, including the Contractor's personnel (or that of its subcontractor(s)) performing the Work.
- 103.9 Performance of the Work shall include all the labor, supervision, administration, management, material procurement, tools, installation and testing equipment, miscellaneous material, and consumables to furnish, detail, fabricate, deliver, unload, store, remove from storage, construct, erect and install the type of Work identified herein.
- 103.10 Provide all installation equipment and machinery, welding equipment, welding rods and all incidental items not shown or specified but reasonably implied for successful completion of the Work and in strict accordance with design drawings and Specifications, including inspection, testing and quality standards.
- 103.11 Inspection and tests specified in various Sections of this Specification shall be performed by personnel qualified to perform such inspections and tests.
- 103.12 Provide installation quality assurance and quality control submittals where required.
- 103.13 Prepare red-lined as-built drawings for review upon completion of the Work to document any variances between the construction issue of the design drawings and the actual installation. Finalize as-built drawings after the Owner and the Consulting Engineer review. Underground pipes shall be professionally surveyed prior to backfilling and provided as project documentation.
- 103.14 All other work, as indicated on the design drawings, as specified herein or as required to properly complete the Work.



104. MATERIAL AND SERVICES FURNISHED BY OTHERS

105. Refer to the Division of Responsibility matrix in Attachment 9 for work performed by Others and equipment furnished by Others to be installed by the Contractor.

105.1 The Contractor shall prepare specifications for all subcontracted items immediately after notification of award and shall award subcontracts in such time that shop detail drawings can be submitted to fulfill the requirements of the Project Schedule, and other requirements given in this Specification.

105.2 The Contractor shall complete all construction engineering work in accordance with the procedures and criteria specified herein, and to meet all local government requirements. The Owner and the Consulting Engineer reserve the right to examine the Contractor's engineering data in order to verify compliance with the requirements of this Specification. The Contractor shall submit any documentation requested by the Owner for the purpose of this verification, including, but not limited to, diagrams and documents associated with computer-aided analyses and programs. The Contractor's standard procedures will not be accepted as a substitute for any requirements specified herein.

105.3 Any design calculations and drawings prepared by the Contractor for the Work associated with erection and/or installation shall be performed by a Professional Engineer registered in the State of Florida. The calculations and drawings shall be sealed, signed, and dated by the same Professional Engineer. This shall also include Work associated with the stability of systems, structures, and components, whether existing or new and shall also apply to Contractor's temporary scaffolding, rigging, shoring, and bracing. The Professional Engineer shall visit the site to oversee that the scaffolding and rigging are installed and used in accordance with the intent of its design.

105.4 Temporary elevators and lifting devices used by the Contractor for the performance of the Work shall meet the applicable Federal, State, and local building code requirements. These plans shall be submitted to the Owner for review and acceptance.

105.5 Drawings shall not be scaled. Follow calculated dimensions in all cases.

106. DEFINITIONS

106.1 The term "indicated" shall mean "as shown, noted, called for, or specified," unless otherwise specifically stated.

106.2 The term "approve," "approved," or "approval" as used in this specification or referenced specifications shall be construed to mean "review" or "reviewed" when used in the context of the Owner or Consulting Engineer reviewing documents or deliverables from the Contractor.

106.3 The term "certified" shall be construed to mean certified by the Contractor unless specifically noted otherwise.

106.4 The term "Codes" means codes, standards or criteria which may be applicable to or affect the manner in which the Work must be detailed, fabricated, or tested, including without limitation those listed in Section 014219 of this Specification.



- 106.5 The term "Shop Inspector" means an employee or authorized representative of the Owner assigned to perform various inspections in the shops of the Contractor, or in the shops of the Contractor's suppliers, to ensure compliance with standards and criteria as required by this Specification.
- 106.6 The term "Design Drawing" means the Consulting Engineer's drawings indicating the Work to be performed.
- 106.7 The term "shop drawing" means the Contractor's or its subcontractor's drawings, including erection drawings, shop detail drawings, bills of material, bolt lists, etc.
- 106.8 The term "Review Status" refers to the numbered boxes on the document review stamp (refer to Attachment 8 of this Specification).
- 106.9 The term "related document" includes the Contractor's fabrication data, engineering data, hardware, schedules, etc.
- 106.10 The term "provide" shall be construed to mean furnish, fabricate, and deliver.
- 106.11 The term "per" shall be construed to mean in accordance with and/or required by.
- 106.12 The term "Work" means the material and services furnished to McIntosh Reciprocating Engine Project identified on the design drawings and as specified herein.
- 106.13 The term "approved equal" means an acceptable equivalent to a specified material that has been accepted by the Owner.
107. INTENT OF DOCUMENTS
- 107.1 The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the documents is to include all design, labor and material, equipment, and transportation necessary for the proper execution of the Work.
- 107.2 Discrepancies between the design drawings and the Project Specification, or errors or omissions or misdescription in either the design drawings or in the Project Specification, shall be referred to the Consulting Engineer for interpretation and adjustment prior to beginning fabrication. Do not proceed without the Consulting Engineer's written acceptance.
- 107.3 The Specification includes references to codes and standards of various governing organizations. These standards indicate the minimum requirements for the Work. Other national standards that are equal to the specified standards may be used for the Work. The Contractor is solely responsible for the Work and compliance with the specified standards.
108. PERFORMANCE OF THE WORK
- 108.1 This project is not pursuing Leadership in Energy and Environmental Design (LEED) Certified. However, the Contractor shall provide materials and employ construction practices that are sustainable to the greatest extent possible including disposal of waste.
- 108.2 The Contractor shall provide a representative that will input and provide daily force



reports and daily production reports.

- 108.3 The performance of the Work, as specified herein and as indicated on the design drawings, shall comply with the current safety and health standards authorized by the U.S. Department of Labor's Occupational Safety and Health Administration, as well as state and local jurisdictional requirements.
- 108.4 The Contractor shall take all appropriate precautions to ensure the safety of all people working on site or visiting the Contractor's fabrication shops.
- 108.5 The Contractor shall maintain the necessary skilled and qualified labor force for the Work to ensure the on time delivery of the fabricated material to the project site and the on time completion of the Work.
- 108.6 The Contractor's personnel shall be competent, capable, qualified, and able to perform the duties required to the satisfaction of the Owner. A supervisor vested with authority to make decisions binding on the Contractor shall be assigned to the task to resolve fabrication problems as they arise so as not to delay fabrication or delivery of the material or to resolve installation problems as they arise so as not to delay completion of the Work.
- 108.7 In the event of variation between the Consulting Engineer's Standards and this Specification or the design drawings, the Specification and design drawings shall govern. In the event of variations between the Specification and the design drawings, the design drawings shall govern.
- 108.8 The Contractor shall be solely responsible for advising the Consulting Engineer in writing of any conflicts between the Specification and the design drawings and the Contractor's drawings, including performance and levels of quality. The Contractor agrees that its obligations, liabilities, and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification and the design drawings.
- 109. **REGULATORY REQUIREMENTS**
- 109.1 The Contractor shall at all times be solely responsible for complying with all applicable laws, ordinances, regulations, and codes, including those relating to safety of all persons, in connection with the Work. No obligation of the Consulting Engineer shall impose upon them any duty to review the Contractor's compliance with safety measures.



110. PROTECTION OF PROPERTY AND PERSONNEL SAFETY

- 110.1 The Contractor shall take adequate precautions to protect existing structures, fences, pavements, above ground utilities and underground utilities and to avoid damage thereto. The Contractor shall, at its own expense, repair any damage caused by its operations.
- 110.2 The Contractor shall be responsible for determining what temporary support and bracing must be provided to support loads that the Work may be subjected to, including construction equipment and the operation of such equipment. The design of any temporary support determined to be required by the Contractor shall be prepared under the supervision of a Professional Engineer registered in the State where the Work is to be installed and shall be certified by that engineer.
- 110.3 The Contractor shall be responsible for the adequacy and safety of such support and bracing.
- 110.4 Shoring and bracing equipment and practices shall meet all OSHA requirements.
- 110.5 The Contractor shall conduct safety training of all its personnel (including any subcontractors) in accordance with the Owner's safety requirements (i.e., the Contractor Safety Training Program).

111. CLEAN-UP AND DISPOSAL OF DEBRIS

- 111.1 The Contractor shall be responsible for clean-up and disposal of all debris resulting from the installation work.
- 111.2 Clean up, disposal and site restoration, if required, shall be in compliance with the applicable requirements of all access permits. If any additional permits are required for disposal of debris, these shall be the responsibility of the Contractor.
- 111.3 Work areas shall be kept clean and orderly at all times with as little disturbance as possible to existing conditions. Upon completion of work at each site, all tools, equipment, material, and debris shall be completely removed and the area left in a clean condition.

112. EXISTING SITE CONDITIONS

- 112.1 The Owner has prepared the project site by clearing and grubbing the area and providing a suitable grade level from which the Work can be performed and will provide suitable site access. The Contractor shall inspect the site and notify the Owner of any deficiencies that would prohibit proper completion of the Work for resolution.
- 112.2 Existing Underground Obstructions:
  - a. The Owner has attempted to locate all of the known underground utilities and obstructions prior to performance of the Work and has relocated any potential interferences to the best of their ability.
  - b. If uncharted utilities or obstructions are encountered during the performance of the Work, the Contractor shall notify the Owner of any such uncharted utilities or obstructions that would prohibit proper completion of the Work for resolution.



- 112.3 Prior to performing any Work, in any part of the Project Site, and prior to installing any foundations or below grade utilities in the area of the Work, the Contractor shall make a thorough field check for the purposes of verifying existing conditions that may affect the Work. The Contractor shall include a thorough investigation of the potential interferences and difficulties that it may encounter in the proper and complete execution of the Work, including the field location and identification of underground and overhead utilities within and adjacent to the limits of the Work. The Contractor shall advise the Owner immediately of the discovery of any conditions, including the existence of underground and overhead utilities that may affect the timely and safe execution of the Work.
- 112.4 The Contractor further acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface material and obstacles, including underground or embedded utilities, to be encountered insofar as this information is reasonably ascertainable from an inspection of the site (including field location and identification of underground utilities) and reference drawings made available by the Owner, as well as from information presented by the drawings and specifications that are a part of the Contract, the character and extent of existing work within or adjacent thereto and any other work being performed thereon at the time of the submission of bids.
- 112.5 Should the Contractor fail to perform any of the obligations set forth above, the Contractor's later plea of ignorance of existing or foreseeable conditions which create difficulties or hindrances in the execution of the Work will not be considered as an excuse for any failure on the part of the Contractor to fulfill in every detail the requirements of the Contract nor will such a plea be acceptable as the basis of a claim for additional compensation.
- 112.6 The Contractor needs to be aware that some installation work may be performed in an area where headroom is limited. Refer to reference drawings to determine equipment headroom clearances.
113. VERIFICATION OF DIMENSIONS ON DRAWINGS AND MEASUREMENTS AT SITE
- 113.1 The Contractor shall make a thorough field check for the purpose of verifying existing conditions that may affect the Work, such as possible errors in work previously done by others, difficulties that might be encountered in the execution of the Work for any reason, and dimensions and other questions relating to interconnection of the Work with the existing construction.
- 113.2 The Contractor shall satisfy itself as to the accuracy of the dimensions of the existing construction as such dimensions relate to the dimensions given on any drawing issued by the Consulting Engineer. It shall be understood that neither the Consulting Engineer nor the Owner guarantee the exactness of such dimensions.
- 113.3 Should the Contractor discover any variation in the dimensions of existing conditions and the dimensions given on any drawings issued by the Consulting Engineers, the Contractor shall give immediate notice thereof to the Owner and the Contractor shall not proceed with the Work until such variation is resolved.
114. SOIL DATA
- 114.1 Subsurface investigations have been performed. The geotechnical information about the project site is included in Attachment 3 and indicates the general character of the





subsurface conditions. This information is made available for the Contractor's information and for interpretation of soil and water conditions that may be encountered at the site. The logs and test data that are provided are not to be taken as a complete description of the site soil and water information, but only display what was found in borings at the indicated locations. The Owner and the Consulting Engineer take no responsibility for the accuracy of this information.

115. DESIGN DRAWINGS

115.1 The design drawings prepared by the Consulting Engineer indicate the physical dimensions of the Work to be installed as defined by the Scope of Work and form a part hereof. Refer to Attachments 4-9 of this Specification for a list of the applicable design drawings.

116. REFERENCE DRAWINGS

116.1 The reference drawings assembled by the Consulting Engineer are for information only. Refer to Attachments 4-9 of this Specification for a list of the applicable Reference Drawings.

117. VENDOR SUPPLIED EQUIPMENT DRAWINGS

117.1 The vendor supplied equipment drawings assembled by the Consulting Engineer cover the equipment that will be furnished by Others for installation by the Contractor as defined by the Scope of Work and form a part hereof. Refer to Attachments 4-9 of this Specification for a list of the applicable vendor supplied equipment drawings.

END OF SECTION 011100



**SECTION 011900**  
**SITE DESIGN DATA**

**PART 1 - GENERAL**

101. **EXTENT**

101.1 This Section provides site design data and includes the following:

- a. Plant location.
- b. ASHRAE data.
- c. Natural phenomena design data.

102. **REFERENCE DOCUMENTS**

102.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents indicated in Section 014219, in addition to federal, state, or local codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the applicable additions, addenda, amendments, supplements, thereto, in effect as of the date indicated in Section 014219.

102.2 ASCE – American Society of Civil Engineers:

- a. 7-16 – Minimum Design Loads for Buildings and Structures

102.3 ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

102.4 ICC – International Code Council

- a. Adopted Building Code, FBC 2020 – Florida Building Code

102.5 NFPA – National Fire Protection Association:

- a. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances

103. **SYSTEM DESCRIPTION OR DESIGN REQUIREMENTS**

103.1 Location of Project Site:

- a. Address of Plant: McIntosh Power Station, 3030 E Lake Parker Dr, Lakeland, FL 33805.
- b. Location of Plant: McIntosh Power Station is located on the Lake Parker in Polk County, State approximately five (5) miles northeast of Lakeland, Florida.
- c. Nominal Project Site Latitude/Longitude: North 28.085090 degrees, West 81.930091 degrees



- c1. The Latitude/Longitude provided is only an approximate Project Site location and should not be used for permitting, design or construction purposes. Contact the Owner for detailed information.
  - c2. Nominal Project Site Elevation: 142'-0". The Elevation provided is only approximate and should not be used for permitting, design or construction purposes. The datum of the provided Elevation may not correspond directly to the onsite monuments and must be confirmed. Contact the Owner for detailed information.
- 103.2 ASHRAE Data:
- 103.3 Table 1-1 below lists the climate statistics, which are based on American Society of Heating, Refrigeration and Air Conditioning (ASHRAE) data.

**TABLE 1-1**  
**MCINTOSH POWER PLANT CLIMATE STATISTICS**

<b>Statistic(s)</b>	<b>Units</b>	<b>Value</b>	<b>Reference</b>
Project site elevation	ft. MSL	140	USGS
Mean annual dry bulb temperature	°F	73.2	Winter Haven; ASHRAE (2017)
Estimated MCWB for mean annual dry bulb temperature	°F	68.5	80% RH assumed
50-yr extreme high dry bulb temperature	°F	106.1	Winter Haven; ASHRAE (2017)
MCWB for the 50-yr extreme high dry bulb temperature	°F	82.7	Winter Haven; ASHRAE (2017)
50-yr extreme low dry bulb temperature	°F	21.7	Winter Haven; ASHRAE (2017)
MCWB for the 50-yr extreme low dry bulb temperature	°F	19.6	Winter Haven; ASHRAE (2017)
1% maximum dry bulb temperature on an annual basis	°F	92.8	Winter Haven; ASHRAE (2017)
Estimated MCWB coincident with the 1% dry bulb temperature	°F	75.1	Winter Haven; ASHRAE (2017)
99% dry bulb temperature on an annual basis	°F	52.1	Winter Haven; ASHRAE (2017)



Statistic(s)	Units	Value	Reference
Estimated MCWB coincident with the 99% dry bulb temperature	°F	41.0	Winter Haven; ASHRAE (2017)
Average annual precipitation (rainfall)	Inches	51.1	Winter Haven; ASHRAE (2017)

Note 1: The Latitude/Longitude and Elevation provided in Table 1-1 are that of the ASHRAE weather station and not those of the Project Site.

103.4 Natural Phenomena Design Data:

- a. Risk Category III (FBC 2020).
- b. Snow Loads:
  - b1. Basic Snow Load on Ground,  $p_g$ : 0psf
- c. Wind Loads:
  - c1. Exposure: C
  - c2. Basic Wind Velocity, V: 145 mph, 3-sec gust at 33-ft above the ground for Exposure Category C
- d. Seismic Loads:
  - d1. Maximum considered earthquake spectral response acceleration (0.2 second period)  
 $S_s = 0.057g$ .
  - d2. Maximum considered earthquake spectral response acceleration (1.0 second period)  
 $S_1 = 0.031g$ .
  - d3. Seismic Importance Factor,  $I_E = 1.25$ .
  - d4. Based on the information presented in the Geotechnical Report, the Project Site has been assigned to Site Class E.
- e. Rainfall: The rainfall design basis may vary for the different systems and system components. Precipitation amounts and intensities to be used with each design basis are to be obtained from industry accepted standards, NOAA ATLAS 14 Volume 9, or other recognized local standards.
- f. Temperature: Systems and system component design criteria which require ambient temperature extremes shall use the range from 19.6°F to 106.1°F for dry-bulb temperatures.
- g. Relative Humidity: The average annual relative humidity is 74.5 percent.



- h. Barometric Pressure: The average annual barometric pressure is 30 inches HgA based on a site elevation of 140 feet above mean sea level.
- i. Frost Depth:
  - i1. Per UFC 3-220-10N, the extreme frost penetration depth is 0".
  - i2. Fire protection shall have a minimum depth of cover (top of pipe) of 30" per the NFPA Standard.
  - i3. Pressure piping shall have a minimum depth of cover (top of pipe) of 36".

**PART 2 – PRODUCTS**

Not Applicable.

**PART 3 – EXECUTION**

Not Applicable.

END OF SECTION 011900



## **SECTION 013216**

### **PROJECT SCHEDULE**

#### **PART 1 – GENERAL**

##### **101. EXTENT**

101.1 This Section 013216 outlines the requirements for Project Controls which are to be set in place for the Owner to accurately and transparently evaluate the status of the Work with regard to the Contractor's schedule, cost and performance of the Work. Contained in this Section are Contractor's requirements for the Proposal Project Schedule, the Detailed Project Schedule, Resource Loading, Schedule Updates, Progress Reporting and Owner required and controlled schedule dates.

##### **102. GENERAL SCHEDULE REQUIREMENTS**

102.1 The Contractor shall employ and retain experienced personnel and, provide appropriate support to plan, develop, provide, and properly maintain schedules, progress reports, earned value information, estimate and budget development, plans, cost reporting, cost forecasting functions, and invoicing in accordance with requirements of the Contract, including the Project Controls requirements. These practices relate, among other things, to Planning and Scheduling, Progress Measurement and Earned Value, Cost Control, and Change Management of the Work. The Contractor is responsible for ensuring that Owner is informed at all times of the status of the Work, changes in personnel, changes in the Work scope, changes in the planned Work sequences, changes to the remaining Work schedule, unplanned interferences to performing the Work, and any actual or potential delays to the Work regardless of the source or reason.

102.2 The Contractor shall provide the name, email address, qualifications, experience, general contact information and title of its representative who is responsible for developing, accessing and maintaining the Contractor's schedule. Once submitted and approved by Owner, such designated person shall not be replaced without written approval by Owner.

102.3 Contractor must meet or exceed the Project Controls requirements and provisions detailed in the Contract, including those identified by this Section 013216.

102.4 The Contractor must have a formal policy that endorses the use of configuration management and defines key roles and responsibilities. The Contractor must also ensure that sufficient resources are provided to adequately implement the configuration management process. The Contractor should establish and document the configuration management requirements at the earliest practical time prior to initiation of the schedule development activities.

- a. Configuration Management is used to enforce four primary goals: (1) ensure that a disciplined approach is used in changing approved/issued documentation, (2) changes must be applied consistently through all impacted documents, (3) source documents are identified, and (4) the Baseline is maintained as current throughout the Project.

102.5 The Detailed Project Schedule shall be a CPM (Critical Path Method) schedule composed of respective detailed activities ("Detailed Activity(ies)") logically tied together to form a comprehensive single project schedule network.



102.6 The Contractor must work collaboratively within the Owner's Project Schedule System and with Owner's Project Controls Representative(s) (or Owner's Engineer Project Controls Representative) to ensure the requirements and provisions as identified by this Section 013216 are met.

102.7 Schedule Hosting Environment requirements are as follows:

- a. The Owner will provide the hosting environment where Contractor's Detailed Project Schedule will reside along with other Contractor and Supplier schedules which the Owner will incorporate to create a Master Project Schedule.
- b. The Contractor will have access to and maintain and update its portion of the Detailed Project Schedule. Access to the Owner Engineer's Primavera Project Enterprise System P6 database will be provided via a Web based service such as LoadSpring Solutions, LLC ("LoadSpring") or a Virtual Private Network (VPN) connectivity to the Owner's scheduling software.
- c. Identified Project team member will be provided with limited "write" access to the Master Project Schedule for their company only. At no time will the Contractor be allowed to alter any P6 activity relationships to or from other parties' Project Schedules maintained in the Owner's hosting environment.
- d. Contractor may begin development of their respective Detailed Project Schedule within its own Primavera P6 databases with the understanding that the Contractor's Detailed Project Schedule will be transferred to the Owner using an XER backup and be incorporated into Owner's Master Project Schedule after the Contractor's Detailed Project Schedule has been approved and accepted by the Owner as the initial Baseline. Once the Contractor's Detailed Project Schedule has been transferred, the Contractor shall access and maintain Contractor's Detailed Project Schedule within the Owner's Project Enterprise System.

102.8 New Schedules are to be created in a planning/developmental node. Titles for the new schedules should be structured using the following naming conventions:

Project ID	Project Name
01.29.01.01-XX-Y	Proposed Project Schedule (example)

The Project ID consists of the first 4 levels of the WBS, followed by a revision letter "XX" while under development. Once the schedule is approved by the Owner, the revision becomes a numeric value. The suffix "Y" is determined by the schedule type, where a "C" designates the current schedule, "BL" designates a baseline schedule, and an "A" designates an archived schedule.

102.9 Owner Activity Code Structure. Owner will provide, and Contractor shall utilize, an activity coding structure for the Project Schedule. In addition to Owner's codes, Contractor may utilize additional coding as may be required for Contractor's internal use and reporting. Owner's initial activity coding structure is identified upon award. Owner reserves the right to change and enhance Owner's schedule coding structure as Owner deems appropriate throughout the Project. Contractor will incorporate Owner's changes and enhancements to the Owner activity coding structure in the Detailed Project Schedule at no additional cost to the Owner.



102.10 The Contractor’s schedule shall be carried out in accordance with Table 013216-1 and the Submittal Schedule given in Section 013324 of this Specification. It shall be the Contractor’s responsibility to maintain the progress of its Work in accordance with the schedule.

Table 013216-1  
Owner-Required and Milestone Schedule Dates

No.	Item	Date	Liquidated Damages?*
1	Contractor Mobilization	08/03/2022	No
2	Stormwater Ponds Complete	08/26/2022	No
3	Site Preparation & Heavy Haul Modifications Complete	08/30/2022	No
4	Engine, Engine Hall, and Exhaust Gas Duct Structure Piling Complete	10/14/2022	No
5	SCR, Stack and GSU Piling Complete	10/19/2022	No
6	Engine Foundations Complete	12/06/2022	No
7	Engine Hall Foundations Complete	12/1/2022	No
8	Electrical Equipment Building Foundation Complete	01/04/2023	No
9	Balance of Plant Foundations Complete	12/06/2022	No
10	Underground Piping Complete	11/28/2022	No
11	Electrical Duct Banks Complete	12/22/2022	No
12	Complete All Punch List Work	01/11/2023	Yes
13	Complete Demobilization	01/8/2023	No

\*Contractor shall refer to the terms and conditions governing Liquidated Damages set forth in the Contract.

The term “Foundations Complete” is defined as the day after the seven (7) day curing period has been completed, for all items other than the Engine Foundations. In the case of the Engine Foundations, “Foundations Complete” corresponds to the date on which the concrete has achieved at least 75% of the specified compressive strength as determined by ASTM C1074 via the Maturity Method, or by testing field cured cylinder specimens.

Table 013216-2  
Owner-Controlled Schedule Dates

No.	Item	Date
1	Pre-Bid Walkdown (Non-mandatory)	04/26/2022
2	Proposals Due	05/16/2022
3	Estimated Contract Award	07/21/2022
4	Plant Available to Contractor to Begin Work	07/22/2022
5	Engine Hall Foundation Issued for Construction	07/25/2022

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No.	Item	Date
6	Heat Recovery Buffer Tank Foundation Issued for Construction	08/02/2022
7	Electrical Building Foundation Issued for Construction	08/08/2022
8	Radiator Foundation Issued for Construction	08/11/2022
9	Hall Ventilation Equipment Foundations Issued for Construction	09/06/2022
10	Oily Water Separator Delivery	09/28/2022
11	Sanitary Lift Station Delivery	11/09/2022
12	Complete Installation	12/31/2022

103. PROPOSAL PROJECT SCHEDULE REQUIREMENTS

103.1 The Contractor shall submit with its proposal a comprehensive Proposed Project Schedule. The Proposed Project Schedule shall be of sufficient detail to identify, at a minimum:

- a. The general approach and sequence of the Work, as outlined in the Installation Plan to be developed by the Contractor in accordance with the Scope of Work given in Section 011100 and Attachment 9 of this Technical Specification.
- b. Anticipated award date
- c. The Owner-Required Schedule dates as set forth in 013216-1.
- d. The Owner-Controlled Schedule Dates presented in 013216-2.
- e. The material delivery dates as identified in 013216-1.
- f. Construction-related engineering.
- g. Material procurement by Contractor.
- h. Submittal of shop detail and erection drawings for components supplied by Contractor.
- i. Significant interface points between the Owner and Contractor, including material and/or components that will be provided by the Owner or Contractor.
- j. Planned delivery dates for material and components furnished by Contractor.
- k. Start and completion of fabrication periods for material furnished by Contractor.
- l. Start and completion for each key component’s fabrication, assembly and/or subassembly on site.
- m. A Proposal Project Schedule that provides sufficient detail to describe the Detailed Activities for all planned tie-in Outages
- n. Submittal of all other information as defined in Section 013324 List of Submittals

103.2 The Proposal Project Schedule shall be in the form of a bar chart or Gantt chart, and must show the logical flow and progression of the Work and the anticipated critical



path(s). As a minimum, the work associated with engineering, material procurement, construction, outage, and completion shall be segregated.

104. DETAILED PROJECT SCHEDULE DEVELOPMENT

104.1 Contractor's schedule shall be executed in accordance with Table 013216-1, the schedule provided in the Contract and the Submittal Schedule in Section 013324. It shall be the Contractor's responsibility to maintain the progress of its Work in accordance with the schedule.

104.2 Schedules provided by Contractor are subject to Owner review, comments, and approval as outlined in Section 105 below. The Owner's review or approval of any schedule is solely for the purpose of assuring the Owner that the applicable Contractor's schedule submission meets the intent of this Section. The Owner's review or approval does not constitute a guarantee or agreement by the Owner that the submitted schedule is complete or is otherwise executable by the Contractor.

104.3 Project Controls Kickoff Meeting. Within seven (7) days of contract award, Contractor and Owner shall conduct a Project Controls Kickoff Meeting including their respective Project Controls, designated Project Management personnel, information technology and finance personnel, to discuss the Project Controls, schedule, hosting access, schedule links, EVMS, invoicing, cost reporting, change management, risk management and asset management requirements and Project procedures discussed in this Section. Owner will provide initial review and training of Owner-provided systems, such as LoadSpring, at this time. As necessary, additional meetings will be scheduled between Owner and Contractor to assure that both parties have a complete understanding of the requirements, systems, and procedures. Contractor shall submit to Owner for review, Contractor's proposed long-term Schedule Maintenance Procedures ("SMP"). To the extent that there are inconsistencies between the SMP and the Contract, the Contract shall govern.

a. The goal of the Project Controls Kickoff Meeting shall be to establish a simple, bullet format desk outline that addresses:

a1. P6 WBS Structure and Titles.

a2. Global Activity Codes and dictionary definitions.

a3. EPS and/or Project Activity Codes and definitions (if used).

a4. Resource dictionary and titles.

a5. Resource Codes and dictionary definitions.

a6. Cost Account Codes and dictionary definitions.

a7. User Defined Fields (Activity / Resource) defined for generic use and purpose.

a8. Calendar Definitions.

a9. P6 Activity Step Templates (if used).

a10. Time Impact Analysis procedures.

a11. Special formatting issues such as Activity Numbering.



- a12. Owner's Schedule Hosting Environment access and use.
  - a13. Plan for supporting Update Process and Cycles.
  - a14. Plan for Schedule/Cost Change Control.
  - a15. List of key contacts (name, email address, phone).
- 104.4 Bar Chart Schedule. Within fourteen (14) Days after contract award, Contractor shall submit to Owner for review, a comprehensive bar chart schedule that identifies all major phases, work areas, structures, and Detailed Activities associated with the entire scope of Contractor's Work. This schedule shall include any anticipated work not yet awarded to the Contractor and shall include all Owner Milestone Dates identified in Table 013216-1.
- 104.5 The term days is defined as calendar days.
- 104.6 Detailed Project Schedule
- a. Within fourteen (14) Days after contract award, Contractor shall submit its Detailed Project Schedule along with a detailed Project Execution Plan, addressing all aspects of the design process, material procurement, document submittals (refer to Section 013324 for the list of submittals), fabrication, inspections, material receipt and storage, assemblies, subassemblies, construction and erection, and turn-over sequences to the Owner that will satisfy the dates per Table 013216-1 and Section 013324 for Owner's review and approval.
  - b. Owner Review and Comment.
    - b1. Following submission by Contractor, the Owner will have fourteen (14) Days to review and comment on the submitted Detailed Project Schedule. Unless otherwise agreed by the Parties, on or before ten (10) Days following Contractor's receipt of Owner's comments on the proposed Detailed Project Schedule, Owner and Contractor will meet to discuss Owner's findings. No later than fourteen (14) Days following owner and Contractor's meeting, Contractor shall incorporate all agreed upon changes, including changes required by the Contract, and resubmit the proposed Detailed Project Schedule to Owner for consideration. The above process of resubmission, review, meeting, and incorporating corrections shall continue until Owner approves the Detailed Project Schedule at which time that Detailed project Schedule will be designated as an approved Detailed Baseline Schedule and shall be used as the initial Baseline Detailed Project Schedule.
    - b2. In the event Owner rejects the proposed Detailed Project Schedule, and while the draft Detailed Project Schedule is being revised and approved, Owner may elect to have Contractor start updates on one of the rejected draft Detailed Project Schedules, as a parallel schedule file. Upon Owner's written approval of the Detailed Project Schedule, Contractor will transfer Owner-approved status information from the parallel updated schedule file to the approved Detailed Baseline Schedule to assist in expediting the development and reporting of the status updates.
    - c. In the case of start milestone dates identified in Table 013216-1 or anticipated delivery dates identified in Table 013216-1, work shall not be scheduled to start any sooner than shown, unless approved by the Owner. In the case of completion milestones, the Work shall be scheduled to complete on or before the dates identified in Table 013216-1.



- d. The Detailed Project Schedule shall be completed using the Primavera Enterprise P6 v7.0 scheduling software unless a different scheduling software or version is approved by the Owner.
- e. The Detailed Project Schedule and all Detailed Project Schedule updates shall, at a minimum, include the following characteristics:
  - e1. The Detailed Project Schedule shall be of sufficient detail to assure adequate planning and execution of the Work, such that, in the judgment of Owner, it provides an adequate basis for monitoring and evaluating the progress of the Work.
  - e2. Contractor's Detailed Project Schedule shall be in the form of a single schedule network depicting the entire scope of the Contractor's efforts to complete the Work. The schedule network shall be complete with no open ends, other than one activity indicating the Project award milestone. All Detailed Activities shall be tied to both start and completion milestones. All Detailed Activities and milestones shall be sequenced together in a logical order to form float paths. All float paths shall ultimately lead to and be logically tied to a related intermediary start and completion milestone as defined by Table 013216-1. Intermediate start and completion milestones and completion interface milestones shall be tied to the Project completion milestone.
- f. Submittal Detailed Activity requirements are as follows:
  - f1. As required to meet the dates set forth in Table 013216-1, Contractor shall include Detailed Activities that fully identify and delineate the time and logical sequences for the development, submittal, review, and return of each drawing or drawing package, data, calculations, or other documents as set forth in the Contract, including this Technical Specification.
  - f2. As appropriate, the submittal Detailed Activities shall be properly sequenced and logically related to the appropriate engineering, manufacturing, inspection, and delivery tasks so that the status of individual submittal Detailed Activities reflect on the projected schedule dates of the related and logically tied Detailed Activities.
  - f3. The submittal Detailed Activities shall include a period of not less than twenty (20) Days, or as otherwise set forth in the Technical Specifications, for the Owner's Engineer to review each initial submittal. The Owner's Engineer's review period will commence when the electronic submittal is received by the Owner's Engineer and will end when the submittal is returned or is otherwise discharged by the Owner's Engineer.
  - f4. The submittal Detailed Activities shall allow for a minimum of one Contractor re-submittal and one Owner re-submittal review period or additional re-submittal periods based on the Contractor's experience, for each required submittal. Owner and Contractor shall mutually determine how this allowance will be incorporated into to the Detailed Project Schedule allowing for full transparency and identification.
- g. Contractor and Owner-Supplied Material requirements are as follows:
  - g1. The Detailed Project Schedule shall account for both the Contractor's procurement of key materials and those items being supplied by the Owner. All significant or key material deliveries will be tracked separately and identified with "Delivery Received" milestones in the Detailed Project Schedule that will be logically tied to all related on-site schedule installation activities that are dependent upon the associated delivery to proceed.



Deliveries controlled or managed by the Owner shall be identified separately from those controlled by or managed by the Contractor.

- g2. The Contractor-supplied materials shall be shown in the Detailed Project schedule with an appropriate level of detail that facilitates detailed in-progress status reporting of key elements for each item of procurement. Key elements shall include, but not be limited to: award; release to fabricate; fabrication; shop drawing and product submittals; QA/QC hold points; and individual deliveries of key components matching the level of detail contained in the Contractor's construction schedule. Any planned material deliveries which include multiple deliveries spanning a time greater than seven (7) Days shall each be scheduled and tracked separately. Each key or significant delivery shall be logically tied to a corresponding Contractor "Delivery Received" milestone, which in turn will be logically tied to the on-site schedule installation Detailed Activities which are contingent on the delivery. Following Owner's reasonable approval, bulk or common materials require only Start and Complete Delivery milestones and need only be logically tied to the first and last installation Detailed Activity that would be contingent upon the associated deliveries.
- g3. In the case of material deliveries by the Owner and Owner-Controlled Dates, the dates for the Owner "Delivery Received" milestones in the schedule will be established by the application of "Finish On or After" date constraints in the P6 software for each milestone. These dates will conform to the dates listed in Table 013216-1. The Contractor will coordinate with the Owner, as necessary, to identify changes in Owner delivery dates due to awarded contracts, known status updates, or approved changes.
- h. Fabrication, Inspection and Delivery Detailed Activity requirements are as follows:
  - h1. The Contractor's Detailed Project Schedule shall include a detailed fabrication, inspection, and delivery Detailed Activities for items furnished and/or installed by the Contractor. The fabrication, inspection, and delivery Detailed Activities shall address all major or significant procurement and fabricating steps or processes, including the creation of shop detail and erection drawings for all materials, assemblies and subassemblies and products being provided. In addition, any required or anticipated key hold points and key inspections required by this Technical Specification or by the Contractor's own procedures shall be identified and accounted for in the fabricating, inspection and delivery Detailed Activities. Any Owner-required releases, inspections, or reviews shall be clearly identified in the Detailed Project Schedule.
  - h2. As required to meet the dates set forth in this Technical Specification, the fabricating, inspection, and delivery Detailed Activities shall identify all deliveries including bulk materials, subassemblies, assemblies, structural steel, process piping, and products to be installed. The Detailed Project Schedule installation sequences and dates shall be subject to further coordination with the Owner, Owner's Engineer, and Owner's Other Contractors.
  - h3. Partial deliveries with distinct separate delivery times (i.e., greater than seven (7) days apart) shall include multiple delivery activities (e.g., 0-50%, 51 to 100%) to be coordinated with the receipt of the component on site.
  - h4. Contractor may release Subcontractors' engineering as needed to meet the engineering deliverables schedule.
- i. The Detailed Activities in the Detailed Project Schedule shall meet the following criteria:



- i1. Conform to and include the Owner's requirements for common schedule coding structures, WBS codes, calendars, etc., in accordance with the Owner's guidelines to be provided at award.
- i2. As reasonably feasible, the Detailed Activities shall be divided by separate or distinct areas and features of the Work as identified by the Owner's WBS and schedule codes provided by the Owner, further divided into the lowest practical level of detail representing single operations, identifiable deliverables, or identifiable actions that are performed by specific groups, individuals, or entities. Separate Detailed Activities shall not be combined if they can be easily tracked individually or require the passing of a deliverable from one distinct group to another.
  - i2.1 Field operations involving pre-erection fabrication will be divided from erection work. Installation shall be further divided by the distinct operations carried out by individual crews or labor trades in a single continuous operation.
  - i2.2 Non-continuous work will be divided into separate Detailed Activities.
  - i2.3 Subcontracted work tasks will be separated from the Contractor's self-performed work tasks.
  - i2.4 Significant QA/QC Detailed Activities or hold points will be included in the schedule.
  - i2.5 Any rehab, replacement, or temporary work shall be broken out separately for each work phase and area.
  - i2.6 Testing and turnovers will be shown separate from installation work.
- i3. Planned Detailed Activity durations shall be no greater than the following, unless the Contractor can show good reason why it would be impractical to meet these requirements:
  - i3.1 Thirty (30) Days for engineering related work,
  - i3.2 Sixty (60) Days for procurement related work, and
  - i3.3 Fourteen (14) Days for site construction related work.
- i4. Original and subsequent remaining durations shall take into account weather conditions that the Contractor or their Subcontractors can reasonably anticipate for the planned operation and seasonal conditions.
  - i4.1 Failure to include a reasonable anticipation of weather shall not be grounds for a request for a Project time extension under Section 18.
- j. Individual Detailed Activities must clearly delineate the representative work and work area to be performed in the Detailed Activities descriptions. No two Detailed Activities shall have the same description. When common or repetitive Detailed Activity work task descriptions are used in multiple Detailed Activities, each will include unique descriptive words to distinguish one Detailed Activity from other without the use of coding or WBS
- j1. Non-milestone Detailed Activities shall begin with an action verb, where appropriate. (e.g., install, adjust, erect, test, etc.) Milestone descriptions shall include a form of the word Begin or Complete and Milestone where appropriate.



- k. The Project shall be scheduled in units of days accounting for various shift work, as applicable. Each Detailed Activity in the Detailed Project Schedule shall be assigned a Project scheduling calendar per the Owner's Master Project Schedule lists of calendars, available at award. As needed, the Contractor may request that additional Project scheduling calendars be created by the Owner. Once Baseline, work calendars shall not be changed without written notification to the Owner, including the reasons for this change.
- l. For purposes of interfacing the Contractor's Detailed Project Schedule with the Owner's Master Project Schedule, the Contractor will provide "Installation Interface" milestones representing work areas or items of work to be turned over to the Contractor from the Owner or those work areas or items to be turned over by the Contractor to the Owner. Interface Milestones shall be clearly identified and be logically tied to all associated work or float paths. In cases where the interface is provided by the Owner, the Contractor will include a "Finish On or After" date constraint representing the date contained in Table 013216-1. The Contractor will coordinate with the Owner as necessary to identify changes in the Owner interface dates due to awarded contracts, known status updates, or approved changes.
- m. Constraints and Schedule Tie requirements are as follows:
  - m1. The Contractor's Detailed Project Schedule shall minimize the use of artificial date constraints for purposes of calculating either early or late dates, other than to indicate contractual start or completion dates. When artificial date constraints are used, the purpose of each date constraint will be recorded in the schedule activity "Notes" log (e.g., Date Constraint xx/xx/xx used to indicate Contract Completion Milestone Date). Contractor shall not use Mandatory Start or Finish constraints in developing or maintaining the Detailed Project Schedule.
  - m2. The Contractor's use of "start to start" or "finish to finish" schedule logic shall be kept to a minimum. When start to start logic types are used, the finish of the affected predecessor activity shall have a finish successor defined in order to avoid possible open ended Detailed Activity finishes. When finish to finish logic types are used, the affected successor create and manage the EVS Activity shall have a defined predecessor start.
  - m3. The Contractor's use of "finish to start" schedule logic shall be maximized as a direct outcome of the level of detail Owner desires in the Detailed Project Schedule. The Contractor's use of "finish to start" schedule logic with time lags shall be kept to a minimum. In no case shall a finish to start logic with a time lag represent work effort that otherwise could be represented by a Detailed Activity (i.e., coating cure time, inspection hold, Owner review, hoisting equipment movement). When the Contractor deploys the use of time lags on finish to start logic, the purpose and objective for the time lag shall be recorded on the predecessor's create and manage the EVMS Activity "Notes" log. The Contractor will be responsible to monitor and maintain all deployed time lags to assure that they accurately reflect the Contractor's current work plan.
- n. Resource Loading requirements are as follows:
  - n1. Once approved by the Owner as a Baseline, each engineering and field installation Detailed activity in the Detailed Project Schedule that requires physical effort to perform to include anticipated Subcontractor's work, but other than the Owner's reviews, milestones, time related holds, shall be assigned an estimated amount of direct man-hours broken down by discipline and craft by the Contractor. The purpose of the work



hour assignments will be to provide an estimated work effort weight or weighted value of each task relative to each other and relative to the overall work effort of the Contractor. This information will be used to establish time based planned progress and to generate planned performance indices in the form of an Earned Value Management System (“EVMS”). Such EVMS shall include the following:

- n1.1 Direct man-hour resources will include the assigned hours for each resource type applied.
- n2. The Contractor will predetermine for each Detailed Activity resource loaded in the schedule, the method to quantify the physical progress made as the work is executed, expressed as a percentage of completion. This predetermination will be referred to as the “Rules of Credit” (ROC). This information will be used by the Contractor and verified by the Owner to establish the percentage of completion for each Detailed Activity resource loaded in the schedule.
  - n2.1 This percentage of completion will be multiplied by the pre-established resource loading man-hours to determine the “Earned” man hours and current progress.
  - n2.2 This information will be used to establish a basis to compare current progress against the planned progress and to generate periodical performance indices.
- n3. ROC are a form of progress measurement and will be predetermined by the Contractor and approved by the Owner. The ROC will be tailored to specific tasks and be used to establish the physical percentage of completion as work progresses on the applicable Detailed Activity. ROC do not have to perfectly represent the actual quantities but must be reasonably evident and measurable. Proposed ROC are to be submitted with the Detailed Project Schedule. Acceptable ROC methods may include but are not limited to:
  - n3.1 Establish percentages to multiple actions or multiple deliverables contained in a single Detailed Activity whose total does not exceed 100% (e.g., develop preliminary drawing = 50%, internal review and comment on preliminary drawing = 20%, edit and issue final drawing for approval = 30%).
  - n3.2 Establish key material quantities to be installed that will be measured against actual quantities installed. (e.g., 50 tons of steel installed / 100 tons planned = 50%).
  - n3.3 Establish operational planned quantities that will be measured against actual quantities performed (e.g., 400 lf of pipe weld performed / 4000 lf planned = 10%).
  - n3.4 Establish “Steps” in the applicable Detailed Activity which identifies specific operations (e.g., forms = 30%, rebar and embeds = 50%, pour = 10%).
  - n3.5 Contractor will keep on record and provide to Owner if asked their ROC calculations that established the claimed percentages of completion.
- o. All payment milestones in the schedule of values shall be included in the Detailed Project Schedule with at least one predecessor and one successor. This information will be used to establish an activity driven contract value spend report and confirm the achievement of individual payment milestones.





105. OWNER'S REVIEW AND APPROVAL OF CONTRACTOR'S DETAILED PROJECT SCHEDULE:
- 105.1 Detailed Project Schedule Approval
- a. The Contractor's submittal of the full Detailed Project Schedule will be subject to the Owner's review, comment, and approval, in accordance with the Contract. The submission shall be in the form of a Primavera P6 XER file along with printouts depicting the following:
    - a1. Early and late dates for the Detailed Project Schedule Detailed Activities.
    - a2. Planned durations and total float for the Detailed Project Schedule Detailed Activities.
    - a3. The Detailed Project Schedule critical path and all near critical paths that are within thirty (30) days of the critical path.
    - a4. Executive Summary Level (a.k.a. Level 1) Bar Chart representing the summary totality of time used for the primary engineering, procurement, deliveries, and construction, along with Owner Required Milestones identified in Table 013216-1 for each Facility as taken from the P6 schedule data file.
    - a5. A Management Summary Level (a.k.a. Level 2) Bar Chart representing in summary fashion individual Engineering Discipline efforts, Key Material Procurements, Construction by Areas, and Key Systems Testing along with Owner Required Milestones identified in Table 013216-1 for each individual unit as taken from the Detailed Project Schedule P6 schedule data file.
- 105.2 Owner shall provide written comments and approval status within fourteen (14) Days of submission. As deemed appropriate by Contractor, Owner and Contractor shall meet as soon as practical, but no later than ten (10) Days, after Owner's comments are received to review and discuss necessary changes or corrections that Owner will require. As necessary, resubmission of the Detailed Project Schedule addressing any required changes will occur within twenty-eight (28) days after receipt. This process will repeat until the Detailed Project Schedule is accepted by the Owner as being in compliance with Article 104.
- a. In the event the Contractor fails to secure Owner approval of the Detailed Project Schedule, Contractor shall maintain and update a version of the Detailed Project Schedule as a separate P6 schedule file at least once every fourteen (14) Days. Such updates and maintenance shall include work progress, changes in percentages of completion, actual dates, changes in remaining durations, changes in planned work sequences, and changes in work scope. Any and all updates shall be provided to the Owner shall be in the form of a P6 XER file and a printable file. Once the Detailed Project Schedule has been approved, all prior maintenance and status updates shall be transferred onto the approved Detailed Project Schedule, forming the first update.
  - b. The Owner's review or approval of the Detailed Project Schedule is solely for the purpose of assuring the Owner that the Contractor's Detailed Project Schedule meets the intent of this Section. The Owner's review or approval does not constitute a guarantee or agreement by the Owner that the submitted Detailed Project schedule is complete or is otherwise executable by the Contractor.



105.3 Failure by the Contractor to submit either the Detailed Project Schedule by the times specified or in the manner prescribed shall give the Owner the right withhold any and all payments due Contractor until such time Contractor has fully complied the requirements listed in Section 013216, Article 104.

106. BASELINE DETAILED PROJECT SCHEDULE

- a. Once submitted and approved by the Owner, the approved Detailed Project Schedule file shall be presented and designated as the “Baseline Detailed Project Schedule.” The Baseline Detailed Project Schedule, or subsequently approved Baseline Detailed Project Schedule revisions, shall be used to measure and evaluate all schedule progress.
- b. Owner’s goal and preference is to avoid and minimize the need to Re-baseline if possible. Any changes to the Baseline Detailed Project Schedule, including Re-baselining or resourcing changes or change order maintenance, will be subject to the Owner’s review and approval. All subsequently approved Baseline Detailed Project Schedule Re-baselining or Baseline Maintenance revisions shall be assigned a sequential number; shall have the schedule files preserved for future reference; and shall replace the prior Baseline Detailed Project Schedule revision as the baseline from which to measure and evaluate the Contractor’s Project progress.
- c. After submittal of the Detailed Project Schedule, the Contractor is required to use the Owner’s scheduling database for their computerized scheduling. The original baseline will be duplicated in a working file that Contractor will maintain and update on a periodic basis as described in Article 108 of this Specification to accurately reflect completed work, in progress work, and the planned sequence and timing of the remaining work.
- c1. Until such time that the Detailed Project Schedule is approved by the Owner as the Baseline Detailed Project Schedule, the Owner may request Contractor to update a Detailed Project Schedule as a parallel schedule file. Upon approval of a Baseline Detailed Project Schedule, Contractor will transfer status information from the parallel updated schedule file to the Baseline Detailed Project Schedule Baseline Detailed Project Schedule to form the first approved schedule update in order to assist in expediting the development and reporting.
- d. Within fourteen (14) Days after approval of the Baseline Detailed Project Schedule, the Contractor shall provide the Owner for review, comment and approval a fully resource loaded Baseline Detailed Project Schedule as described in Article 108 of this Technical Specification of all engineering, procurement, construction and start-up Detailed Activities, including those performed by Subcontractors. The resources in the schedule shall equal the direct work hours as bid by Contractor and posted in the proposal pricing pages under the heading of “Man-Hours” for each task. With this submission, Contractor will also submit its proposed Rules of Credit (ROC).The Resource loading and ROC shall be subject to Owner’s review and approval.
- d1. Submission shall include as a minimum:
  - d1.1 Resource Loaded P6 XER file,
  - d1.2 Manpower tabulations: by Detailed Activities, by WBS, by Responsibility codes and by Construction Areas,
  - d1.3 Manpower histograms and S-curves; by Responsibility codes, by WBS and by Summary Total,



- d2. Manpower histograms by Responsibility codes, by WBS and by Summary Total.
- d3. Owner will provide the Contractor with Owner's review comments and approval status for both the Resource Loading and ROC within fourteen Days after submission. Contractor will work cooperatively to resolve any issues brought forth by Owner review and as necessary correct and or resubmit the Resource Loaded Schedule.
- d4. In cases where engineering or installation Work will be performed by a yet to be awarded Subcontractor as of the Resource Loading submission, Contractor will reasonably estimate the man hours to be included in the schedule resource loading for such work. Once awarded, the Subcontractor shall provide the Contractor with a corrected resource loading. Contractor shall give written notice to the Owner when such situation does occur and shall secure the Owner's written approval and procedure use the updated resource loadings.
- e. Once the Baseline Detailed Project Schedule has been approved, the Contractor shall not, without the Owner's prior written approval and consent, make the following changes to any Baseline or subsequent schedule updates:
  - e1. Delete or modify a schedule activity ID number.
  - e2. Substantively change a Detailed Activity description so as to modify the general scope of work that each Detailed Activity in Detailed Project Schedule was intended to cover.
  - e3. Modify the work hours loaded into the schedule.
  - e4. Change or modify a calendar or change or modify the assigned calendar to individual Detailed Activities.
  - e5. Change or modify the Owner's WBS or Project coding.
- 106.2 Following the establishment of the Baseline Detailed Project Schedule, the Contractor will assist the Owner, as necessary, to merge the approved Baseline Detailed Project Schedule into the Owner's Master Project Schedule. Assistance will generally be to verify the logical ties from the Contractor's Delivery Completion Milestones to the related Detailed Activities in the field erection schedule. Additional assistance may be requested to modify the Contractor's erection sequence to better match and optimize the other field erection schedules either at the time of merging the Baseline Detailed Project Schedule with the Master Project Schedule or later when the other field erection schedules baseline has been established. Any changes resulting from merging the approved Baseline Detailed Project Schedule into the Owner's Master Schedule shall not be subject of a change order unless the Owner's Required Schedule Dates in Table 013216-1 are modified. Any modification to the Owner's Required Schedule Dates in Table 013216-1 must be approved through the change order process.
- 107. MASTER SCHEDULE
- 107.1 The Contractor's Detailed Project Schedule shall be compatible with the Owner's overall Project schedule ("Master Project Schedule") that will contain the detailed schedules of other suppliers and field erectors. As a minimum, the following shall apply to this requirement:
  - a. Each Detailed Activity in the Detailed Project Schedule shall meet the needs of the Owner's Master Project Schedule; should these needs change, the Contractor shall



adjust the installation sequences, add Detailed Activities or milestones, adjust delivery or interface milestone dates, or adjust the level of detail in their Detailed Project Schedule as determined by the Owner.

- b. The Owner will determine and maintain the schedule interface points between all Owner, Contractor, and Owner's Other Contractors in the Master Project Schedule, which will include any schedule logic ties, with the assistance of the Contractor. Any Contractor-suggested adjustments to the schedule interface points will be brought to the Owner's attention for the Owner's consideration. Contractor shall highlight all non-Contractor interface points with the Owner, vendors or other external entities that could impact the schedule and execution plan. Contractor will assume overall schedule integration to assure linkage of those interfaces within the schedule.
- c. The Detailed Activity ID characters shall include a reservation for the Owner's assignment. The number of reserved characters shall be determined by the Owner at a later date.
- d. The sequencing of these Detailed Activities will be used by the Owner in the Master Schedule as the primary interface points and schedule logic ties to the other field erection activities.
- e. The Master Project Schedule will be contained and maintained in the Owner's Schedule Hosting Environment.

108. DETAILED PROJECT SCHEDULE UPDATES

- 108.1 Once the Detailed Project Schedule has been submitted and approved as the Baseline Detailed Project Schedule, the Contractor shall continuously show evidence of the orderly progress, consistent with the Table 013216-1 and the schedule in the Contract by updating the Detailed Project Schedule and providing written progress reports.
- 108.2 Schedule updates shall occur periodically during the performance of the Work, except as required for recovery plans as noted in the Contract. The exact timing and method of each schedule update and report submission will be confirmed with Owner.
- 108.3 Frequency of Schedule Updates.
  - a. Schedule status updates shall occur every thirty (30) Days for the first 180 Days after contract award or more frequently if the Owner determines this would be advisable to assure schedule compliance. The schedule status date will be the last business day of the month at 11:59 pm.
  - b. After the first 180 Days after contract award, schedule status updates shall occur every fourteen (14) Days until Contractor Mobilization, or more frequently if the Owner determines this would be advisable to assure schedule compliance. The schedule status date will be every 14th Day at 11:59 p.m.
  - c. Following Contractor Mobilization, schedule status updates shall occur every seven (7) Days or more frequently if the Owner determines this would be advisable to assure schedule compliance. The schedule status date will be every seven (7) Days at 11:59 p.m.
  - d. The Contractor's schedule updates of the Detailed Project Schedule shall continue until the Work has been completed.



- 108.4 All updates shall comply with the following requirements:
- a. Reflect Contractor's then-current means and methods, planned or anticipated sequences, planned or anticipated dates, and any known or anticipated delays.
  - b. Determine the current percentage completion status of all Detailed Activities by calculating actual progress by the approved ROC Guidelines, or other approved Earned Value Management practices.
    - b1. When requested by Owner, Contractor will provide information and back-up support to validate methods used to develop physical percent complete.
    - b2. Physical percent complete will not be based solely on remaining durations compared to original durations or actual milestone payments earned compared to milestone payments budgeted.
    - b3. All activities shall use P6's "Physical Percent Complete" status method unless based on Level of Effort. Contractor shall not use P6's "Duration Percent Complete" method for the purpose of determining percentage of completion or changes in remaining durations.
    - b4. All significant reductions to previously reported percent complete (greater than a 5% reduction) will be reported in Contractor's status report along with a detailed explanation.
  - c. Remaining durations shall represent the Contractor's current best estimate for each Detailed Activity based upon then-current or known factors which might affect the remaining duration.
    - c1. Contractor shall not base the remaining duration of any Detailed Activity on the percent completed or an automated countdown process such as expected finish constraints. Expected Finish Dates should be regarded as commitments by the responsible individual and should not be taken lightly. Expected Finish Dates should preferably be used to calculate remaining duration of in progress Detailed Activities and be removed once applied.
    - c2. Significant changes in the remaining durations greater than the span of time between updates will be reported in Contractor's status report.
  - d. Any and all revisions to the WBS, approved activity codes, activity calendars, assigned calendars, activity descriptions or activity resource loading shall require prior written approval of Owner.
  - e. Any revisions to any logic affecting the critical path or near critical paths, shall be reported and described in detail in Contractor's update status report.
  - f. Use retained logic for all schedule update calculations. Any Detailed Activities that are reported by P6 to be "out-of-sequence" shall have their logic ties appropriately revised to correct the out-of-sequence condition.
  - g. Identify the actual start and completion dates for each Detailed Activity in the schedule as supported by Project records.
    - g1. Any changes in previously reported actual dates shall be reported and described in detail in Contractor's update status report.



- h. For Owner submittal reviews and other Owner related Detailed Activities in progress but not yet completed, or for Owner interface milestones contained in the Contractor's Detailed Project Schedule, Contractor shall request status from the Owner.
  - i. Report Actual Direct Man Hours and Earned Direct Man Hours by resource code or agreed upon summary level
  - j. Approved scope changes affecting in-progress Work shall be incorporated into the Contractor's Detailed Project Schedule by the Contractor within fourteen (14) Days of approval. Approved scope changes which do not affect in-progress Work shall be incorporated into the Contractor's Detailed Project Schedule by the Contractor within thirty (30) Days of approval or before the start of scope change Work, whichever is shorter. Schedule impacts of the Work scope changes shall be identified prior to work commencing.
- 108.5 The Contractor will be required to discuss the status of the Detailed Project Schedule during the plan of the day meetings.
- 108.6 The Contractor is required to notify the Owner of any substantial change in the Detailed Project Schedule that will affect material deliveries or installation within forty-eight (48) hours of identifying the issue. An updated schedule detailing the substantial change shall also be submitted concurrently.
- 108.7 Progress Measurement:
- a. Progress measurement shall be performed and reported by the Contractor using an Earned Value Measurement System (EVMS) based on Rules of Credit and Man-Hour Resource Loading. Proposed progress milestones shall be reviewed with the Owner and agreed upon at the onset of the Work. Contractor will submit their EVMS calculations via updates to Contractor's schedule in the Owner's system for the Owner's representative to review at the commencement of the Project and on the same periodic basis as the schedule updates during the execution of the Project, or as requested by the Owner.
  - b. Contractor will provide planned and actual quantity installed of bulk materials such as:
    - b1. CY of concrete,
    - b2. Tons of Concrete Reinforcement Steel,
    - b3. Tons of Structural Steel,
    - b4. SF of Sheet metal Siding
    - b5. SF of Sheet metal Roofing
    - b6. SF of Hopper Plate work
    - b7. Tons of Conveyor Gallery
    - b8. Tons of Conveyor Gallery Supports
    - b9. LF of large bore pipe,
    - b10. LF of pipe welding,



- b11. SF of thermal insulation
  - b12. LF of buried piping > 4"
  - b13. SY of Suspended grading,
  - b14. LF of AG Conduit > 3"
  - b15. LF of AG Conduit < 2.5"
  - b16. LF of cable tray
  - b17. LF of Power wire pulled
  - b18. # of Power Panels
  - b19. # of Power Wire Terminations
  - b20. LF of Control Cable pulled
  - b21. # of I&C Panels
  - b22. # of Control Cable Terminations
  - c. EVMS reports on the same periodic basis as the schedule updates during the execution of the Project, or as requested by the Owner.
  - d. Progress Reporting
- 108.8 Monthly Progress Report:
- a. Each month, the Contractor shall provide a Project Status Report in narrative form that includes:
    - a1. Work accomplished in the previous period.
    - a2. Work planned for the next reporting period.
    - a3. List all changes made to the DPS with the schedule updates (this can be satisfied with P6 Digger Report or equivalent reporting software).
    - a4. Overall Project status including engineering, manufacturing, and deliveries.
    - a5. Current critical path of the schedule and comparison in the previous period to current update.
    - a6. Known or suspected problem areas.
    - a7. Recovery plans.
    - a8. Unresolved issues.
    - a9. Proposed and approved change orders and their effect on the progress of Contractor's Work.
    - a10. A comparison of Baseline Schedule dates to the current schedule dates with all variances identified.



- a11. Detailed reconciliation of the Contractor's invoicing.
- b. Relative to the work hour estimates as provided in Section 104.6n of this Section, the Contractor is also to provide the following in the Project Status Report:
  - b1. A comparison of the Baseline Schedule cumulative work hours to date to the current earned cumulative work hours to date, including histograms and S-curves graphs.
  - b2. A comparison of the Baseline Schedule deliveries and delivery quantities to date to the actual delivery quantities to date, including histograms and S-curves graphs.
  - b3. A comparison of the Baseline Schedule planned number submittals to date to the actual submittals to date including histograms and S-curves graphs.
  - b4. The Project Status Report delivery method will be mutually agreed upon in writing. The Contractor shall provide the Owner with the Project Status Report within one (1) business day of the close of the reporting period.
- 108.9 The Contractor will be required to participate in Weekly Conference Calls with Owner to discuss the status of the Detailed Project Schedule after site work has started. This is in addition to mutually agreed upon status meetings. During the weekly conference call, Contractor shall present the following:
  - a. Weekly Status updates using commodity curves.
  - b. Weekly Schedule updates.
- 108.10 Daily Reporting Requirements:
  - a. Daily reporting is required of Contractor when personnel are present at the site. Weekly and monthly reporting shall begin after contract award.
  - b. Contractor shall provide a Daily Report in a mutually agreed upon format between Contractor and Owner to the Owner each day by 4:00 p.m. If Contractor or Subcontractor has a standard Daily Report, then Contractor shall submit the format to the Owner for review and written approval. If acceptable to the Owner, the Contractor's or Subcontractor's form may be used. However, the Contractor's form shall contain, at a minimum, the same information as the Owner's form.
  - c. Contractor is responsible for providing a Daily Report for themselves and for each of its Subcontractors while performing work on Site. Contractor's report must identify all Subcontractors working on Site for any given Day, and shall include as an attachment those Subcontractors' daily reports. Any missing Subcontractor reports shall be identified for the day and provided within twenty-four (24) hours of the date and time they were originally due.
- 109. **PHOTOGRAPHIC DOCUMENTATION REQUIREMENTS**
- 109.1 The Contractor shall comply with the Owner's requirements for photographic documentation as defined in the Contract.

END OF SECTION 013216





**SECTION 013323**  
**SHOP DRAWINGS AND PRODUCT DATA**

**PART 1 – GENERAL**

101.           EXTENT

- 101.1           This section covers the requirements for the preparation and the submittal of project specific drawings and data required for the Work. This includes shop detail drawings, field erection drawings, welding procedures, etc., as indicated on the design drawings or in the technical sections of this Specification.
- 101.2           The required engineering and design shall begin immediately after Contract award, regardless of the shipping date and shall proceed in an expeditious and orderly manner until complete.
- 101.3           Design calculations and drawings prepared by the Contractor or its subcontractor for the Work shall be performed by a Professional Engineer registered in the State where the work is to be installed. The calculations and drawings submitted for review shall be sealed, signed, and dated by the same Professional Engineer in accordance with the State's Engineering Practice Act and Rules.
- 101.4           Only project-specific drawings and data shall be submitted to the Owner and Engineer, as described herein.
- 101.5           Performance of any Work, including raw material procurement, fabrication of material, procurement of equipment or commodities on the installation of any item requiring the review of drawings, data, etc., prior to obtaining final review of drawings, data, etc., is at the Contractor's risk as the Owner and the Consulting Engineer do not accept responsibility for such actions.
- 101.6           Review of drawings, data, etc., shall not act to relieve the Contractor from responsibility for deviations from Contract Design Drawings and Specifications, unless it has, in writing, called the Owner's attention to said deviations at the time of submission of relevant drawings, data, etc., and received written authorization for said deviations.
- 101.7           The Contractor shall not change the delivery schedule if significant alterations to drawings are a result of the Contractor's error or noncompliance.
- 101.8           It shall be the Contractor's responsibility to obtain the Owner's acceptance without comment on those drawings covering an item at least two (2) weeks before that item is required. The Contractor shall be responsible for any field changes resulting from failure to adhere to this requirement.
- 101.9           Refer to Attachment 9 for the project document and drawing submittal process.

102.           PREPARATION OF SHOP DETAIL DRAWINGS

- 102.1           The Contractor's drawings shall preferably be prepared in Microstation .DGN, AutoCAD .DWG or .DXF file format. All drawing files shall be merged with the appropriate background file before submittal.



- 102.2 Data submittals, such as equipment lists, valve lists, etc. shall be prepared in Windows-based Access or Excel format and submittal in the overall equipment database.
- 102.3 All drawings, calculations, and data shall be prepared and submitted in U.S. Customary units (feet, inches, etc.) and in the English language.
- 102.4 Identification of changes on all drawings from the previous issue shall be clearly shown on each drawing. Changes should be circled and marked with a revision number.
- 102.5 Document Numbering: All documents submitted shall be identified using the Owner's document numbering system.
- 102.6 Shop Details Drawings:
  - a. Shop drawings shall be checked and signed by authorized personnel prior to submittal.
  - b. Shop drawings shall meet the quality, legibility and documentation requirements specified herein.
  - c. Shop detail drawings shall indicate, in detail, all parts of the Work fully dimensioned, including reinforcing steel sizes and bending dimensions for reinforcing steel, member sizes, and material thickness.
- 102.7 Each issue of a drawing shall include the date of issue and a description of revisions, if any. Identify the changes from previous issues by clearly encircling the change and marking it with a revision letter or number.
- 102.8 Master Bills of Material: In conjunction with the development of detailed shop fabrication drawings, the Contractor shall develop a Master Bill of Material (MBOM) for the Work. The MBOM shall be developed in accordance with the following requirements:
  - a. The MBOM shall be developed in a standard software platform such as Excel by Microsoft.
  - b. The MBOM shall contain a single line for each unique mark.
  - c. Quantity of pieces required.
  - d. Quantity of pieces fabricated.
  - e. Quantity of pieces delivered previously.
  - f. Quantity of pieces delivered this shipment.
  - g. Quantity of pieces not yet delivered.
  - h. The MBOMs shall be provided with each periodic installation schedule update showing their development status.



- i. That portion of the MBOM pertaining to delivery shall accompany each truck load of material delivered to the project site as a coversheet to the Contractor's normal shipping bill of material.

103. REVIEW PROCEDURE

103.1 General:

- a. Review of shop drawings, data, etc., by the Consulting Engineer does not relieve the Contractor of any of the Contractor's obligations.
- b. Should the Contractor take any exception to the Specification or indicate a deviation to the Design Drawings, it shall be requested on a separate letter and such exception or deviation shall be noted on the drawing.
- c. The Consulting Engineer reserves the right to refuse to review drawings, data, etc., which do not meet the requirements specified herein. This refusal shall not in any way relieve the Contractor from the responsibility for meeting the Scheduled submittal dates.
- d. Drawings will be checked for arrangement and construction only, and their review by the Owner and/or the Consulting Engineer will not relieve the Contractor from responsibility for any errors of dimensions, quantities and/or other errors that may develop later.
- e. For shop drawings, one (1) digital print of each submitted shop drawing will be returned to the Contractor marked with the Consulting Engineer's Review Stamp filled-in, and with comments, corrections and/or changes. When the Contractor receives this reviewed print, it shall promptly incorporate the comments, corrections and/or changes on the original drawing tracing and resubmit it as many times as required, until the specific drawing is returned with a Review Status 1, and does not require corrections or changes.
- f. Submit correlating erection drawings with each set of shop detail drawings to indicate correct locations of members submitted. Shop detail drawings submitted without erection drawings will not be reviewed until the appropriate erection drawings are submitted. Additionally, erection drawings showing members for those shop drawings have not been submitted shall be resubmitted when remaining shop details are submitted for review.

103.2 Documents or portions thereof, submitted for review will be reproduced and distributed to meet the project requirements. This includes documents with proprietary statements, unless Contractor advises in writing that the documents are not to be reproduced.

103.3 A minimum of two (2) weeks shall be allowed on all comment cycles.

103.4 Resubmittal, if required, shall be performed as quickly as possible so as not to cause delay to any part of the Work, and shall be no longer than two (2) weeks.

103.5 Shop test data and performance curves shall be submitted for review before shipment.

104. DOCUMENT SUBMITTAL SCHEDULE

104.1 Documents required shall be submitted to the Engineer for review in accordance with the schedule in Section 013324.



105. FINAL RECORD DRAWINGS, DOCUMENTS AND DATA

105.1 Documents shall not be submitted for Owner's record until they are acceptable to the Engineer without comment.

105.2 Contractor shall submit final as-fabricated record drawings, documents, and data, including subcontractor documents, within two (2) weeks prior to shipment, or as directed by Owner.

105.3 At the completion of the project, Contractor shall submit a complete set of all final (as-built) Contractor and Subcontractor drawings, including any changes through performance testing.

105.4 Contractor's final record submittals shall be in Microsoft Word, Microsoft Excel, and MicroStation or AutoCAD file formats. Drawing files shall be submitted electronically using the project's collaborative file sharing platform with the project name, station name, station unit number, drawing numbers and revision numbers, and CAD file names, identified in a separate electronic drawing list, together with one full size print of each drawing.

END OF SECTION 013323

**SECTION 013324**  
**LIST OF SUBMITTALS**

<b>ITEM</b>	<b>REFERENCE SECTION</b>	<b>REFERENCE ARTICLE</b>	<b>SUBMITTAL REQUIRED</b>	<b>DUE DATE</b>
Work Description			Description of scope of supply that shall be included in Contractor's work.	With Proposal
List of Technical/Commercial Exceptions and Clarifications	--		Provide all exceptions and clarifications to specification, using Purchaser's template file.	With Proposal
Certificate of Compliance	014500		Contractor's certificate of compliance.	With Proposal
Identification of Fabrication Subcontractors and Location of Fabrication Shops	013323		All Subcontractors including shop locations shall be identified.	With Proposal
Experience List			Florida and regional project experience list	With Proposal
Proposal Project Schedule	013216		The proposal schedule shall indicate all phases of work to be done including procurement, fabrication, testing, delivery, etc.	With Proposal
Proposal Pricing Pages	Attachment 2		Completed price quotation table.	With Proposal
Proposal Data Pages	Attachment 1		Completed proposal data pages.	With Proposal
Project Execution Plan			Narrative describing the sequence of work planned by Contractor, including procurement of commodities, sequencing of tasks per area and identifying the resources planned for the project, ie quantity of piling rigs.	With Proposal

**SECTION 013324**

**LIST OF SUBMITTALS**

<b>ITEM</b>	<b>REFERENCE SECTION</b>	<b>REFERENCE ARTICLE</b>	<b>SUBMITTAL REQUIRED</b>	<b>DUE DATE</b>
Site Specific Safety Plan	011100	103.3	Submit a site specific safety plan and a plan for maintaining adequate craft to safety professionals ratio.	With Proposal
			Submit hot work permits, confined space program, and weld program.	With Proposal
Quality Control	014500	104	Quality Assurance and Quality Control Plan	With Proposal
			An installation plan describing the installation sequence and inspections and/or tests to be performed, as a preliminary Inspection and Test Plan.	With Proposal
Transportation Plan	016500	101.3	A detailed transportation plan for shipping and delivery of the material and/or equipment assembled to the greatest extent shippable	With Proposal
Progress Reports	013216	106	Progress Reports	As Requested
Detailed Project Schedule, Including Shop Inspections for Contractor and Subcontractor (Baseline Schedule)	013216	104.6	Final schedule shall indicate all phases of work to be done including procurement, fabrication, testing, delivery, mobilization, construction, construction testing and turnover to commissioning, etc., etc.	2 Weeks After Award
Safety Data Sheets (SDS)	016600	102.5	Safety Data Sheets.	Prior to Delivery
Inspection and Test Plan	014500	104	An inspection and test plan based on the project schedule indicating the inspections and/or tests to be performed during project execution.	2 Weeks After Award

**SECTION 013324**

**LIST OF SUBMITTALS**

<b>ITEM</b>	<b>REFERENCE SECTION</b>	<b>REFERENCE ARTICLE</b>	<b>SUBMITTAL REQUIRED</b>	<b>DUE DATE</b>
Testing documentation and data	014500		Daily Records, Testing Records, Photographic Records, Daily Reports, Final Report	2 Weeks After Work Completion
Final Record Drawings, Documents, and Data	013323	106	Final as-fabricated, as-construction record marked up drawings, documents and data, including any changes through construction testing. Underground construction drawings to be marked up with revised coordinates if different than the Issue For Construction drawings.	2 Weeks After Work Completion

**SECTION 013324**

**LIST OF SUBMITTALS**

<b>ITEM</b>	<b>REFERENCE SECTION</b>	<b>REFERENCE ARTICLE</b>	<b>SUBMITTAL REQUIRED</b>	<b>DUE DATE</b>
Concrete Work	033115	103	Submit shop drawings for fabrication, bending and placement of concrete reinforcement	Six weeks prior to fabrication
			Concrete joint location drawings	Four weeks prior to fabrication
			Rebar material certification	Prior to fabrication
			Concrete mix design	Five weeks prior to fabrication
			Manufacturer's catalog for waterstops, vapor retarder, curing compound, joint sealant, form release, etc.	Eight weeks prior to fabrication
			Concreting plans such as provisions for mass concrete including the thermal control plan, hot weather, etc.	Six weeks prior to fabrication
			Concrete cylinder compressive strength tests	Per Section 033115
Hot-Dip Galvanizing	050515	103	Galvanizing procedure	Eight weeks prior to fabrication
			Certificate of Compliance	Two weeks after completing fabrication
Anchor Bolts	050530	103	Material certification for anchor bolts/rod	At Delivery
			Anchor Rod Shop detail drawings	Two weeks prior to delivery
Joint Sealants	079200	103	Manufacturer's product data sheets, installation instructions and details, and material certifications. Color samples.	Prior to Delivery
Coating Systems	099113	103	Product Data Sheets, test reports, SDS sheets and samples. Quality assurance program and procedures	Four weeks prior to delivery



**SECTION 013324**

**LIST OF SUBMITTALS**

<b>ITEM</b>	<b>REFERENCE SECTION</b>	<b>REFERENCE ARTICLE</b>	<b>SUBMITTAL REQUIRED</b>	<b>DUE DATE</b>
Temporary Sediment Control during Construction	311010	103	Material certificate signed by silt fencing manufacturer	At least 30 days prior to use
Excavation and Backfill for Foundations	312316	103	Material Certificates for all bedding and backfill materials, and samples as requested by Owner.	At least 30 days prior to use
Geotextile Material	311521	103	Specifications on the geotextile, manufacturer's certification, manufacturer's quality control and construction quality control plans, samples if requested by Owners	At least 30 days prior to use
Pipe Bedding Material	312333	104	Material certificates signed by material producer, and samples if requested by Owners	At least 30 days prior to use
Prestressed Precast Concrete Driven Piles	316213	107	Pile driving equipment description, results of the wave equation analysis, and shop drawings.	At least 30 days prior to use
Prestressed Precast Concrete Driven Piles	316213	107	Fabrication records, tensioning and detensioning records, and construction quality control plan.	At least 30 days prior to use
Prestressed Precast Concrete Driven Piles	316213	107	Records of pile installation.	4 Weeks After Work Completion
Prestressed Precast Concrete Driven Piles	316213	307	Certified load test data	1 Week After Testing
Sanitary and Storm Structures	330301	104	All sanitary and storm structure shop drawings and product data (including precast manholes)	2 Weeks After Award
Sanitary, Storm, and Water Pipe	330301	104	Data for pressure test, leak tests and deflection tests, and test results	Within 7 days after completion of tests

**SECTION 013324**

**LIST OF SUBMITTALS**

<b>ITEM</b>	<b>REFERENCE SECTION</b>	<b>REFERENCE ARTICLE</b>	<b>SUBMITTAL REQUIRED</b>	<b>DUE DATE</b>
Underground Pipe Testing	400510		Pneumatic/hydrostatic testing; flushing; and cleaning procedures/plans including natural gas cleaning and fire protection flushing	4 Weeks Prior to Testing
Underground CS Pipe Welding	400510		Welding procedures and welder certifications	4 Weeks Prior to First Weld
Underground HDPE	330302	104.1	Competent person certification, fusion weld procedures and joint parameters, size of equipment, heating tool surface temperature, and interface pressure  Material certificates  Melt bend width for each pipe diameter	4 Weeks Prior to First Weld
	330302	104.2 and 104.4	Log indicating location of each joint with visual examination and inspection results  Biological Tests	1 Week After Testing
Piping	400510	105	Test results	1 Week After Testing
			As-built drawings	4 Weeks After Work Completion
			Manufacturer's product data showing the selected component and operating conditions with non-project specific information removed or crossed out	4 Weeks Prior to Delivery
Valves	400523	105	Shop detail drawings  Manufacturer's product data showing the selected component and operating conditions with non-project specific information removed or crossed out	4 Weeks Prior to Delivery

**SECTION 013324**

**LIST OF SUBMITTALS**

<b>ITEM</b>	<b>REFERENCE SECTION</b>	<b>REFERENCE ARTICLE</b>	<b>SUBMITTAL REQUIRED</b>	<b>DUE DATE</b>
Specialties			Manufacturer's product data showing the selected component and operating conditions with non-project specific information removed or crossed out	4 Weeks Prior to Delivery
Underground electrical raceway	337119		Bills of material for all components and materials	4 Weeks Prior to Installation
			Detailed red line record drawings showing dimensions, routes, GPS coordinates, and final installation	4 Weeks After Work Completion
Grounding system	260526		Bills of material for all components and materials	4 Weeks Prior to Installation
			Detailed red line record drawings showing dimensions, routes, and final installation; installed system resistance test results	4 Weeks After Work Completion
Cathodic protection system	264200		Cathodic protection study report: Physical layout and connection diagrams; Bills of material for all components and materials	4 weeks before selection of vendor,
Close Out Submittals	017700	105	Evidence of Payment and Release of Liens	
			Certification of Insurance for Products and Completed Operations	

END OF SECTION 013324



**SECTION 014219**  
**REFERENCE DOCUMENTS**

**PART 1–GENERAL**

101. EXTENT

101.1 This Section includes:

- a. Schedule of References.
- b. Quality Assurance Provisions.

101.2 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. References to these documents are to the latest issue date of each document, unless otherwise indicated in this specification or in the 2020 Florida Building Code, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

101.3 Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.

101.4 Acronyms will be used throughout the text of this specification to refer to the applicable organizations.

102. SCHEDULE OF REFERENCES

102.1 AABC – Associated Air Balance Council

102.2 ACI – American Concrete Institute

102.3 ADA – Americans with Disabilities Act of 1990

102.4 AGA – American Galvanizers Association

102.5 AGA – American Gas Association

102.6 AGMA – American Gear Manufacturers Association

102.7 AHDGA/ZI – American Hot Dip Galvanizing Association.

102.8 AISC – American Institute of Steel Construction

102.9 AISE – Association of Iron and Steel Engineers

102.10 AISI – American Iron and Steel Institute

102.11 AMCA – Air Movement and Control Association International, Inc.

102.12 ANSI – American National Standards Institute

102.13 API – American Petroleum Institute

102.14 ASCE – American Society of Civil Engineers



- 102.15 ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers
- 102.16 ASME – American Society of Mechanical Engineers
- 102.17 ASNT – American Society for Nondestructive Testing
- 102.18 ASSE – American Society of Safety Engineers
- 102.19 ASTM – ASTM International
- 102.20 AWS – American Welding Society
- 102.21 AWWA – American Water Works Association
- 102.22 CFR – Code of Federal Regulations
- 102.23 CGA – Compressed Gas Association
- 102.24 CMAA – Crane Manufacturers Association of America
- 102.25 CPSC – Consumer Product Safety Commission
- 102.26 CRSI – Concrete Reinforcing Steel Institute
- 102.27 CTI – Cooling Technology Institute
- 102.28 EEI – Edison Electric Institute
- 102.29 EPA – Environmental Protection Agency
- 102.30 EPRI – Electric Power Research Institute
- 102.31 FBC – Florida Building Code 2020
- 102.32 FED SPEC – Federal Specifications and Standards
- 102.33 HI – Hydraulic Institute
- 102.34 HMI – Hoist Manufacturers Institute
- 102.35 IAPWS – International Association for the Properties of Water and Steam
- 102.36 ICC – International Code Council
- 102.37 ICEA – Insulated Cable Engineers Association
- 102.38 IEEE – Institute of Electrical and Electronics Engineers
- 102.39 IGCI – Industrial Gas Cleaning Institute
- 102.40 ISA – International Society of Automation
- 102.41 ISO – International Organization for Standardization
- 102.42 MSS – Manufacturers Standardization Society of the Valves and Fittings Industry
- 102.43 NACE – NACE International, The Corrosion Society
- 102.44 NEBB – National Environmental Balancing Bureau



- 102.45 NEC – National Electrical Code
- 102.46 NEMA – National Electrical Manufacturers Association
- 102.47 NERC – North American Electric Reliability Corporation
- 102.48 NESC – National Electrical Safety Code
- 102.49 NFPA – National Fire Protection Association
- 102.50 NIST – National Institute of Standards and Technology
- 102.51 OSHA – Occupational Safety & Health Administration
- 102.52 PCA – Portland Cement Association
- 102.53 PFI – Pipe Fabrication Institute
- 102.54 RCSC – Research Council on Structural Connections
- 102.55 SAE – SAE International
- 102.56 SAMA – Scientific Apparatus Makers Association
- 102.57 SSPC – The Society for Protective Coatings
- 102.58 TEMA – Tubular Exchanger Manufacturers Association
- 102.59 UL – UL LLC
- 103. QUALITY ASSURANCE PROVISIONS
- 103.1 Conform to reference standard by date of issue current on date for receiving bids.
- 103.2 For products or workmanship specified by association, trade, or federal standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- 103.3 Obtain copies of standards when required by Contract Documents.
- 103.4 Maintain copy at job site during submittals, planning and progress of the specific work, until substantial completion.
- 103.5 Should a specified reference standards conflict with Contract Documents, request clarification from Consulting Engineers before proceeding.
- 103.6 The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

END OF SECTION 014219



**SECTION 014500**  
**QUALITY CONTROL**

**PART 1 – GENERAL**

101. **EXTENT**

- 101.1 This Section covers the administrative and procedural requirements for quality assurance and quality control.
- 101.2 Testing and inspecting services are required to verify compliance with design and construction specifications and for production of standard products. These services do not relieve Contractor of responsibility for compliance with the Contract Documents.
- 101.3 The Contractor shall have an inspection, testing and documentation program in effect. The Contractor shall be responsible for assuring that its subcontractor's Quality Control Program meets the specified requirements imposed on the Contractor by the Owner.
- 101.4 All manufacturing, processing, testing, and inspection operations affecting the equipment or material may be subject to surveillance by the Owner or the Owner's Representative.
- 101.5 Requirements for Contractor to provide quality-assurance and -control services may be supplemented by provisions of other sections of the specifications.
- 101.6 Other Sections may contain QA activities specific to those work results.
- 101.7 The Contractor is responsible to assure that any activities sub-contracted to lower-tier constructors or agencies are contractually "passed-down" and the Contractor shall assure that their sub-tier entities follow these requirements.

102. **RELATED WORK SPECIFIED IN OTHER SECTIONS**

- 102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:
  - a. Divisions 03 through 40 Sections for task-specific test and inspection requirements.

103. **REFERENCE DOCUMENTS**

- 103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents indicated in Section 014219, in addition to federal, state, or local codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the applicable additions, addenda, amendments, supplements, thereto, in effect as of the date indicated in Section 014219.
- 103.2 ANSI – American National Standards Institute
- 103.3 API – American Petroleum Institute
- 103.4 ASME – American Society of Mechanical Engineers



- 103.5 ASTM – ASTM International
- 103.6 NEMA – National Electrical Manufacturers Association
- 104. SUBMITTALS
- 104.1 Submit the following documents for review in accordance with the submittal requirements of Section 013323, and as follows:
  - a. The Quality Assurance and Quality Control (QA/QC) Plan.
  - b. Within two (2) weeks prior to beginning of fabrication or as defined elsewhere under Drawings/Data submittal requirements, the following applicable procedures shall be submitted for review and acceptance as applicable:
    - b1. Welding Procedure Specifications (WPS), Procedure Qualification Records (PQR), and welder certifications.
    - b2. Inspection and test procedures conducted in accordance with applicable industry standards such as, but not limited to, ASME, ANSI, IEEE, API, HEI, NEMA, ASTM.
    - b3. Cleaning, painting, storage, packaging, and shipping procedures. Contractor shall attach the Safety Data Sheets (SDS) with all painting/coating procedures.
    - b4. Nondestructive examination procedures and personnel qualifications.
    - b5. Other special processes and procedures, such as heat-treating, pipe bending, flushing, etc.
    - b6. The Contractor shall develop and submit an installation plan describing the installation sequence and inspections and/or tests to be performed, for use in determining inspection points that the Owner may desire to witness. The Owner will advise the Contractor, prior to the start of fabrication, manufacturing, and/or construction of those steps in the fabrication, manufacturing and/or installation process that the Owner desires to witness and Owner will also identify which of these points that require work to be stopped pending written authorization to proceed from the Owner.
  - c. Quality documents, such as but not limited to the ones listed below, shall be submitted as required by the Owner for review and acceptance:
    - c1. Material certifications, including filler metal certifications.
    - c2. Inspection check sheets and nondestructive examination records.
    - c3. Test records.
    - c4. Manufacturer's data reports, safety data sheets, etc.
    - c5. Copies of all deviation reports/non-conformance reports and dispositioning records.
    - c6. Certificate of conformance.
  - d. Radiographs and reader sheets shall be submitted to Owner for review and acceptance within ten (10) days after completion of radiographic examination. All radiographs not properly identified will be rejected.





- e. Non-conformances and deviations shall be documented in detail and promptly submitted to the Engineer for review, acceptance, and resolution.
- 104.2 The Contractor shall furnish the following documents for the Owner's records upon completion of the work:
- a. Certificate of Compliance, stating that all equipment and materials furnished comply with this Specification and accepted deviations.
  - b. Documents identifying deviations and their acceptance.
  - c. Others as indicated in individual Specification sections.
105. GENERAL QUALITY CONTROL AND QUALITY ASSURANCE PROVISIONS
- 105.1 Contractor shall ensure that all materials, equipment, products, and work are manufactured in accordance with the QA/QC program. Contractor shall resolve any comments to the Owner's satisfaction, post-award.
- 105.2 The Contractor shall be responsible for ensuring that its sub-contractor's QA and QC programs meet the specified requirements imposed on the Contractor by Owner.
- 105.3 Contractor shall develop an inspection point program. The program shall include the manufacturing, inspection, and test operations that the Contractor believes may be of interest to Owner in demonstrating product quality, whether performed in its or its sub-contractors' facilities.
- 105.4 Owner and/or its designated representative shall have full access to Contractor's and its sub-contractor's facilities for reviewing conformance to the approved QC program and records, and for witnessing of inspections and tests. Owner and Engineer shall be notified ten (10) working days prior to the start of the witness and hold points as specified by Owner.
- 105.5 The Work shall be designed, fabricated, manufactured and/or performed to meet the service, performance, and minimum level of quality requirements specified herein. The Contractor shall be solely responsible for advising the Owner, in writing, of any conflicts between the Project Specification and the Contractor's installation plans, including performance and levels of quality.
- 105.6 Material, fabrication and placing procedures may be subject to inspections and tests conducted by the Owner or its designated representative. Such inspections and tests will not relieve the Contractor of responsibility for providing material and placing procedures in compliance with specified requirements. The Owner reserves the right, at any time before final acceptance, to reject material, equipment, and workmanship not complying with the specified requirements.
- 105.7 Non-conformances and deviations shall be documented in detail and promptly submitted to the Owner for review, acceptance, and resolution.
- 105.8 Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, workmanship, and conditions to produce work in accordance with the Contract Documents.



- 105.9 Examine the areas and conditions under which work is to be installed and the Owner in writing of conditions detrimental to the proper and timely completion of the work.
- 105.10 Errors or flaws in the work discerned during construction and which prevent the proper installation shall be corrected promptly. The Contractor shall make immediate substitution of the non-complying material or shall make field changes to make the non-complying material acceptable.
- 105.11 For installation steps and tests that the Owner desires to witness, the Contractor shall notify the Owner ten (10) working days prior to witness points and ten (10) working days prior to hold points as a first notice. A second notice shall be given 72 hours prior to both witness and hold points. Notification of hold or witness points shall not be considered to have been given until the Owner has acknowledged receipt of such notification.
- 105.12 All deviations from this Specification shall be documented and referred to the Owner for written disposition.
106. WORKMANSHIP
- 106.1 Comply with industry standards of the region except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- 106.2 Provide suitably qualified personnel to produce work of specified quality.
107. MANUFACTURER'S INSTRUCTIONS
- 107.1 Comply with equipment supplier's and fabrication contractor's instructions in full detail, including each step in sequence.
- 107.2 Should instructions conflict with the Contract Documents, request clarification from the Owner before proceeding.
108. COMPLIANCE WITH REFERENCE DOCUMENTS
- 108.1 For products and workmanship governed by association, trade, or federal standards, comply with requirements of this referenced document. General reference documents are listed in Section 014219 of this Specification.
- 108.2 Have copies of referenced standards on hand during performance of the Work.
109. QUALITY PLAN
- 109.1 Quality Assurance Program:
- a. The Contractor shall have a QA Program in effect at all times to verify that all items and services, including subcontracted items and services, comply with the requirements of the Purchase Order and its attachments.
  - b. This Program shall clearly establish the authority and responsibility of those responsible for the QA Program. Persons performing quality functions shall have sufficient and well-defined responsibility and authority to enforce quality requirements; to identify, initiate, recommend, and provide solutions to quality problems; and to verify the effectiveness of the solutions.



- c. When requested, the Contractor shall submit a controlled copy of its QA or Quality Systems Manual for review and acceptance by the Owner. In addition, when requested by the Owner, the Contractor shall submit copies of any associated implementing procedures and/or instructions.
  - d. If subsequent to its acceptance, the QA Program is found to be ineffective or inadequate in providing acceptable quality control, the Owner reserves the right to require the necessary revisions.
  - e. The Quality Program shall describe as a minimum, the following activities as applicable to the Contractor's scope of supply:
    - e1. Document Control System.
    - e2. Procurement Control System.
    - e3. Special Process Control (welding, NDT, etc.).
    - e4. Identification of Materials and Parts.
    - e5. Calibration of Measuring and Test Equipment.
    - e6. Control of Nonconforming Material.
    - e7. Quality Records.
  - f. Exceptions to the above Quality program requirements can be made on a case-by-case basis with the Owner concurrence.
  - g. As applicable to the Contractor's scope of supply, the following information shall be submitted to the Owner for review and concurrence, prior to the start of manufacturing:
    - g1. Welding procedures, procedure qualification records, welder's qualification requirements, shop, and field heat treatment procedures.
    - g2. Nondestructive test procedures, acceptance criteria, and personnel qualifications.
    - g3. Description/Criteria of acceptance inspections and tests to be performed.
    - g4. Performance test procedures with acceptance criteria.
    - g5. Types of records and reports to be submitted with the finished product.
  - h. Once accepted, the Contractor will be monitored during construction for adherence to its Quality Assurance Program.
- 109.2 Following are examples of the supplier quality monitoring process, and may be used in whole or in part, as determined necessary, to assure that the supplied product meets specification requirements:
- a. Quality Audits.
  - b. Review of vendors' "Quality Management Program" (QA/QC Manuals, Fabricator's Inspection Point Program, Shop Inspection/Test Procedures, Special Process/Fabrication Procedures, etc.).



- c. Source surveillance performed during manufacture/fabrication.

110. INSPECTIONS AND TESTS

110.1 General:

- a. The Inspection and Test Plan, provided by the Contractor shall indicate all inspections and tests to be performed with the specified equipment. The Inspection and Test Plan shall refer to the applicable inspection and test instruction, whether for source, incoming, intermediary, final or site inspections and tests. The Contractor's Inspection and Test requirements shall fulfill the minimum inspection and test requirements. The Owner, the licensing authorities, as well as their agents shall have the right to witness all tests and inspections carried out in compliance with the Contractor's Inspection and Test Plan. They shall be permitted access the Contractor's shop, where and while all tests or inspections are being performed.
- b. Shop Tests and Inspections: The shop tests and inspections of the specified equipment shall be carried out according to the Contractor's Inspection and Test Plan, which has been approved by the Owner.
- c. Site Tests and Inspections: The site tests and inspections of the specified equipment shall be carried out according to the Contractor's Site Inspection and Test Plan, which has been approved by the Owner.

110.2 Material or equipment shall not be shipped before the Contractor presents a Certificate of Compliance, signed, and dated by the Contractor's Quality Assurance/Quality Control department. A copy of this document shall be securely attached to the equipment to be shipped. It is important that the equipment arrives at the site with a copy of the Certificate of Compliance attached.

110.3 The Contractor's Responsibilities for Subcontractors:

- a. The Contractor shall identify in purchase documents to its Suppliers, all applicable quality and QA requirements imposed by this specification on the Contractor and shall ensure compliance thereto. The Contractor has the prime responsibility for subcontractor surveillance and evaluating and monitoring the implementation of the Quality Assurance Programs of its subcontractor.
- b. The Contractor shall submit a copy of its subcontractor Surveillance plans to the Owner for review prior to implementation. Upon request, the Contractor shall submit to the Owner copies of the reports of the subcontractor surveillance activities that it performs on its Suppliers.

110.4 Witness and Hold Points:

- a. The Owner shall have the right to establish witness and hold points. In addition, the Owner may establish witness points to ensure resolution of quality problems.
- b. Witness points are defined as predetermined points during installation when installation procedures or activities may be inspected or witnessed for compliance with the Contract, specification, and quality requirements.



- c. Hold points are defined as predetermined points during the installation process when procedures must be inspected and accepted by the Owner prior to continuing installation. The Owner shall have the right to access the Contractor's and its subcontractor's facilities at any time to verify the progress and quality of the work.

END OF SECTION 014500



**SECTION 015250**

**CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

**PART 1 - GENERAL**

101. EXTENT

101.1 This Section covers the following areas:

- a. Temporary utilities: electricity, communication, water, and sanitary facilities.
- b. Temporary controls: barriers and enclosures, cleaning, fire protection equipment, noise, dust, and erosion controls.
- c. Temporary construction: equipment, scaffolding, storage, temporary buildings, etc.
- d. Station and Project rules and security.
- e. First Aid Station.

102. REFERENCE DOCUMENTS

102.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to any applicable federal, state, or local law, regulation, requirement, code, rule, standard, or guideline, to the extent mandatory (collectively "Applicable Law").

102.2 Contractor to submit procedures for hot work permits, confined space program, and weld program to Owner for review. If programs are acceptable to Owner, Contractor can use Contractor's programs. If not acceptable to Owner, Contractor to use Owner procedures.

102.3 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

102.4 Abbreviations listed indicate the form used to identify the reference documents in the Specification text.

- a. NEC - National Electrical Code
- b. NFPA – National Fire Protection Association
- c. OSHA – Occupational Safety and Health Act (including current regulations)

103. SUBMITTALS

103.1 Safety Data Sheets (SDS) (1 month prior to material arrival on site)



104. GENERAL

104.1 All construction facilities and temporary controls necessary for the execution of the Work shall be designed, provided, installed, maintained, protected, removed, and the like by Contractor unless explicitly specified herein to be by others.

104.2 In execution of the Work, Contractor shall take into consideration the work by others to minimize subsequent impacts to their work. Contractor shall coordinate their work and cooperate with all parties.

105. TEMPORARY ELECTRICITY

105.1 Contractor shall design, supply, install, and maintain all extension and distribution facilities from site 480V source. See site drawing near Owner trailers. Routing must be acceptable to the Owner's Representative. (e.g. installations in traffic areas shall be run minimum ten (10) feet overhead for routes inside existing structures and run underground for all other areas.)

105.2 Contractor shall furnish and install ground fault circuit interrupters (GFCI's) as required in Section 305 of the National Electrical Code; remove GFCI's when work is complete.

106. TEMPORARY COMMUNICATION SERVICE

106.1 Contractor shall design, provide, install, maintain, and pay for telephone, internet, etc. communication services as necessary for Contractor's use to perform the Work and for Owner and Owner Representative's use.

107. TEMPORARY WATER SERVICE

107.1 Owner will provide a single source of service water (not potable) on site. The Contractor may use reasonable quantities of this water, free of charge, in the performance of Contractor's Work. The Owner will not be responsible for the failure of any water supply or facilities. When service water is provided to Contractor, the following applies.

107.2 Owner will provide a single source of potable water.

107.3 Locations for both water supplies will be walked down during the pre-bid meeting. Contractor to include any required piping to trailers and any other facilities.

107.4 Contractor shall:

a. Furnish all material, connect to existing pipeline(s), and install, as approved by the Owner's Representative, and maintain such branch mains, risers, outlets, and hoses. Provide isolation valve(s) immediately downstream of tie-in(s), shutoff valve(s) at each outlet, and, as needed, hose connections.

b. For Contractor supplied installations, post warning signs at all service water outlets stating, "water not suitable for drinking" and provide appropriate labels/paint scheme/signage/etc. to identify the service.

107.5 Contractor shall maintain overall responsibility to provide safe, potable drinking water to Contractor's personnel per applicable law.



- 107.6 Owner will provide a single source of potable water on site. The Contractor may use reasonable quantities of this water, free of charge, in the performance of Contractor's Work. The Owner will not be responsible for the failure of any water supply or facilities. When potable water is provided to Contractor, the following applies.
- 107.7 Contractor shall:
- a. Use due care to protect Owner's domestic water supply from contamination. No connections shall be made or any water used without approval from Owner's Representative for each connection. Contractor shall at all times maintain a positive disconnection between domestic supply and containers, tanks, tanker trucks, equipment, etc. Similar precautions shall be followed to prevent contamination by interflow or siphonage through direct connections to waste or drain lines. A backflow preventer may be utilized to prevent contamination.
  - b. Furnish all material, connect to existing waterline, and install, as approved by the Owner's Representative, and maintain such branch mains, risers, outlets, and hoses. Provide isolation valve(s) immediately downstream of tie-in(s), shutoff valve(s) at each outlet, and, as needed, hose connections. Meet all applicable law including: materials, installations, testing, disinfecting, and flushing branch connections, and distribution.
  - c. For Contractor supplied installations, provide appropriate labels/paint scheme/signage/etc. to identify the service.
  - d. Provide its own storage vessels, coolers, ice, water containers, etc., as required for Contractor's drinking water use. Contractor shall provide and maintain drinking water containers.
108. TEMPORARY SANITARY FACILITIES
- 108.1 Contractor shall provide and maintain required facilities and enclosures and dispose of waste off site per all applicable law.
- 108.2 The Owner's Representative will designate approved locations for the Contractor's facilities.
- 108.3 The use of the Station's permanent sanitary facilities by Contractor's personnel is not permitted.
109. TEMPORARY FACILITIES, STRUCTURES, AND CONSTRUCTION AIDS
- 109.1 Contractor shall design, provide, install, and maintain all necessary construction equipment, cranes, tools, hoists, scaffolding, ladders, guards, and other arrangements necessary for the proper execution of the Work or required by applicable law.
- 109.2 Temporary facilities, structures, and construction aids required or utilized by the Contractor in execution of the Work shall be designed, provided, and maintained by Contractor. Examples include trash chute(s) from elevated areas to dumpster(s) at grade, temporary pipe supports, structural braces, guy-wires, etc. All temporary facilities, structures, and construction aids by Contractor shall be designed and stamped by a professional engineer, registered in the State in which the Work is performed.





110. BARRIERS

110.1 Contractor shall:

- a. Prevent unauthorized entry to construction and unsafe areas and protect existing facilities and adjacent properties from damage due to the Work, including construction, demolition, etc. by any means necessary including, but not limited to barriers.
- b. Protect vehicles, traffic, stored materials, site, and structures from damage including non-Contractor owned by any means necessary including, but not limited to barriers.
- c. Owner will provide fencing to isolate the RICE project from the coal plant demolition project.

111. PROTECTION OF WORK AND PROPERTY

111.1 Contractor shall:

- a. Protect the Work, including but not limited to equipment, materials, and installations that are in the Contractor's care, custody, and control.
- b. Provide and implement special protection where specified in individual specification sections.
- c. Provide temporary and removable protection for existing and new installations. Actively provide control in immediate work area to minimize damage.
- c1. Protect the Work and existing structures/buildings/equipment from flooding, which are resultant of the Work. Provide all equipment necessary to prevent or overcome flooding.
- d. Provide its own temporary fire protection facilities for the equipment and materials furnished by Contractor or the Owner and for Contractor's temporary construction buildings and structures. This equipment shall be installed, maintained, and inspected in accordance with applicable NFPA codes.

111.2 Protection Required During Construction: In addition to OSHA, State, and standard protection precautions required during the Work protection for/from the following shall be provided:

- a. Erosion and sediment control of the work areas and as indicated on the Design Drawings and Section 311010.
- b. Dust control including but not limited to dust caused by truck traffic through residential areas and on site.

112. PROGRESS CLEANING

112.1 See section 024116 for additional hazardous material/waste and general waste management, characterization, disposal, and documentation requirements.

112.2 Contractor shall:



- a. Prevent at all times any unnecessary accumulation or scattering of materials, tools, and equipment throughout the site. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
  - b. Provide appropriate size and type of trash receptacles strategically located through the Work area to adequately manage waste. When disposable drinking water cups/etc. are utilized on site, Contractor shall supply an appropriate trash receptacle at each location.
  - c. Remove waste materials, debris and rubbish from site as directed by the Owner's Representative.
- 112.3 Hazards Control:
- a. Store volatile wastes in the approved, covered containers and remove from premises daily.
  - b. Prevent accumulation of wastes which create hazardous conditions.
  - c. Provide adequate ventilation and controls during use of reactive, volatile, or noxious materials.
  - d. Where applicable, provide hazardous waste management program that meets Station/Project Rules and all applicable law. At minimum, hazardous waste may not be stored on site more than five (5) days.
- 112.4 Conduct cleaning and disposal operations to comply with all applicable law including local ordinances and anti-pollution laws.
- a. Do not burn or bury rubbish or waste materials on site.
  - b. Do not dispose of any wastes into or allow any wastes to enter into storm sewers, sanitary sewers, streams, or waterways. All waste shall be disposed of per applicable law.
- 112.5 Under no circumstances shall any rubbish/debris/waste be dropped or thrown from one level to another within or outside any building. Approved trash chutes or other safe means shall be utilized.
- 112.6 If Contractor fails to comply with any of the above provisions, Owner reserves the right to remove debris, tools, and equipment, and to charge the cost of such removal to Contractor. Such charge shall apply as a credit on the Contract amount.
113. STATION/PROJECT RULES AND SECURITY
- 113.1 Contractor and Contractor's subcontractors shall abide by all station and/or project rules/regulations/policies (herein referred to as Rules) in effect at the work site.
- 113.2 Contractor's personnel shall be restricted to the immediate area of the Work and to approved storage and office areas. Routes for entry and egress will be approved in advance by Owner.
- 113.3 Contractor shall obtain information from the Owner as to all restricted areas and shall be responsible for policing Contractor's personnel to keep them out of such restricted areas.



- 113.4 Contractor shall not alter plant structures or devices other than as described in the Contract and Design Documents except by written authorization of the Owner.
114. FIRST AID STATION
- 114.1 Contractor shall supply its own first aid facility and staff for the treatment of Contractor's personnel.
115. REMOVAL OF UTILITIES, FACILITIES AND CONTROLS
- 115.1 Contractor shall:
- a. Remove temporary utilities, equipment, facilities, structures, construction aids, materials, and installations at the termination of their usefulness and prior to final inspection, unless otherwise directed by Owner.
  - b. Clean and repair damage caused by installation or use of temporary work including but not limited to: asphalt, painted surfaces, penetrations, etc. or as specified in contract documents.
  - c. Restore existing facilities and areas used during construction to original condition or as specified in contract documents.

END OF SECTION 015250

015250-6



**SECTION 016131**  
**NAMEPLATES AND TAGS**

**PART 1 - GENERAL**

101. EXTENT

101.1 Section prescribes the minimum requirements for equipment nameplates and tags.

102. GENERAL

102.1 Number equipment and components using Owner's numbering system.

102.2 Owner's identification numbering system is provided in the P&ID legends and symbols sheet to consistently number equipment and components throughout the generating plant (See Attachment 6).

102.3 Identification numbers shall be consistent with the numbering on drawings, lists, indexes, data sheets, manuals and electronic files.

102.4 Contractor shall provide nameplate and tag information for review.

102.5 Nameplates or tags shall indicate, as a minimum, the manufacturer's name, manufacturer's project number, the Purchase Order number under which the item was purchased, the equipment identification number using the Owner's identification number to identify that piece of equipment on Contractor's drawings and the item's serial number.

103. REQUIREMENTS

103.1 Nameplates and tags shall be provided for all valves, specialty components and other items of similar nature supplied with a unique identification number, plant KKS tag number, and in accordance with the following guidelines.

103.2 The nameplates and tags shall be manufactured of stainless steel. Contractor shall engrave the identification information on the nameplates or tags and permanently affix them to the device.

103.3 Nameplates or tags shall be stamped, as a minimum, with the manufacturer's name, manufacturer's project number, the Purchase Order number under which the item was purchased, the identification number using the Owner's identification number to identify that piece of equipment on Contractor's drawings and the item's serial number.

103.4 Contractor shall install stamped stainless steel tags for the following equipment. The tags shall be secured with stainless steel wire with ends crimped together.

a. Valves with Owner's valve tag number(s).

b. Hydrants with Owner's tag number(s)



- 103.5 Piping labels with the plant KKS tag number and service for the underground piping shall be painted on the above grade portion of piping (just below the flange) by Contractor. Color of painted label per service may differ and must be approved by Owner prior to application.

END OF SECTION 016131



**SECTION 016500**  
**PRODUCT DELIVERY REQUIREMENTS**

**PART 1 - GENERAL**

101.        **EXTENT**

101.1       This Section covers the basic requirements for the delivery of material, products and equipment to the project site and addresses the following topics:

- a.        Location of Project.
- b.        Transportation facilities.
- c.        Pre-assembly of equipment.
- d.        Packaging and shipping.
- e.        Identification of shipped items
- f.        Delivery of equipment.
- g.        Protective coatings and preservatives.
- h.        Inspection and verification of delivered equipment and fabricated material.
- i.        Contractor to keep track of all shipments, including Contractor shipments, engine OEM shipments and Owner shipments for the project.

101.2       The Contractor is responsible to assure that any activities sub-contracted to lower tier constructors or agencies are contractually passed down and Contractor shall assure that their sub-tier entities follow these requirements.

101.3       A detailed transportation plan for shipping and delivery of the equipment and/or fabricated material assembled to the greatest extent shippable.

102.        **PRE-ASSEMBLY OF EQUIPMENT AND FABRICATED MATERIAL**

102.1       Within the shipping limitations to the project site and to the maximum extent practical, Contractor shall pre-assemble all components off site.

103.        **PACKAGING AND SHIPPING**

103.1       Contractor shall adequately prepare the equipment or fabricated material for shipment. Where required to preserve/protect the equipment or fabricated material, Contractor shall furnish and install covers to protect the equipment from rain, hail, wind, dust, and environmental conditions detrimental to the equipment or material. Equipment shall be adequately sealed and protected during shipment to prevent corrosion, entrance of foreign matter and possible damage from rough handling during transit. Any articles or materials that might otherwise be lost in shipping shall be boxed or wired in bundles and plainly identified as described hereinafter.

103.2       When a shipment is to be made, Contractor shall notify the Owner giving a description of the articles shipped, the packing list and any other information necessary for



identification. The packing list or shipping documents shall minimally include the following information:

- a. Owner/Client Purchase Order Number.
- b. Contractor part, piece, or identification numbers as appropriate.
- c. Shipment tracking number.

103.3 Contractor shall also provide instructions for assembly and storage of equipment, instruments or fabricated material that should be stored inside or that requires special attention or maintenance prior to installation and for the period of time between completion of installation and the time that the equipment is placed in service.

103.4 Protective Coatings and Preservatives:

- a. Preservative coatings used on components shall be suitable for the conditions normally expected during shipping, storage and throughout the erection period.
- b. Each type of preservative used shall be identified as to quality, life expectancy and type. Toxic and hazardous type preservatives shall not be used. Safety Data Sheets (SDSs) shall be provided for all preservatives brought on to the project site. The SDSs shall be submitted to the Owner and shall cover step-by-step procedures, including federal, state, and local governing controls for handling and removal of each type of preservative. This information shall be submitted six months prior to delivery. The material represented on these SDSs requires approval by the Owner prior to the bringing the material on the project site.

103.5 Contractor shall provide notification to the Owner at least fifteen (15) days in advance of the expected shipping date. At that time, the Owner will advise Contractor of acceptable delivery hours.

103.6 All equipment and separately shipped items shall be clearly identified with a securely fastened, weatherproof tag. All shipping containers, packing lists, bills of material, correspondence, etc., shall also be identified with identical information. Boxes, shipping containers, crates, etc., shall have a packing list firmly attached to the exterior and a duplicate packing slip packed internally.

103.7 Identification requirements are as follows:

Owner	_____
Station / Unit	_____
Equipment/Instrument Tag No.	_____
Service	_____
Contract / Specification No.	_____
Contractor's Order No.	_____
Date shipped	_____

103.8 Contractor shall be responsible for its sub-contractor(s) adhering to the above shipping preparations on all equipment and items shipped directly to the site by the sub-contractor.



- 103.9 No early shipment of equipment covered by this Specification shall be made unless a release has been obtained from the Owner.
- 103.10 All weld preparation, flanged faces, other machined surfaces, and protruding parts shall be adequately protected against accidental damage and corrosion during transit or storage. Protective covers and braces shall be securely fastened to prevent displacement during transit.
104. DELIVERY OF EQUIPMENT
- 104.1 The Owner and Contractor shall agree on the date and time of delivery for the purchased products, equipment, or material. Contractor shall receive all materials. Owner is operating power generation units during project execution and thus has requested the below notifications of deliveries.
- 104.2 At least two (2) weeks prior to the start of delivery of equipment, Contractor shall submit complete bills of material to the Owner. Contractor's tag numbers and Owner's equipment tag numbers shall be shown on the bills of material, and on the equipment and all external appurtenances via a nameplate or metal tag securely wired to the device. In particular, the bills of material shall identify:
- a. Date of shipments.
  - b. Number of shipments.
  - c. Complete contents of each shipment.
  - d. Origin of each shipment.
- 104.3 Owner's site project manager shall be notified of the delivery date at least one week before the equipment is to be delivered. Further, Owner's site project manager shall be notified of the delivery time at least twenty-four (24) hours before the equipment is to be delivered.
- 104.4 Contractor shall identify the means by which equipment will be transported to the site.
- 104.5 Contractor shall coordinate all deliveries and cooperate fully with Owner's site representative. Details on delivery schedule, unloading and handling requirements, storage prior to and during installation and any onsite requirements of the equipment shall be coordinated with the Owner.
- 104.6 Contractor shall ensure the necessary storage instructions are on site and followed to maintain the original condition of equipment, before installation and until the equipment is placed in service.

END OF SECTION 016500

016500-3





**SECTION 016600**

**PRODUCT RECEIVING, STORAGE, AND HANDLING REQUIREMENTS**

**PART 1 - GENERAL**

101. **EXTENT**

101.1 This Section covers the basic requirements for the receipt, handling, and storage of material, products, and equipment received at the Project site. It addresses the following topics:

- a. Receiving, unloading, storage, and protection.
- b. Inspection, verification, and reporting.
- c. Special handling of alloy and stainless steel.

101.2 The Contractor is responsible for ensuring that any activities sub-contracted to lower tier contractors or agencies are contractually bound and that their sub-tier entities follow these requirements.

102. **RECEIVING, UNLOADING, STORAGE AND PROTECTION**

102.1 Owner will designate storage or laydown areas for material, product, and equipment deliveries. See overall site drawing in Attachment 5.

102.2 The Contractor shall receive, unload, store, manage, and protect all material, products and equipment delivered based on the Contractor's requirements and the requirements of the Owner. The Contractor shall:

- a. Authorize the delivery vehicle onto the site and escort the delivery while on site.
- b. Direct the safe and proper unloading and handling of the material, products, and equipment.
- c. Receive (count, verify, and inspect) the material, products, and equipment.
- d. Properly place the material, products, and equipment into approved storage.
- e. Document the receipt, inspection, site security, and storage maintenance of the material, products, and equipment.

102.3 The Contractor shall provide the heaters and equipment as necessary to control and maintain the temperature and environment as required by Equipment Suppliers' for material or equipment that is sensitive or vulnerable to environmental damage or requires heated storage.

102.4 Equipment required by the Equipment Suppliers to be covered or wrapped during storage shall be maintained by the Contractor including the responsibility to frequently inspect and replace deficient or missing protective coverings.

102.5 Protective Coatings and Preservatives:



- a. Preservative coatings used on components shall be suitable for the conditions normally expected during shipping, storage and throughout the erection period. Installation Contractor shall monitor and reestablish as necessary any preservatives or coatings that have deteriorated and become ineffective in accordance with the requirements of the manufacturer.
  - b. Each type of preservative used shall be identified as to quality, life expectancy and type. Toxic and hazardous type preservatives shall not be used. Safety Data Sheets (SDSs) shall be provided for all preservatives brought on to the project site. The SDSs shall be submitted to the Owner and shall cover step-by-step procedures, including federal, state, and local governing controls for handling and removal of each type of preservative. The material represented on these SDSs requires written approval by the Owner prior to the bringing the material on the project site.
- 102.6 Material, products, and equipment shall be stored and tracked by a material log or database system with input capabilities from bar-coding or radio frequency devices so that material location and status is known from the time the material is received, during the time that it is removed from storage, installed in its final location, and until it is turned over to the project start-up group or the Owner.
- 102.7 Contractor to include an overall site storage plan/map, updated bi-weekly to the Owner, tracking container locations on site.
103. INSPECTION, VERIFICATION, AND REPORTING
- 103.1 Contractor shall inspect and verify that products, equipment, and fabricated material delivered to the project site are free from obvious damage or defects, correctly identified, and acceptable for their intended use. Contractor shall develop their own procedures, as required, to perform the receipt inspection and verification.
- 103.2 Products, equipment, and material shall be inspected visually prior to off-loading from the delivery truck or vehicle. Visual defects shall be handled in the following manner.
- a. Any defects in shipping crates or boxes for Contractor will be noted on the bill of lading and acknowledged (with driver's signature) by the delivery driver. Shipping crates for other deliveries for the Owner do not need to be opened.
  - b. Once this damage is noted and before the driver and delivery vehicle are released, the crate or box will be opened and the contents inspected for damage.
  - c. The Equipment Supplier or Contractor's own management will be contacted immediately, before the driver leaves the Project site, for direction as to whether or not the damage item should be returned.
  - d. If the item is accepted with damage, pictures will be taken of the damage and a report (Nonconformance Report or NCR), including the pictures, shall be sent to Contractor for disposition of the damage or deficiency.
- 103.3 If an item is rejected for any reason, a notification to the Owner is required.
- 103.4 Once the delivery is accepted and offloaded, the material, product or equipment will be verified (receipt inspection) against the requirements of the shop detail drawings, data sheets, project specification or any other documentation available to assure that the



equipment or fabricated material has been correctly supplied, properly identified, and suitable for its intended use. This receipt inspection shall be documented using a material control log or database system.

- 103.5 A nonconformance report (NCR) will be filed with the Equipment Supplier or Contractor, with a copy to the Owner, for any equipment or fabricated material that does not meet the shop detail drawings, data sheets or project specification.
- 103.6 Contractor shall track the NCR to closure. No equipment or fabricated material shall be installed with an outstanding unresolved NCR.
- 103.7 It shall be Contractor's responsibility to work with the Equipment Suppliers to correct any discrepancy in the equipment or fabricated material delivered to the Project site.
104. SPECIAL HANDLING OF PASSIVATED CORROSION RESISTANT METALS (STAINLESS STEELS, NI-CR ALLOYS, ALUMINUM, AND TITANIUM)
- 104.1 Passivated corrosion resistant metal (stainless steels, Ni-Cr alloys, aluminum, and titanium) items shall be handled, stored, secured, fit, formed, cut, transported, and lifted to prevent iron contamination. The following practices shall be part of any procedures which are developed to achieve this requirement:
- a. Shipping – do not steel chain to truck bed.
  - b. Lifting – use nylon (or other non-steel) slings. Forklifts shall have the front arms protected (carpeted) when off-loading materials.
  - c. Fitting Equipment – shall be made of the same passivated corrosion resistant metal or contact points shall be lined with the same passivated corrosion resistant metal.
  - d. Grinders – shall be marked so that once they are used on carbon steel they shall not be used on passivated corrosion resistant metal.
  - e. Rolling Brakes and Shears – clean all contacting surfaces with a solvent and put cardboard or other membrane between the equipment and the passivated corrosion resistant metal material.

END OF SECTION 016600



**SECTION 017700**  
**CONTRACT CLOSEOUT PROCEDURES**

**PART 1 - GENERAL**

101.        **EXTENT**

- 101.1        This Section includes the requirements to closeout the Contract once the Work is complete.
- 101.2        Upon completion of the Work, clean-up project site and construction area. Provide access and coordinate with Owner's personnel.
- 101.3        Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- 101.4        Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- 101.5        Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

102.        **FINAL CLEANING**

- 102.1        In addition to removal of debris and cleaning specified in other sections, remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from interior and exterior exposed-to-view surfaces.
- 102.2        Remove temporary protection and labels not required to remain.
- 102.3        Clean finishes free of dust, stains, films, and other foreign substances.
- 102.4        Clean surfaces of equipment; remove excess lubrication.
- 102.5        Remove waste, debris, and surplus materials from site.
- 102.6        All salvage will remain the property of the Owner and shall be disposed of as directed by the Owner's Representative.
- 102.7        Burning of materials for disposal purposes will not be permitted.
- 102.8        Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- 102.9        Prior to final completion or to Owner occupancy, the Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that the entire Work is clean.

103.        **SUBSTANTIAL COMPLETION**

- 103.1        When Contractor considers the Work is substantially complete, the Contractor shall submit to the Owner the following:
  - a.            A written notice that the Work, or designated portion thereof, is substantially complete.



- b. A list of items to be completed or corrected.
- 103.2 Within a reasonable time after receipt of such notice, Owner will make an inspection to determine the status of completion.
- 103.3 Should the Owner determine that the Work is not substantially complete:
- a. Owner will promptly notify the Contractor in writing, giving the reasons, therefore.
  - b. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Owner.
  - c. The Owner will re-inspect the Work.
104. FINAL INSPECTION
- 104.1 When Contractor considers the Work is complete, the Contractor will submit written certification that:
- a. Contract Documents have been reviewed.
  - b. Work has been inspected for compliance with Contract Documents.
  - c. Work has been completed in accordance with Contract Documents.
  - d. Equipment and Systems have been tested in the presence of the Owner's representative and are operational.
  - e. Work is completed and ready for final inspection.
- 104.2 The Owner will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- 104.3 Should the Owner consider that the Work is incomplete or defective:
- a. The Owner will promptly notify the Contractor in writing, listing the incomplete or defective Work.
  - b. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Owner that the Work is complete.
  - c. The Owner will re-inspect the Work.
- 104.4 When the Owner finds that the Work is acceptable under the Contract Documents, the Owner shall request the Contractor to make closeout submittals.
105. CONTRACTOR'S CLOSEOUT SUBMITTALS TO OWNER
- 105.1 As prerequisites to final payment, submit evidence of compliance with requirements of governing authorities.
- 105.2 Submit evidence of Payment and Release of Liens.
- 105.3 Submit certification of Insurance for Products and Completed Operations.



- 106. FINAL ADJUSTMENT OF ACCOUNTS
- 106.1 Submit a final statement of accounting to the Owner.
- 106.2 Statement shall reflect all adjustments to the Contract Sum:
  - a. The original Contract Sum.
  - b. Additions and deductions resulting from:
    - b1. Previous Change Orders and/or Contract Modifications.
    - b2. Unit Prices.
    - b3. Deducting for uncorrected Work.
    - b4. Penalties and Bonuses.
    - b5. Deductions for liquidated damages.
    - b6. Deductions for re-inspection payments.
    - b7. Other adjustments.
  - c. Total Contract Sum, as adjusted.
  - d. Previous payments.
  - e. Sum remaining due.
- 106.3 The Owner will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders or Contract Modifications.
- 107. FINAL APPLICATION FOR PAYMENT
- 107.1 Contractor shall submit the final Application for payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION 017700

017700-3



**SECTION 019100**

**CONSTRUCTION TESTING, TURNOVER AND COMMISSIONING SUPPORT**

**PART 1 - GENERAL**

101. **CONSTRUCTION AND COMMISSIONING DELINEATION OF WORK**

101.1 The Contractor shall perform, install, and document their work as described in the following delineation of responsibility matrix:

<b>MATRIX DEFINITIONS &amp; LEGEND</b>	
<b>Perform -</b>	Indicates which group will perform this activity. The work includes all manpower, means of access, construction equipment, and material to perform the activity as well as completing the associated documentation for the activity, documentation shall be added to the System Turnover Package to the Owner. Several of the activities (flushes/cleaning for example) require strict procedural compliance.
<b>Coordinate -</b>	Indicates which group will provide the overall coordination of the activity.
<b>Accept -</b>	Indicates which group will have to accept the completion of the activity. When there is an acceptance criterion, Commissioning will then sign off for acceptance if the documentation indicates the test results are in the acceptable range. Commissioning will have the opportunity to witness this activity. When the test data is outside the acceptable criterion range, others (Owner, OEMs, Vendors, and/or Consulting Engineer) will become involved to assist in resolving the issue.
<b>Oversight -</b>	Indicates which group will conduct checks only for the activity.
<b>Review -</b>	Indicates which group will monitor the activity to verify the performance is meeting the required standards.
<b>Install -</b>	Indicates which group will install the equipment. Construction will be the only responsible party that carries this indication (Start Up (SU) support craft labor is construction craft labor working under Commissioning guidance, on commissioning activities).

<b>RESPONSIBILITY MATRIX NOTES</b>	
(1)	Asterisk (*) denotes activities that are expected to be completed before turnover from Construction to Owner.



<b>RESPONSIBILITY MATRIX NOTES</b>	
(2)	Motor heaters which are connected to temporary power during construction shall remain connected and energized. The permanent cables shall be prepared by Construction with cable and conductor labels as well as any lugs and hardware necessary for the final connection to be completed. The permanent cable will then be connected by SU support craft labor after turnover to Commissioning.

**General:**

<u>Activity</u>	<u>Contractor</u>	<u>Commissioning</u>	<u>Owner</u>	<u>Notes</u>
Administer Lock Out Tag Out Program (LOTO)	Perform	Coordinate/Oversight	-	Prior to Plant acceptance or Substantial Completion.
Submittal of Engineering lists (motor, pipe, instrument, pump, valve, I/O, cabling, etc.)	-	Obtain from Consulting Engineer/Review	-	Make information available to Owner & Contractor.
Site Cleanliness	Perform	Provide oversight	-	-
Storage of Engine OEM Materials (2)	Perform	-	-	According to Engine OEM Direction via O&M manuals
Master Deficiency List (MDL) maintenance	-	Compile during CTO walkdowns/ Incorporate onto Master MDL/Coordinate resolution	-	Consulting Engineer maintains on a System Turnover Package basis.
System walkdowns of installed systems for completeness and document punchlist items for incorporation in MDL	*Perform	Coordinate/Schedule Owner & vendor to attend & compile overall system MDL items	-	Contractor shall perform construction system walkdowns to ensure completion prior to making a request for turnover walkdown with Consulting Engineer. Contractor shall conduct final system turnover walkdowns with Consulting Engineer and Owner.
Compile completed construction testing data forms for turnover to Commissioning at system release	*Perform	Oversight/Accept	-	Consulting Engineer to review for completeness.





<u>Activity</u>	<u>Contractor</u>	<u>Commissioning</u>	<u>Owner</u>	<u>Notes</u>
Turnover of Systems to Owner	-	Perform - includes prior CTO construction data & relevant Commissioning of systems data	-	Owner review/Accept.
As-Built Drawings	Perform/ provide at CTO turnover	-	-	Contractor to red-line changes in the field. Engineering to issue as final.
Provide temporary power (2)	Perform from Owner source tap, via contractor extensions in field	-	-	-
Install/remove temporary equipment, strainers, valves, pipe hangers, blanks, tubing, instrumentation, orifices, etc., used for testing purposes	Install/ Perform	-	-	Contractor to restore system to final design condition with oversight/review of Consulting Engineer.
Install/remove temporary scaffolding, access platforms, etc., as required	Coordinate	-	-	
Repair or replace all equipment, instruments, controls, valves, welds, and/or gaskets that are damaged or found to be defective during initial operation of plant systems	Install/ Perform	-	-	Responsibility of cost for each occurrence will be reviewed and assessed (extra or not) by Project Team. Oversight will be provided by Consulting Engineer.



<u>Activity</u>	<u>Contractor</u>	<u>Commissioning</u>	<u>Owner</u>	<u>Notes</u>
Perform and document routine maintenance and inspection of materials, equipment, valves, vessels, electrical components, instruments, etc., in accordance with the manufacturer's recommendations.	Perform lay-up maintenance from initial arrival at site until final turnover to Owner	Oversight, after Turnover to Owner	-	After turnover to Owner all maintenance activities will be performed by Others with direction/oversight by Commissioning. Oversight will be provided by Consulting Engineer.
Install equipment, instrumentation, valves, etc., identification tagging.	Perform/ Install	Accept	-	Contractor to install identification tagging in accordance with design drawings and technical specifications.

**Mechanical:**

<u>Activity</u>	<u>Contractor</u>	<u>Commissioning</u>	<u>Owner</u>	<u>Notes</u>
System Cleaning (1) - Air Blows, Steam Blows, Chemical Cleaning, Pigging, etc.)	*Perform; Provide labor for temp material/equip install/removal	Oversight	-	Consulting Engineer will review/approve procedure. Oversight will be provided by Consulting Engineer.
System Cleaning (1) – Fuel Gas System Blows	*Perform	Oversight/Accept	-	Consulting Engineer will review/approve procedure. Oversight will be provided by Consulting Engineer.
Initial Lubrication and Fills (flush quantity & post flush 1 <sup>st</sup> fill only, OWS pumps & Sanitary Lift)	*Perform	Oversight/Accept	-	After 1 <sup>st</sup> fill, subsequent lubricants to Owner account.
Hydrostatic & Pneumatic Testing	*Perform	Oversight/Accept	-	Spot-check the procedure for boundaries etc. Spot-check the testing process. Oversight will be provided by Consulting Engineer.



<u>Activity</u>	<u>Contractor</u>	<u>Commissioning</u>	<u>Owner</u>	<u>Notes</u>
Vacuum, Smoke and/or Sonic Leak Testing	*Perform	Oversight/Accept	-	Spot-check the procedure for boundaries etc. Spot-check the testing process. Oversight will be provided by Consulting Engineer.
Tank/Vessel Inspection	*Perform	Participate/ Coordinate/ Oversight/Accept	-	Commissioning Group part of the final closeout inspection. Oversight will be provided by Consulting Engineer.
Lubrication Records (OWS pumps & Sanitary Lift)	*Perform & include in CTO package	Oversight/Accept	-	Review the actual record.
Mechanical Equipment Data Record	Perform & include in CTO package	Oversight/Accept	-	Review the actual record.
Piping Inspection Report (1 per System)	*Perform & include in CTO package	Oversight/Accept	-	Review the actual record.

101.2 System Walkdowns:

- a. The Contractor shall conduct construction completion system walkdowns as a presentation of the system for acceptance by Owner. The Contractor's participation shall include their site supervision at the level of General Foreman and/or above during system walkdowns.
- b. The Contractor shall lead the walkdowns prepared with knowledge of the physically installed system and location of components, associated system drawings, documentation needed to review and verify the construction completion of the installed system, and a list of known deficiencies.

101.3 Master Deficiency List (Punchlist):

- a. During walkdowns, Commissioning and/or Owner shall make note of and document identified outstanding work to be completed such as punchlist items, deficiencies, etc., and will maintain these items on a Master Deficiency List for the system.
- b. The Contractor shall designate a planned completion date for all deficiencies within two (2) days of the completed walkdown date and identify any constraints to their completion.
- c. Owner or Consulting Engineer will define the priority of the deficiencies based on above ground contractor's schedule, start up sequence, safe check out, and/or operation of the system. Priority assignments for deficiencies are described as follows:
  - c1. Priority 1; Major - must be completed prior to system turnover from Contractor to Commissioning.



- c2. Priority 2; Significant - must be completed prior to performance of commissioning testing/ operation.
  - c3. Priority 3; Minor - must be completed prior to system turnover from Commissioning to facility operations.
  - c4. Priority 4; General worklist - must be completed by Contractor prior to Owner acceptance of Substantial Completion and/or Final Payment.
  - c5. Priority 5; Other - commercial / Owner requested items.
  - d. Contractor shall not remove deficiency list items or change priority assignments of deficiencies without Commissioning and/or Owner approval.
- 101.4 Construction Turnover (CTO) Documentation:
- a. Commissioning will scope drawings to define system turnover boundaries and provide the turnover package format, including Drawing and Engineering Lists to the Contractor.
  - b. The Contractor shall document all construction checkout, quality assurance/quality control and testing results as part of the turnover to Commissioning process.
  - c. All documentation will be reviewed and accepted by Owner or Consulting Engineer prior to acceptance of the system by Owner or Consulting Engineer.
  - d. The required format and content of the Construction turnover packages that are to be assembled, completed, and populated by the Contractor prior to turnover to Owner typically will be the following:

**Construction Turnover Index**

<b>Master Tab</b>	<b>Description</b>	<b>STP</b>
A-1	Construction Completion Verification	*
A-2	System Scoping Drawings	*
A-3	List of Drawings & Engineering Lists	*
A-3-1	• Piping & Instrument Diagrams [P&ID] Drawing List	*
A-3-2	• Pipeline List & Piping Specialty Equipment List	*
A-3-3	• Piping Isometrics/ Pipe Support Drawing List	*
A-3-4	• Valve List	*
A-3-5	• Instrument List	*
A-3-6	• Analog/Digital Input/Output [I/O] List	*
A-3-7	• Electrical Drawing List	*
A-3-8	• Cable Tabulation List	*
A-3-9	• Equipment List	*
A-3-10	• General Arrangement Drawing List	*
A-3-11	• Vendor Drawing List	*
A-3-12	• Other Reference Drawing List	*
A-3-13	• Construction As-Built Drawings	*
A-4	Master Deficiency List (Generated by Construction/Contractor)	*



<b>Master Tab</b>	<b>Description</b>	<b>STP</b>
A-5	Mechanical Construction Installation Checklist & Documentation	*
A-6	Electrical Construction Installation Checklist & Documentation	*
A-7	Instrument and Control [I&C] Installation Checklist & Construction Documentation	*
A-8	Release for Subsequent Construction (RSC) Documentation	*
A-9	Miscellaneous Construction Documentation (e.g. Storage and Preventative Maintenance Documentation, Vendor Reports, etc.)	*
A-10	Turnover- Construction to Commissioning Certificate	*

\* When the Construction Turnover Package (CTO) does not require a specific section, this column is to indicate **N/A**.

END OF SECTION 019100

019100-7



**SECTION 033115**  
**CONCRETE WORK**

**PART 1 - GENERAL**

101. **EXTENT**

101.1 Concrete construction shall conform to the requirements of ACI 301, this Section and to the requirements indicated on the Design Drawings.

101.2 The work shall include, but not be limited to, the following:

- a. Furnishing and erecting formwork.
- b. Furnishing and placing reinforcing steel, including stirrups, spirals, and other reinforcement materials with all necessary wire ties, bar supports, spacers, block supports and other devices required to install and secure reinforcement properly.
- c. Designing, detailing, furnishing, and placing bar supports for top bars in footings and foundation mats greater than four (4) feet (1.2 m) thick, for bottom bars in grade beams or slabs on grade, for the bars in singly reinforced slabs on grade and additional support bars as required.
- d. Furnishing, placing, finishing, and curing of all concrete.
- e. Furnishing of miscellaneous accessories required to properly execute the work.
- f. Furnishing and placing joint filler.
- g. Furnishing and placing vapor retarders for the following foundations:
  - g1. Engine Foundation
  - g2. Engine Hall Building
  - g3. Electrical Building Foundation

102. **REFERENCE DOCUMENTS**

102.1 Standards, Specifications, manuals, codes, and other publications of nationally recognized organizations are referenced herein. References to these documents are to the issue date as indicated by the Florida Building Code. If the document is not referenced in the Florida Building Code, then the reference is to the latest issue date of the document together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of the Contract for the Work.

102.2 Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents in this Section and in Section 014219, in addition to federal, state, or local codes having jurisdiction.

102.3 API - American Petroleum Institute:

- a. API STD D650 - Welded Tanks for Oil Storage.



- 102.4 ASTM - ASTM International:
- a. A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - b. A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
  - c. A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
  - d. D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications
  - e. C29/C29M - Standard Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
  - f. C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - g. C33/C33M - Standard Specification for Concrete Aggregates
  - h. C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
  - i. C94/C94M - Standard Specification for Ready-Mixed Concrete
  - j. C127 - Standard Test Method for Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
  - k. C131/C131M - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - l. C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
  - m. C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete
  - n. C150/C150M - Standard Specification for Portland Cement
  - o. C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete
  - p. C227 - Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
  - q. C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
  - r. C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete
  - s. C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
  - t. C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete



- u. C311/C311M - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
  - v. C494/C494M - Standard Specification for Chemical Admixtures for Concrete
  - w. C511 - Standard Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
  - x. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
  - y. C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars
  - z. C1074 - Standard Practice for Estimating Concrete Strength by the Maturity Method
  - aa. C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
  - bb. C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
  - cc. D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
  - dd. D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
  - ee. E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs
  - ff. E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- 102.5 USACE - U.S. Army Corps of Engineers, Concrete Research Division (CRD)
- a. CRD-C 513 - Corps of Engineers Specifications for Rubber Waterstops
  - b. CRD-C 572 - Corps of Engineers Specifications for Polyvinylchloride Waterstop
- 102.6 CRSI - Concrete Reinforced Steel Institute:
- a. Manual of Standard Practice.
103. SUBMITTALS
- 103.1 Submit the documents listed in this Article for review in accordance with the submittal requirements of Section 013323.





- 103.2 Shop Drawings:
- a. Concrete reinforcement: Submit shop drawings for fabrication, bending and placement of concrete reinforcement in accordance with the requirements of Paragraph 301.1 of this Section. Comply with ACI SP-66 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement, etc.
  - b. Construction joint location: Submit supplemental construction joint locations in accordance with the requirements of Paragraph 302.1 of this Section.
- 103.3 Steel producer's Certified Material Test Reports (CMTR) performed on the reinforcing steel in accordance with ASTM A615/A615M prior to fabrication. The reports shall include both mechanical and chemical test results.
- 103.4 Concrete Mix Design, including the source and quality of concrete materials and the concrete proportions proposed for the work shall be submitted to the Owner for review at least five (5) weeks prior to starting the concrete work. The submittal shall demonstrate that the mix design satisfies the requirements of ACI 301-16, Section 4.2 and Attachment 1, Flow Chart for Concrete Mix Design Documentation. This includes complete certified reports covering the materials and proportions prepared and tested in accordance with ACI 301. As a minimum, the information and the required documents shall be as presented in Attachment 2, Required Concrete Mix Design Data, and shall be provided for each required type of concrete, including field test or trial batch test data to support strength basis. For concrete strength and proportioning requirements, refer to Article 204 of this Section.
- 103.5 A delivery ticket shall be prepared for each load of ready-mixed concrete. A copy of each ticket shall be handed to the Owner's Representative by the truck operator at the time of delivery. Tickets shall indicate the mix identification, the number of cubic yards (cubic meter) delivered, the quantities of each material in the batch, the outdoor temperature in the shade, the time the cement and water were added, and the numerical sequence of the delivery. The ticket shall list the delivery truck number and the number or mixing drum revolutions at the time of the batch. For ready-mix concrete requirements, refer to Article 206 of this Section.
- 103.6 Manufacturer's catalog for the following products:
- a. Water stops.
  - b. Joint filler.
  - c. Joint sealants and backing rods.
  - d. Curing compounds.
  - e. Sealers and hardeners.
  - f. Form release agents and form ties.
  - g. Dowel sleeves and accessories.
  - h. Concrete bonding agents.
  - i. Concrete coatings and membranes.



- j. Vapor retarders.
- 103.7 Concreting Plans:
  - a. Plan for curing concrete, meeting ACI 301 mass concrete (Section 8) and hot or cold weather concrete provisions.
  - b. Supplemental construction joint locations in accordance with the requirements of Paragraph 302.1 of this Section.
  - c. Thermal control plan for each mass concrete placement meeting the submittal requirements of ACI 301-16, Section 8.1.4, at least four weeks prior to concrete pour.
- 103.8 Concrete Cylinders For Strength Tests And Field Collected Test Data: Contractor shall deliver to the Testing Laboratory the cured concrete cylinders and recorded field test data. Specific requirements are presented in Paragraph 205.3 of this Section.
- 104. FIELD QUALITY CONTROL
  - 104.1 Examine the areas and conditions under which concrete work is to be installed and notify Owner of any quality concerns.
  - 104.2 The Contractor will engage an independent testing and inspection agency to inspect the concrete work in progress and to perform tests and prepare test reports.
  - 104.3 Each batch plant from which concrete will be supplied shall have current NRMCA or equivalent laboratory certification.
  - 104.4 Material and fabrication procedures may be subject to additional inspection and tests in the shop and in the field by the Owner. Such inspections and tests will not relieve Contractor of responsibility for providing material and fabrication procedures in compliance with specified requirements. The Owner reserves the right, at any time before final acceptance, to reject material not complying with the specified requirements.
  - 104.5 Tolerances for concrete construction, including tolerances on structure dimensions, concrete finishing tolerances and tolerances on placing reinforcing and embedded materials, shall be in accordance with the applicable sections of ACI 117 and ACI 301.
  - 104.6 Reinforcing steel with rust, mill scale, or a combination of both shall be considered satisfactory, provided the minimum dimensions, including height of deformations and weight of a hand-wire-brushed test specimen are not less than ASTM A615/A615M requirements.

## **PART 2 - PRODUCTS**

- 201. FORMWORK
  - 201.1 Conform to the applicable requirements of ACI 301.
  - 201.2 Plywood Forms: Plywood shall be water resistant and shall be treated to prevent the grain from rising. If a lining is used it shall consist of accepted nonabsorptive fiber board plastic coated to resist moisture and with a hard smooth surface on contact side.
  - 201.3 Steel Forms: Provide minimum gauge thickness, stiffened to support weight of concrete with minimum deflection.



- 201.4 Glass Fiber Reinforced Resin Type: Preformed shape, stiffened to support weight of concrete with minimum deflection.
- 201.5 Form Ties:
- a. Factory fabricated, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent the spalling of concrete surfaces upon their removal.
  - b. Provide ties so that the portion remaining within concrete after removal is at least 1-1/2 inches (40 mm) inside concrete, and which will not leave holes larger than one-inch (25 mm) diameter in concrete surface for concrete exposed above grade.
- 201.6 Form Release Agent: Nonstaining type. Contractor shall select with acceptance of the Owner and verify compatibility with finish coating system when applicable.
202. REINFORCING STEEL
- 202.1 Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; uncoated.
- 202.2 Reinforcing Steel: ASTM A615/A615M, Grade 60 (Grade 420 MPa) carbon steel, deformed bars, uncoated.
- 202.3 Reinforcement Support: Provide bolsters, chairs, spacers, etc., required for spacing and support of reinforcement in accordance with CRSI Manual of Standard Practice Class C. Wood and brick ARE NOT PERMITTED. Use precast concrete blocks of the same strength as the concrete to support reinforcing steel placed on soil.
- 202.4 Reinforcing steel (embedded in soil) for a future foundation extension shall be galvanized and protected from damage during backfilling.
203. CONCRETE
- 203.1 Cement: ASTM C150/C150M, Type II or dual certified I/II, low alkali, and moderate heat of hydration. Equivalent alkali content shall not exceed 0.6% per Table 2, ASTM C150/C150M.
- 203.2 Fly ash: Per ASTM C 618, Class C or F, with loss on ignition not to exceed six percent. Fly ash shall be compatible with cement and shall not react deleteriously with alkalis in cement. Concrete contractor shall have fly ash sampled and tested in accordance with ASTM C311/C311M.
- 203.3 Slag Cement: Per ASTM C989/C989M, Grade 100 or Grade 120.
- 203.4 Aggregates: Per ASTM C33/C33M, and as herein specified:
- a. Fine: Graded natural sand, manufactured sand or a blend of natural and manufactured sands may be used provided all of the requirements ASTM C33 are met.
  - b. Coarse Aggregate: Use only graded crushed stone or gravel. For concrete fifteen (15) inches (380 mm) or less in thickness the coarse aggregate shall be graded from 3/4" (20 mm) to No. 4 (4.75 mm) (Size No. 67). For all other concrete work, the coarse aggregate shall be graded from 1-1/2" (40 mm) to No. 4 (4.75 mm) (Size No. 467).
  - c. The aggregate percent retained on each sieve shall be more than 8% and less than 18%, except for the largest and smallest sieves.



- 203.5 Water: Clean, fresh, free from oils, acid, organic matter, or other matter deleterious to concrete meeting the requirements of ASTM C1602. Potable water is preferred.
204. CONCRETE STRENGTH AND PROPORTIONS
- 204.1 General: Proposed concrete proportions shall be subject to acceptance by the Owner and Consulting Engineer based on demonstrated ability to produce concrete meeting all requirements of the Specification.
- 204.2 Proportions of materials for concrete shall be established to provide:
- a. Adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without excessive segregation or bleeding under conditions of placement to be employed.
  - b. Resistance to freezing and thawing and other aggressive actions.
  - c. Conformance with strength test requirements specified in Article 205 of this specification.
- 204.3 Concrete proportions shall be established on the basis of previous field experience, laboratory trial batches as specified in Article 4.2 of ACI 301 with the materials to be employed in the work, or using empirical data as specified in Article 4.2 of ACI 301.
- 204.4 The procedure as given in Appendix 3 of ACI 211.1 may be used as a guide in performing concrete trial mixes.
- 204.5 Prepare design mixes for each of the categories below. Develop the design mixes using the services of the Independent Testing Laboratory. All mixes are normal weight concrete with air-entrainment unless noted. Submit the design mixes to the Consulting Engineer for approval.
- a. Concrete Category A: Use for all concrete fifteen (15) inches (400 mm) or less unless noted: 4500 PSI (31 MPa) at 28 days, fly ash 25% by weight of cementitious content, size #67 coarse aggregate.
  - b. Concrete Category B: Use for all concrete larger than fifteen (15) inches (400 mm) unless noted: 4500 PSI (31 MPa) at 28 days, fly ash 25% by weight of cementitious content, size #467 coarse aggregate.
  - c. Concrete Category C: Use for mud mats and seal slabs: 2000 PSI (14 MPa) at 28 days.
  - d. Concrete Category D: Use for ductbanks or as indicated on Design Drawings: 4500 PSI (31 MPa) at 28 days, fly ash 25% by weight of cementitious content, size #8 or #89 coarse aggregate.
- 204.6 Water-Cementitious Material Ratio: Not more than 0.45, including free surface moisture on aggregates.
- 204.7 Proportions and Slump:
- a. The proportions of cement to coarse aggregate shall be at least that which will produce a plastic mix of suitable workability for each portion of the Work so as to result in uniformly dense concrete free from aggregate pockets or honeycomb.



- b. Slump limits: Proportion and design mixes to result in concrete slump at point of delivery of not less than two (2) inches (50 mm) and not more than five (5) inches (120 mm).
- c. Proportions to meet these requirements are established by design mixes as set forth herein. All concrete for the Work shall be in strict conformance with these design mixes.
- d. Concrete temperature at point of delivery shall not exceed 90°F (32°C) or be below 40°F (4°C).

204.8 Admixture Use:

- a. Add air-entraining admixture at manufacturer's prescribed rate so that concrete at point of placement has an air content of 3 percent (3%) to 6 percent (6%) of the volume of the concrete. The admixture shall be added as a solution in a portion of the mixing water, using a suitable mechanically activated dispenser.
- b. A water-reducing admixture may be used at the Contractor's option and shall be per ASTM C494 Type A. When used a water-reducing admixture shall be added at rates recommended by the manufacturer.
- c. The use of an accelerating admixture requires the written authorization of the Owner. When so authorized, the accelerating admixture shall meet the requirements of Paragraph 203.7 of this Section and shall be added at rates recommended by the manufacturer.
- d. The use of a retarding admixture shall be per ASTM C494 Type B (retarding) or Type D (retarding and water reducing), non-chloride type only, and requires the written authorization of the Owner. When so authorized, the retarding admixture shall be added at rates recommended by the manufacturer.

205. CONCRETE TESTING AND JOB CONTROL OF CONCRETE

205.1 Services of Testing Laboratory: Unless otherwise indicated, the services of a Testing Laboratory will be furnished by the Contractor to:

- a. Test materials for concrete and prepare design mixes in accordance with the requirements of Article 204 of this Section.
- b. Provide molds and instructions to Contractor for properly making, storing, and shipping job concrete test cylinders; and instructions for checking percentage of air-entrainment where air-entrained concrete is used, and for making slump tests.
- c. Determine the compressive strength of job concrete test cylinders.

205.2 Contractor shall furnish Testing Laboratory with sufficient quantities of cement, fly ash, and aggregates, from same sources as will be used for the Work, for testing of these materials and preparation of test cylinders as specified in Table 033115-1 or Table 033115-2, for each design mix. Materials thus furnished shall be used for the entire Project without changes.

205.3 Contractor shall make all concrete test cylinders, as specified in Table 033115-1, from fresh samples of concrete taken on Project Site from discharge of stationary mixers, pumpcrete machines, truck mixers or truck agitators. Locations for taking samples shall be acceptable to the Owner. Making of test cylinders shall include slump tests, taking



temperatures, curing, storing, packing, and delivery to Testing Laboratory of test cylinders and all required data as to materials, name and quality of air-entraining admixtures, water-cement ratio, proportions, slumps, air contents, temperatures, etc., as referenced on the approved mix design.

**TABLE 033115-1, SCHEDULE OF CONCRETE TEST CYLINDERS  
 FOR 28-DAY STRENGTH**

<u>Total cylinders required for each 100 cubic yards (80 cubic meters) of concrete, or from each day's pour if less than 100 cubic yards (80 cubic meters)</u>		<u>Cylinders For Strength Test At</u>		
		<u>7 Days</u>	<u>28 Days</u>	<u>Spare</u>
Cylinder Size				
6" x 12" (150 mm x 300 mm)	3 Sets – 6 Total	2	2	2
4" x 8" (100 mm x 200 mm)	3 Sets – 9 Total	3	3	3

**Notes:**

1. One set of two (2) 6" x 12" (150 mm x 300 mm) cylinders or one set of three (3) 4" x 8" (100 mm x 200 mm) cylinders comprises a strength test.
2. If any cylinder in the (twenty-eight) 28-day strength test shows evidence of improper sampling, molding, or testing, discard the specimen and use one of the spare cylinders to determine the strength. Other spare cylinders may be used only when authorized by the Owner. The contractor shall not use these cylinders for any other purpose and shall make additional cylinders if additional strength tests are desired such as a three (3) day test.

**TABLE 033115-2, SCHEDULE OF CONCRETE TEST CYLINDERS  
 FOR 56-DAY STRENGTH (WHEN SPECIFIED OR APPROVED)**

<u>Total cylinders required for each 100 cubic yards (80 cubic meters) of concrete, or from each day's pour if less than 100 cubic yards (80 cubic meters)</u>		<u>Cylinders For Strength Test At</u>				
		<u>7 Days</u>	<u>14 Days</u>	<u>28 Days</u>	<u>56 Days</u>	<u>Spare</u>
Cylinder Size						
6" x 12" (150 mm x 300 mm)	5 sets – 10 Total	2	2	2	2	
4" x 8" (100 mm x 200 mm)	5 Sets – 15 Total	3	3	3	3	

**Notes:**

1. One set of two (2) 6" x 12" (150 mm x 300 mm) cylinders or one set of three (3) 4" x 8" (100 mm x 200 mm) cylinders comprises a strength test.
2. If any cylinder in the fifty-six (56)-day strength test shows evidence of improper sampling, molding, or testing, discard the specimen and use one of the spare cylinders to determine the strength. Other spare cylinders may be used only when authorized by the Owner. The contractor shall not use these cylinders for any other purpose and shall make additional cylinders if additional strength tests are desired such as three (3) day test.



- 205.4 Cylinder molds, curing and test specimens shall be either 6" (150 mm) diameter by 12" (300 mm) long or 4" (100 mm) diameter by 8" (200 mm) long, have a minimum diameter of at least three (3) times the nominal maximum size of the coarse aggregate, and comply with ASTM C31/C31M, C39/C39M, C143/C143M, C172/C172M, C231/C231M and C511. Contractor shall provide cure boxes for storing test specimens meeting the temperature and other requirements of ASTM C31/C31M.
- 205.5 Unless otherwise indicated, Contractor shall furnish equipment for and shall check the slump of concrete and air content of air-entrained concrete by direct measurement of fresh samples of concrete taken on Project Site from discharge of stationary mixers, pumpcrete machines, truck mixers or truck agitators. Locations of samples for testing slump and air entrainment shall be the same as for samples for test cylinders. At least one air test shall be made for each 100 cubic yards (80 cubic meters) of concrete, provided further that no less than two (2) air tests shall be made for each day's pour if less than 100 cubic yards (80 cubic meters).
- 205.6 Concrete shall be sampled and tested at time of placement, as follows:
- a. Sampling of fresh concrete: Per ASTM C172/C172M, except that requirements shall be modified to comply with the requirements of ASTM C94/C94M.
  - b. Slump: Per ASTM C143/C143M; one test for each set of compressive strength test specimens made.
  - c. Air content: Per ASTM C231/C231M, pressure method, one test for each set of compressive strength specimens.
  - d. Temperature of concrete: Test at point of discharge, hourly when ambient temperature is 40°F (4°C) or below, and when 80°F (27°C) and over; and each time a set of compressive strength test specimens is made.
- 205.7 The data collected shall be forwarded to the Testing Laboratory along with the cured concrete cylinders to be tested.
- 205.8 If the results of strength tests indicate that concrete does not meet specified requirements, the following steps shall be taken:
- a. The Testing Laboratory will be directed to visit Project Site and set up proper controls and inspection of job concrete, and Contractor shall pay entire costs of such services.
  - b. Contractor may be directed to take concrete cores and/or make load tests, at their own expense, of any work that the Contractor has installed with concrete not meeting specified strength requirements. If cores and/or load tests established that such work in place does not meet requirements, Contractor shall correct the work as requested without cost to Owner.
206. READY-MIXED CONCRETE
- 206.1 Ready-mixed concrete shall conform to the requirements of this specification in addition to the applicable requirements of ASTM C94/C94M.
- 206.2 Ready-mixed concrete shall be mixed and delivered in accordance with applicable requirements of ASTM C94/C94M, except that only trucks equipped with a rotary drum or



agitator may be used. Contractor shall notify Lakeland Electric seven days in advance of major concrete work (multiple concrete truck deliveries) for truck coordination.

206.3 When using ready mix concrete per ASTM C94/C94M, delete the reference which allows additional water to be added for concrete with insufficient slump. Addition of water in excess of design quantity is NOT PERMITTED.

206.4 Each ready mix truck shall be inspected at the point of discharge to have less than 300 revolutions and have been less than ninety (90) minutes since water was added to the batch.

207. ACCESSORIES

207.1 Joint filler material:

- a. For expansion joints in concrete paving and concrete structures use preformed expansion joint filler per ASTM D1752.
- b. For expansion joints in concrete slabs on grade and non-building structures use preformed expansion joint filler per ASTM D1752 or ASTM D1751.
- c. For non-expansion control joints use preformed expansion joint filler per ASTM D1751.

207.2 Curing Compound: Membrane forming per ASTM C309. Type 1, for concrete floors and stair treads. Type 1-D with fugitive dye for all other work (wax base not permitted). Manufacturer and type as follows:

- a. BASF Construction Systems- MasterKure product line
- b. Dayton Superior Corporation - Cure & Seal product line
- c. W. R. Meadows, Inc. - CS-309 product line
- d. Equivalent products supplied by other manufacturers shall be approved by Owner and Owner's Engineer prior to use/purchase by Contractor.

207.3 Waterstops: Water stops shall be 6" (150 mm) rubber or PVC, ribbed type with center bulb, capable of resisting 100 feet (30 m) of head unless noted otherwise on the Design Drawings. Water stops shall be designed and tested in conformance to the requirements of the Army Corps of Engineers CRD-C513 (for rubber-type) or CRD-C572 (for PVC-type) or approved equivalent international standard. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride or approved equal. The PVC compound shall not contain any scrapped or reclaimed material or pigment.

- a. Waterstops shall be provided with factory-installed hog rings or grommets spaced at 12" (300 mm) on center along the top and bottom edges of the waterstop to properly secure it to adjacent reinforcing bars to prevent from shifting or movement during concrete placement.
- b. Provide factory made waterstop fabrications for all changes in directions, intersections, and transitions leaving only straight butt joint splices for the field.





207.4 Vapor Retarders: Plastic water vapor retarders used beneath slab in contact with ground shall be per ASTM E1745, Class A.

208. MISCELLANEOUS METAL EMBEDDED MATERIAL

208.1 Embedded materials and fabrication requirements shall be as specified on the Design Drawings.

**PART 3 - EXECUTION**

301. TANK FOUNDATIONS

301.1 Foundations for oil storage tanks shall meet the construction tolerances of API STD 650.

301.2 Foundations for water storage tanks, including the heat recovery buffer tank, shall meet the construction tolerances of AWWA D100.

302. DETAILING AND FABRICATION OF REINFORCEMENT

302.1 Prepare setting plans and bar lists of the reinforcing steel bars to be fabricated in accordance with the Design Drawings. The setting drawings shall show the quantity, grade, size, length, mark, location, and bending diagrams for all reinforcing steel in accordance with the applicable requirements of ACI SP-66. These shop detail drawings which include the setting plans, bending details and bar lists shall be submitted to the Owner and Consulting Engineer for review and acceptance prior to fabrication. Do not start fabrication until these shop drawings have been reviewed and accepted.

302.2 Fabricate reinforcing bars in accordance with the reviewed and accepted shop drawings prepared from the Design Drawings.

302.3 Field fabrications when required shall be accomplished by cold bending. Heat bending is NOT PERMITTED.

302.4 Welding of reinforcing steel is NOT PERMITTED. Bending of reinforcing bars in hardened concrete is NOT PERMITTED.

303. CONSTRUCTION DETAILS

303.1 Construction Joints:

a. Major construction joints are indicated on the Design Drawings. Drawings indicating location of construction joints required in addition to or different from those indicated in the Design Drawings shall be submitted to the Owner and Consulting Engineer for review. These drawings shall be submitted and accepted by the Owner and Consulting Engineer before rebar details are submitted for review.

b. If Contractor desires to revise locations of the accepted construction joints or to add or delete construction joints as the work progresses, then drawings showing proposed changes shall be submitted for review by the Owner and Consulting Engineer. No changes shall be made until acceptance is received. All changes, including required waterstops, if any, shall be made at no cost to Owner.

303.2 Beveled Corners:



- a. Bevel all exposed projecting corners of concrete work, such as piers, columns, beams, equipment foundations and switchyard foundations, 1" (25 mm) by 1" (25 mm) unless otherwise indicated. For exposed vertical corners in contact with ground, extend bevels 1'-0" (300 mm) below finish grade.

303.3 Openings in Concrete:

- a. Provide openings, pockets, chases, recesses, slots, etc., in walls, piers, floors or other portions of concrete Work for structural steel, conduit, pipe, building sewers, sleeves, and similar items, as indicated on the Design Drawings.
- b. Fill all such openings, pockets, chases, etc., with concrete when indicated on the Design Drawings after preceding items, whether they are by Contractor or are by others, are installed as the Work progresses. Finish exposed surfaces of such concrete fills to match adjoining concrete work.

303.4 Control Joints:

- a. Control joints shall be saw cut as soon as possible, but no later than twelve (12) hours after completion of concrete finishing.
- b. Control joints saw cut in concrete shall be filled with a pourable, flowable, self-leveling, flexible, non-shrinking and durable joint sealant. Contractor shall submit the proposed product for the Owner's approval. Joints shall be filled after a minimum of sixty (60) days after concrete placement. Contractor shall vacuum joints prior to sealant installation and follow the sealant manufacturer's requirements.

304. FORMWORK

304.1 General Requirements: Conform to the applicable requirements of ACI 301 and to the following:

- a. Build forms true to line and grade and of matched or surfaced lumber, plywood, steel, or other materials. Forms shall be properly supported, braced, and tied to maintain position and shape. Completed work shall have a smooth finish and uniform color, and shall be level, plumb and true. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. When forms, for slabs and roofs, in the form of metal decking, are provided by others, Contractor shall provide suitable closures to prevent leakage of mortar if not provided with the metal decking.
- b. Arrange bolts and rods used for internal ties so that all metal remaining in concrete shall be not less than 1" (25 mm) from concrete surface after ties are removed. Twisted wire ties shall not be used.
- c. Provide temporary openings at base of forms for columns, walls, piers, and at other points where necessary to facilitate cleaning and inspection prior to placing of concrete.

304.2 Forms for Exposed Surfaces:

- a. "Exposed Surfaces" shall mean all formed concrete surfaces exposed to view on completion of WORK, unless otherwise indicated.



- b. Forms for all exposed surfaces shall produce extremely smooth, dense, and true finishes free of fins, imperfections, or other defects. For exposed surfaces of structures in contact with ground, such finish shall extend 1'-0" (300 mm) below finish grade.
- 304.3 Coating of Forms: Coat forms for exposed concrete surfaces with nonstaining mineral oil, applied before reinforcement is placed. For unexposed concrete surfaces, forms may be wetted thoroughly with water in lieu of oiling, except in freezing weather.
- 305. INSTALLATION OF VAPOR RETARDER
- 305.1 Where indicated in the scope of this specification and/or as shown on the Design Drawings, the plastic vapor retarder shall be installed beneath slabs in contact with ground. Installation of the vapor retarders shall be in accordance with the requirements of ASTM E1643 Standard Practice.
- 306. PLACING REINFORCEMENT
- 306.1 Reinforcing Bars:
  - a. Comply with CRSI Manual for details and methods for reinforcing bar support and placement, as indicated on the Design Drawings, and as specified herein.
  - b. Clean reinforcement free of loose rust, mill scale, oil, grease, mud, dirt, ice, and other foreign material which could reduce or destroy the bar's bond with concrete.
  - c. Accurately position, support, and secure reinforcement against displacement by construction activities and placement of concrete by metal supports or spacers, except use precast concrete blocks to support reinforcement placed on soil.
  - d. Place reinforcement to obtain the minimum concrete coverage as indicated on the Design Drawings. Set wire ties so that ends are directed into concrete and not toward exposed concrete surfaces.
  - e. Bending of reinforcing bars in hardened concrete will not be permitted.
  - f. Heating and welding of reinforcing bars for any purpose WILL NOT BE PERMITTED.
  - g. The Contractor may elect, at its own cost, to use mud mats to assist in the placement of rebar and formwork.
- 306.2 Placing of Welded Wire Reinforcement: Carefully place fabric in position indicated on the Design Drawings, and maintain in this position before and during placing of concrete.
- 306.3 Anchoring Dowels: Securely anchor all dowels in place by wire tying, etc., before starting placement of concrete.



307. INSTALLATION OF EMBEDDED ITEMS

- 307.1 Build in reglets and install anchors, building column anchor rods, equipment anchor rods, dowels, inserts, hangers, nailing strips, grounding, sleeves, conduit, and other items furnished by Contractor, other Subcontractors, or the Owner. Use setting drawings, diagrams, instructions, and directions provided by contractors of the items to be installed. Maintain items plumb, in alignment and in proper position. Use care in placing concrete so as not to dislodge any of these installations.
- 307.2 Electrical conduit and piping embedded in concrete shall be located by the Contractor between the bottom and top reinforcement. Joints and ends of conduit and piping shall be sealed to prevent concrete from entering them. Where conduit or piping crossovers are necessary, they shall not displace reinforcement from its required positions.
- 307.3 Embedded conduit or piping parallel the main reinforcing steel shall be installed so that at least two (2) inches (50 mm) of concrete can completely surround the main reinforcing steel.
- 307.4 Embedded items shall be sufficiently anchored to maintain their position during concrete placement and to prevent their flotation.

308. PRE-POUR/PLACEMENT MEETINGS

- 308.1 Contractor shall initiate and conduct Pre-Pour/Placement meetings at least one (1) week prior of all major concrete pours. Meetings shall include representatives from the Owner, Consulting Engineer, Independent Testing Agency, concrete supplier, and all sub-contractors and suppliers interfacing with Work.
- 308.2 As a minimum, Contractor shall address the following during the meetings:
- a. Review the detailed schedule of concrete pour activities.
  - b. Finalize plans to have the necessary personnel and equipment on site for furnishing, delivering, testing, placing, and finishing the concrete (e.g. quantity and size of concrete vibrating equipment, pump truck staging locations, concrete truck delivery route and wash-out location, etc.).
  - c. Develop contingency plans to overcome potential impacts to the concrete pour (such as extreme weather conditions, disruption in concrete supply, back-up pump truck, etc.).

309. CONCRETE MIXING

- 309.1 All concrete shall be mixed until there is a uniform distribution of materials. Production of concrete shall be in accordance with the applicable requirements of ACI 301.
- 309.2 Site-mixed concrete shall be mixed in a batch mixer. Mixer shall be rotated at a speed recommended by manufacturer, and mixing shall be continued for not less than 1-1/2 minutes after all materials are in drum. For batches larger than 1 cubic yard (1 m<sup>3</sup>), mixing time shall be increased fifteen (15) seconds for each additional cubic yard (cubic meter) or fraction thereof. Where site-mixed concrete is conveyed by trucks from a central batch plant, trucks shall be equipped with an approved rotary drum or agitator. The mixer shall be discharged completely before recharging.



310. CONVEYING CONCRETE

310.1 Convey concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients.

310.2 Chutes or other equipment for conveying concrete shall be of such size and design as to insure a continuous flow of concrete at delivery end without separation of ingredients, and shall be thoroughly cleaned before each run. If use of pumping equipment to convey concrete is accepted, aluminum pipe shall not be used.

310.3 Concrete shall not be allowed to drop freely more than five (5) feet (1.5 m). For drops which exceed five (5) feet (1.5 m), use a hopper and drop chute. For all walls, use a hopper for any depth, with addition of a drop chute for drops which exceed five (5) feet (1.5 m).

311. PREPARATIONS FOR PLACING CONCRETE

311.1 Before concrete is placed, clean the forms and reinforcing of dirt and debris, remove snow and ice, and do all necessary trenching, damming, draining, and pumping so that all concrete can be placed in the dry. Do not place any concrete until forms and reinforcing have been inspected and approved by Owner.

311.2 Before fresh concrete is placed on or against hardened new concrete or old concrete, thoroughly clean surfaces of all laitance, soft or loose materials and deleterious substances. The surfaces shall then be washed clean and thoroughly moistened. Where concrete has dried out, it shall be saturated for at least twenty-four (24) hours. Immediately before fresh concrete is deposited, bond shall be developed by either roughening the surface to a minimum amplitude of 1/4" (6 mm), applying an approved bonding agent in accordance with the manufacturer's recommendation, or thoroughly covering the surface with a sand/water/cement mortar of same mix as concrete to be poured. Fresh concrete shall be placed, before cement mortar, if used, has obtained its initial set or within bonding agent manufacturer's written limit if bonding agent is used.

312. PLACING CONCRETE

312.1 Comply with ACI 301 and as follows:

- a. Place all concrete in a continuous and uninterrupted operation in such manner as to form a monolithic structure, the component parts of which are securely bonded together. No concrete shall be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within a given section. If a section cannot be placed continuously, provide construction joints as specified in Paragraph 302.1 of this Section. Do not deposit segregated concrete or concrete that has partially hardened or been contaminated by foreign materials, nor use retempered concrete. Time interval between placing of successive batches of concrete shall not be greater than thirty (30) minutes.
- b. Deposit all concrete in forms within 1-1/2 hours after introduction of mixing water to cement and aggregates.
- c. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.



- d. Concrete components greater than eighteen (18) inches (450 mm) in thickness shall be placed in layers approximately eighteen (18) inches (450 mm) thick, in accordance with ACI 301 provisions for mass concrete.
- e. Thoroughly compact all concrete work by means of mechanical vibrators.
- f. The minimum and maximum temperature limitations of plastic concrete at the point of delivery shall be according to ACI 301, Section 4 or as required by this Section for mass concrete.

312.2 Cold Weather Placement:

- a. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 301, ACI 306.1 and as herein specified.
- b. The use of frozen materials or materials containing ice or snow IS NOT PERMITTED. Do not place concrete on frozen subgrade, or on subgrade containing frozen materials.
- c. Do not use calcium chloride, salt or other materials containing antifreeze agents. The use of an accelerating admixture requires the written approval of the Owner.

312.3 Hot Weather Placement: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 301, ACI 305.1 and as herein specified.

312.4 Mass Concrete Placement:

- a. The provisions for placing, curing, and protection of mass concrete shall be in compliance with ACI 301 Section 8 and as herein specified.
- b. All concrete structures or foundations larger than 4 feet (1.2 m) in thickness shall be treated as mass concrete. If concrete mix designs do not meet the requirements of Article 204.5 or if the concrete will exceed 70°F at the point of delivery, structures, or foundations less than 4 feet thick may, at the discretion of the Engineer, also be required to be treated as mass concrete.
- c. Mass concrete center temperature shall not exceed 158°F (70°C).
- d. The maximum allowable difference between the center and surface temperature of mass concrete section shall be 35°F (19°C).

313. FINISHING FORMED SURFACES

313.1 All formed concrete surfaces shall be finished in accordance with ACI 301 and as follows:

- a. Exposed Surface Finish:
  - a1. Upon removal of forms, all fins and other projections shall be removed and offsets leveled. All voids, holes, honeycomb, or other damaged surfaces shall be cleaned back to solid concrete, saturated with water, and filled with cement mortar of same composition as that used in the concrete. The concrete shall be finished free from streaks, discolorations, or other imperfections as to produce an extremely smooth, dense, and true finish of uniform color.



- a2. This finish shall be used for all formed surfaces exposed to view.
- b. Unexposed Surface Finish:
  - b1. Upon removal of forms, all voids, holes, honeycomb, or other damaged surfaces shall be cleaned back to solid concrete, saturated with water, and filled with cement mortar of same composition as that used in the concrete.
  - b2. This finish shall be used for all formed surfaces unexposed to view.

314. CONCRETE CURING AND PROTECTION

- 314.1 Concrete shall be cured and protected in accordance with the requirements of Section 5 of ACI 301. Curing should start as soon as the concrete has hardened sufficiently to prevent surface damage. Cure for the minimum periods herein specified before subjecting concrete to live loads, earth loads, traffic, etc.
- 314.2 Protect freshly placed concrete from premature drying, excessive heat or cold, and maintain at a relatively constant temperature for the period of time required for the hydration of cement and proper hardening.
- 314.3 All concrete shall be protected so as to prevent the temperature at the surface from going below 50°F (10°C) or loss of moisture from the surface.
- 314.4 Curing shall continue for at least seven (7) days.
- 314.5 When the temperature of surrounding air is 40°F (4°C), or below, or is expected to drop to 40°F (4°C) or below in the next twelve (12) hours, follow the requirements for cold weather concreting.
- 314.6 Housing or covering of concrete shall be provided when required for cold weather protection and concrete shall be protected from exposure to carbon dioxide and carbon monoxide if direct fired artificial heat is used. Such housing or covering shall remain in place and intact for at least (twenty-four) 24 hours after artificial heating is discontinued.
- 314.7 Contractor shall supply insulation blankets of sufficient thickness, thermocouples, etc., as required to maintain the surface temperature of the concrete in accordance with ACI 301 provisions for mass concrete and as required in this specification for mass concrete.
- 314.8 Avoid rapid drying at the end of the final curing period.
- 314.9 Curing Methods:
  - a. Provide membrane curing by applying membrane forming curing compound to damp concrete surfaces as soon as water film has disappeared. Apply uniformly in a two-coat continuous operation by means of power spray equipment in accordance with manufacturer's directions. Recoat areas which are subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Liquid membrane forming curing compounds shall conform to the requirements of Paragraph 207.2 of this Section and shall be applied in accordance with the manufacturer's recommendations.
  - b. Do not use membrane forming curing compounds on surfaces against which additional concrete or other materials such as waterproofing, membrane roofing, flooring, painting,



or other coatings will be bonded unless the Contractor can prove that the curing compound will not prevent bond, or unless the Contractor takes positive measures to remove the curing compound completely from those areas. If the Contractor cannot comply with this provision, the Contractor shall select one of the other curing methods specified in Section 5.3.6.5 of ACI 301.

- c. Where forms are left in place for entire period for which curing is specified, the use of curing compound may be omitted, provided that in warm weather, temperatures above 80°F (27°C), the forms are kept wet until they can be safely removed.
- d. Where forms are stripped before completion of specified curing period, apply curing compound to such surfaces immediately after completion of form removal.

314.10 Protection of Concrete: Fully protect all concrete from damage or injury during construction operations. Protect exposed external corners of concrete with wood strips securely fastened in place.

314.11 The loading of the concrete component shall not take place until the seven (7) day curing period has been completed or until the concrete component has achieved at least 75% of the specified compressive strength ( $f'_c$ ) as determined by ASTM C1074 Standard Practice for Estimating Concrete Strength by the Maturity Method or by testing field cured cylinder specimens.

314.12 Cleaning of Surfaces: After concrete is placed, all exposed surfaces which have been contaminated by concrete splashing, dripping, etc., caused by such concrete work shall be cleaned to restore these surfaces to their original condition.

315. REMOVAL OF FORMS

315.1 Do not remove forms from any concrete work until the concrete has acquired sufficient strength to safely carry its own weight and any construction loads that may be imposed on it. Methods used for removal of formwork shall be such as to prevent marring, breakage, or other damage to concrete. Removal of formwork shall conform to the applicable requirements of ACI 301.

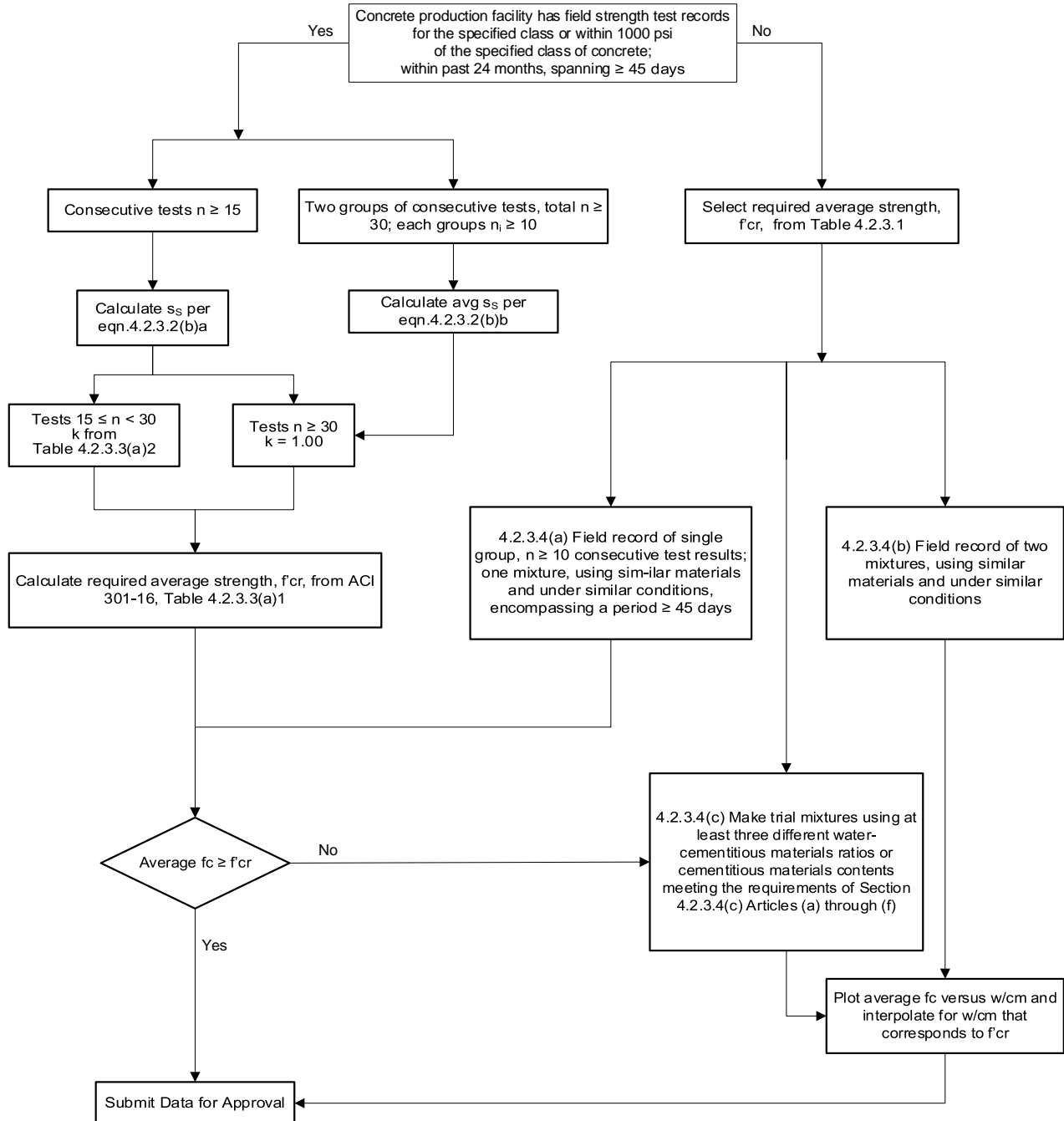
END OF SECTION 033115





**ATTACHMENT 1**

**FLOW CHART FOR CONCRETE MIX DESIGN DOCUMENTATION**



**Flow Chart for Concrete Mix Strength Documentation**

NOTE: All references are to ACI 301-16, Section 4.2.3 U.N.O



**ATTACHMENT 2**

REQUIRED CONCRETE MIX DESIGN DATA

**Provide Data Requested  
and Attach  
Documentation as Noted**

Units: Imperial  Metric

**Description of the Data Required for Each Mix Design**

Project Name

\_\_\_\_\_

Project Owner

\_\_\_\_\_

Project concrete placing contractor

\_\_\_\_\_

Project concrete supplier

\_\_\_\_\_

Main concrete plant/location

\_\_\_\_\_

Main plant/ASTM C94/C94M compliance certification (NRMCA or State DOT)

Attached: Yes  No

Backup concrete plant/location

\_\_\_\_\_

Backup plant/distance from site

\_\_\_\_\_

Backup plant/ASTM C94/C94M compliance certification (NRMCA or State DOT)

Attached: Yes  No

Mix code/ Identification No.

\_\_\_\_\_

Mix use (foundations, slabs, piles, etc.)

\_\_\_\_\_

Concrete strength (psi) or (MPa)

\_\_\_\_\_

Concrete unit weight (pcf) or (kg/m<sup>3</sup>)

\_\_\_\_\_

30 strength tests @ 28 days (psi) or (MPa)

\_\_\_\_\_

Test reports shall indicate the mix code and date tested

Attached: Yes  No

30 strength test average (psi) or (MPa)

\_\_\_\_\_

30 strength test standard deviation (psi) or (MPa)

\_\_\_\_\_

Cement type (I, II, I/II, III, V)

\_\_\_\_\_

Cement content (lbs) or (kg)

\_\_\_\_\_

Cement C3A content %

\_\_\_\_\_

Cement distributor/supplier

\_\_\_\_\_

Cement source plant

\_\_\_\_\_



**Provide Data Requested  
and Attach  
Documentation as Noted**

Units: Imperial  Metric

**Description of the Data Required for Each Mix Design**

Cement ASTM C150/C150M compliance certificate

Attached: Yes  No

Fly ash Class (F or C)

Fly ash content (lbs) or (kg)

Fly ash LOI%

Fly ash distributor/supplier

Fly ash source plant

Fly ash ASTM C618 compliance certificate

Attached: Yes  No

Slag cement Grade (100 or 120)

Slag cement content (lbs) or (kg)

Slag cement distributor/supplier

Slag cement source plant

Slag cement ASTM C989/C989M compliance certificate

Attached: Yes  No

Fine aggregate size

Fine aggregate content (lbs) or (kg)

Fine aggregate source

Fine aggregate unit weight (ASTM C29/C29M)

Fine aggregate absorption (ASTM C127)

Fine aggregate specific gravity (ASTM C127)

Fine aggregate fineness modulus

Fine aggregate ASTM C33/C33M compliance

Fine aggregate ASTM C136/C136M gradation certificate

Fine aggregate ASTM C227, C1567 or C1260 reactivity certification

Attached: Yes  No

Attached: Yes  No

Attached: Yes  No

Coarse aggregate size (e.g. #467, #57, #67)

Coarse aggregate content (lbs) or (kg)

Coarse aggregate source

Coarse aggregate unit weight (ASTM C29/C29M)

Coarse aggregate absorption (ASTM C127)

Coarse aggregate specific gravity (ASTM C127)

Coarse aggregate abrasion (ASTM C131/C131M)



**Provide Data Requested  
and Attach  
Documentation as Noted**

Units: Imperial  Metric

**Description of the Data Required for Each Mix Design**

Coarse aggregate ASTM C33/C33M compliance certificate  
Coarse aggregate ASTM C136/C136M gradation certificate  
Coarse aggregate ASTM C227, C1567 or C1260 reactivity certification

Attached: Yes  No   
Attached: Yes  No   
Attached: Yes  No

Design water content at SSD (lbs) or (kg)  
Batch water required (approximate) (lbs) or (kg)  
Water source (Potable or not)  
Water, if not potable, meets the requirements of ASTM C1602  
Water/cementitious material ratio  
Slump range (in) or (cm)  
Air content range %

Potable: Yes  No   
Yes  No

Are there synthetic fibers in the mix  
Fiber manufacturer  
Fiber type  
Fiber dosage per cubic yards (lbs) or per cubic meter (kg)

Yes  No

Water reducing admixture type  
Water reducing admixture manufacturer  
Water reducing admixture dosage (fl. oz./100 lbs of cement) or (mL/100 kg of cement)  
Water reducing admixture calcium chloride content  
Water reducing admixture product data sheet

Attached: Yes  No

Air entraining admixture type  
Air entraining admixture manufacturer  
Air entraining admixture dosage (fl. oz./100 lbs of cement) or (mL/100 kg of cement)  
Air entraining admixture calcium chloride content  
Air entraining admixture product data sheet

Attached: Yes  No

**Provide Data for Each Additional Admixture to be Used**

Admixture type  
Admixture manufacturer



**Provide Data Requested  
and Attach  
Documentation as Noted**

Units: Imperial  Metric

**Description of the Data Required for Each Mix Design**

Admixture dosage (fl. oz./100 lbs of cement) or (mL/100 kg of cement)  
Admixture calcium chloride content  
Admixture product data sheet

\_\_\_\_\_  
\_\_\_\_\_  
Attached: Yes  No

Admixture type  
Admixture manufacturer  
Admixture dosage (fl. oz./100 lbs of cement) or (mL/100 kg of cement)  
Admixture calcium chloride content  
Admixture product data sheet

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Attached: Yes  No

Admixture type  
Admixture manufacturer  
Admixture dosage (fl. oz./100 lbs of cement) or (mL/100 kg of cement)  
Admixture calcium chloride content  
Admixture product data sheet

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Attached: Yes  No

Admixture type  
Admixture manufacturer  
Admixture dosage (fl. oz./100 lbs of cement) or (mL/100 kg of cement)  
Admixture calcium chloride content  
Admixture product data sheet

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
Attached: Yes  No



**SECTION 050515**  
**HOT-DIP GALVANIZING**

**PART 1 - GENERAL**

101.        **EXTENT**

- 101.1        This Section defines the requirements for hot-dip galvanizing structural steel and plate when so indicated in the division of responsibility for the Scope of Work or on the design drawings.
- 101.2        The work shall include hot-dip galvanizing all ferrous metals after manufacture or fabrication in a controlled shop environment and including, but is not limited to, steel embedded in concrete.
- 101.3        The Contractor shall apply a touch-up and repair coating to any hot-dip galvanized surface that has been marred, scratched, or otherwise damaged due to any reason prior to unloading the material at the Owner's Project site.

102.        **REFERENCES DOCUMENTS**

- 102.1        Standards, Specifications, manuals, codes, and other publications of nationally recognized organizations are referenced herein. References to these documents are to the issue date as indicated by the Florida Building Code. If the document is not referenced in the Florida Building Code, then the reference is to the latest issue date of the document together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of the Contract for the Work.
- 102.2        Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.
- 102.3        Abbreviations listed below refer to the applicable organizations or documents.
- 102.4        AGA - American Galvanizers Association:
  - a.        Inspection of Products Hot-dip Galvanized After Fabrication
  - b.        The Design of Products to be Hot-dip Galvanized After Fabrication
  - c.        Recommended Details of Galvanized Structures
  - d.        Quality Assurance Manual
- 102.5        ASTM – ASTM International:
  - a.        A90/A90M    – Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
  - b.        A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products



- c. A143/A143M – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
  - d. A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - e. A384/A384M – Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
  - f. A385/A385M – Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
  - g. A780/A780M – Repair of Damaged Hot-Dip Galvanized Coatings
  - h. B695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
  - i. D6386 – Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
  - j. E376 – Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods
- 102.6 Federal Specifications:
- a. DOD-P-21035 Paint, High Zinc Dust Content, Galvanizing Repair
  - b. MIL-P-26915 Primer Coating, Zinc Dust Pigmented
103. SUBMITTALS
- 103.1 Submit the following documents to the Owner and the Consulting Engineers for review in accordance with the submittal requirements of Section 013323:
- a. A written procedure for performing the galvanizing process. This procedure shall, at a minimum, demonstrate conformance to ASTM A123/A123M and address surface preparation; selection of blasting material for surface work and quality control procedures for personnel performing the cleaning, hot-dip galvanizing, touch-up, and repair work. This procedure shall be submitted within three (3) weeks after Contract award.
  - b. Certificate of Compliance that the hot-dip galvanized coating meets or exceeds the specified requirements of ASTM A123/A123M, A153/A153M or A767/A767M, as applicable with the delivered product.
  - c. Drawings indicating typical vent and drain hole location and size for handrail and HSS sections prior to preparation of shop drawings.
104. QUALITY ASSURANCE
- 104.1 Coordination between Fabricator and Galvanizer: Prior to fabrication, the fabricator shall submit approved fabrication shop drawings to the galvanizer. The Galvanizer shall review the shop detail drawings for suitability of materials for galvanizing and coordinate any required fabrication modifications.



- 104.2 The steel fabricator will take the necessary steps to prevent cracking of copes in structural steel framing.
- 104.3 Galvanize members after fabrication. Take safeguards against warpage or bending per ASTM A384/A384M. Poorly galvanized members will not be accepted when delivered to the job site.
- 105. **HANDLING AND STORAGE**
- 105.1 All material shall be handled with due care at the Contractor's (or its subcontractor's, if any) shop(s) in order to avoid damage to, or deterioration of, the materials before, during and after fabrication, after galvanizing and during delivery. Special care shall be exercised to properly protect galvanized surfaces.
- 105.2 During storage of material at the Contractor's (or its subcontractors, if any) shop(s), due care shall be exercised to store materials off the ground (and temporarily covered, if required) in order to avoid damage to, or deterioration of, the materials from foreign elements and from water, mud, snow, ice, or other deleterious materials on the ground.

## **PART 2 – PRODUCTS**

### 201. **ACCEPTABLE CORROSION APPLICATORS**

- 201.1 Acceptable applicators are those who are members of the AGA. A list of American Galvanizers Association members is available upon request (800-468-7732) or at [www.galvanizeit.org](http://www.galvanizeit.org).

### 202. **GALVANIZING MATERIAL**

- 202.1 The zinc used in the galvanizing bath shall conform to specification ASTM B6 with the exception that the aluminum content of Prime Western Slab Zinc shall not exceed 0.01 percent.
- 202.2 The use of High Grade (0.03% maximum lead) or Special High Grade (0.003% maximum lead) is acceptable.
- 202.3 The use of Prime Western Grade (0.05 to 1.4% lead) is not permitted.

### 203. **STEEL MATERIAL**

- 203.1 Material for galvanizing to be geometrically suitable for galvanizing as described in ASTM A384/A384M and A385/A385M. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, fabrications, and assemblies.
- 203.2 Material to be chemically suitable for galvanizing.





203.3 Structural shapes, plates, and bars that are to be galvanized shall be manufactured from fully killed or semi-killed steel containing carbon below 0.25%, phosphorus below 0.04%, manganese below 1.3% and providing the Silicon content is between 0.15% and 0.25% for Silicon Killed Steel and between 0.01% and 0.04% for Aluminum Killed Steel. These chemical limits are required to produce an acceptable product when conventional galvanizing techniques are applied. Notify the galvanizer if steel does not meet these requirements so that suitability for galvanizing may be determined and whether special processing techniques are required.

204. FABRICATION REQUIREMENTS

- 204.1 Fabricate structural steel in accordance with Class I, II, and III guidelines as described in AGA's Recommended Details for Galvanized Structures. If no class is given on the design drawings, use Class I.
- 204.2 Fabrication practices for products to be in accordance with the applicable portions of ASTM A143/A143M, A384/A384M, and A385/A385M, except as specified herein. Avoid fabrication techniques that could cause steel distortion or embrittlement of the steel.
- 204.3 Remove all welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.
- 204.4 Provide holes and/or lifting lugs to facilitate handling. Provide vent holes to relieve excessive pressure and to drain excessive zinc.
- 204.5 Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil, paint, and other deleterious material prior to fabrication. Use paint marking products manufactured by SKM Industries, Inc. P.O. Box 278, Olyphant, PA 18447, or approved substitute.
- 204.6 Remove by blast-cleaning or other methods, surface contaminants and coatings that are not removable by the normal chemical cleaning process in the galvanizing operation.
- 204.7 Whenever practical, cutting, drilling, and welding shall be performed prior to galvanizing.
- 204.8 The American Galvanizers Association publication, "The Design of Products to be Hot-Dip Galvanized After Fabrication", will be used as a guide by the steel fabricator.
- 204.9 Holes in material  $\frac{3}{4}$  inch (20 mm) or thicker shall be drilled, not punched or arc-gouged. If the holes must be punched in material that is  $\frac{3}{4}$ " (20 mm) or thicker, the holes shall be punched under size and then reamed to size.
- 204.10 Beam copes and weld access holes in shapes that are to be galvanized shall be ground to a smooth bright finish by the fabricator prior to galvanizing.
- 204.11 Hollow areas need to be well vented. Overlapped and contacting surfaces need to be seal welded to prevent iron oxide from weeping and staining, and to prevent trapped moisture or gas from flashing to steam in the heated galvanizing kettle, which could create an unsafe condition or may result in localized uncoated surfaces.



205. IDENTIFICATION AND TAGGING

205.1 Piece Marking System: The piece marking system established by the fabricator shall be maintained on the galvanized piece. If piece marking has become illegible during the galvanizing process, repair the marking with identical identification of the shipping piece on the left-hand end as detailed.

**PART 3 - EXECUTION**

301. SURFACE PREPARATION

301.1 Pre-clean the Work in accordance with accepted methods to produce an acceptable surface for quality hot-dip galvanizing.

301.2 The fundamental steps in the Hot-Dip Galvanizing Process shall be as follows:

- a. Use a hot alkaline cleaner to remove oil, grease, and most paints. This step removes oil, grease, and most paints. Remove weld spatter, weld slag, and burn residue by abrasive blasting or other mechanical means.
- b. Use a hot acid bath for pickling or to remove scale in accordance with SSPC-SP8. This step removes or reduces surface rust, mill scale and similar contaminants and provides a surface which is conducive to the galvanizing process.

302. COATING APPLICATION

302.1 Galvanize steel members, fabrications, and assemblies after fabrication by the hot-dip process in accordance with ASTM A123/A123M.

302.2 Galvanize bolts, nuts, washers and iron and steel hardware components in accordance with ASTM A153/A153M.

302.3 Pre-fluxing shall be performed using a liquid flux pre-dip (zinc ammonium chloride solution or approved equal) to prevent oxidation and keep the surface active prior to dipping.

302.4 Galvanizing or zinc dipping shall be performed by immersing the parts into molten zinc which is maintained at a temperature of approximately 850°F (455°C).

302.5 After dipping, parts shall be withdrawn slowly from the galvanizing bath and the excessive zinc is removed by draining, vibrating and/or centrifuging.

302.6 Parts shall be cooled in water (quenching) or ambient air dry immediately after withdrawal from the zinc bath. If the galvanized component is going to be painted after galvanizing, the component shall not be quenched after galvanizing per ASTM D6386.

302.7 Safeguard products against steel embrittlement in conformance with ASTM A143/A143M.

302.8 Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.



303. COATING REQUIREMENTS

303.1 Conform to paragraph 6.1 of ASTM A123/A123M.

303.2 Surface Finish: The coating shall be continuous and as reasonably smooth and uniform in thickness as the weight, size, and shape of the item, and necessary handling of the item during the dipping and draining operations at the galvanizing kettle shall permit

303.3 Adhesion: The zinc coating shall withstand handling consistent with the nature and thickness of the coating and the normal use of the article, without peeling or flaking.

304. POST-GALVANIZING TREATMENTS

304.1 After immersion and subsequent removal from the zinc bath, parts shall not be subjected to any process of scraping or wiping which shall reduce the uniformity or the specified weight of the finished coating.

304.2 Do not treat freshly galvanized or passivated surfaces with oils, grease or chemicals which might interfere with adhesion of subsequent paint primers and coatings.

304.3 Galvanized materials subject to extended periods of storage in open, exterior locations shall be given passivating treatment or light oiling to prevent wet storage stain. The treatment, solution and process shall be subject to review and acceptance by the Owner.

304.4 If lifting lugs are added to the component to facilitate the galvanizing process, they shall be removed after galvanizing and the surface shall be repaired.

304.5 Any identification marking shall be examined to confirm that it is still readable and reinstated if is not legible.

304.6 The threads of bolts and nuts shall be examined for functionality and recut or retapped if necessary.

305. INSPECTION AND ACCEPTANCE TESTING

305.1 Inspection and testing of hot-dip galvanized coatings shall be done under the guidelines provided in the AGA publication "Inspection of Products Hot-dip Galvanized After Fabrication".

305.2 Include visual examination and tests in accordance with ASTM A123/A123M to determine the thickness of the zinc coating on the metal surface.

305.3 Furnish notarized Certificate of Compliance with ASTM standards and specifications herein listed. The Certificate must be signed by the galvanizer and contain a detailed description of the material processed. The Certificate shall include information as to the ASTM standard used for the coating.

305.4 Inspection Responsibilities:

a. Inspection by the Steel Fabricator and Galvanizer:

a1. It is the responsibility of the steel fabricator and galvanizing contractor to ensure compliance with this specification. This can be achieved by an in-plant inspection program designed to maintain the coating weight, finish, and appearance within the requirements of this standard. When required, the steel fabricator and galvanizing contractor shall provide a certification of



compliance with the requirements of this specification.

- a2. The fabricator or fabricator's inspector shall visually inspect 100% of the coped members on both sides both before and after galvanizing to identify incidences of cope cracking. If members with cracks are identified, the Owner shall be immediately notified. The cracked piece shall be replaced or repaired with procedures approved by the Engineer prior to delivery at the site. Any fabrication, inspection or examination deemed necessary by the Engineer for the repair of a crack due to galvanizing is at the fabricator's expense.
- 305.5 Arbitration Method: In the event of dispute over any weight of coating measure, the dispute shall be resolved by Test Method ASTM A90/A90M. If not feasible, and if mutually agreeable to the steel fabricator, galvanizing contractor and the Owner, the dispute may be resolved by the use of magnetic thickness gages which have been calibrated for accuracy against standard reference material thickness standards.
- 305.6 Adhesion: Determine adhesion of the coating to the surface of the base metal by cutting or prying with the point of a stout knife, applied with considerable pressure in a manner tending to remove a portion of the coating. The adhesion shall be considered inadequate if the coating flakes off in the form of a layer of the coating so as to expose the base metal in advance of the knife point. Do not use testing carried out at edges or corners (points of lowest coating adhesion) to determine adhesion of the coating. Likewise, do not use removal of small particles of the coating by paring or whittling to determine failure.
- 305.7 Rejection and Retest:
  - a. When inspection of materials to determine conformity with visual requirements of Article 303 of this Section warrants rejection of a lot, the Contractor may sort the lot and submit it once again for acceptance, after the Contractor has removed any nonconforming articles and replaced them with conforming articles.
  - b. The sampling plan that was used when the lot was first inspected shall be used for re-sampling of a sorted lot.
  - c. If the weight of coating does not conform to the requirements specified in ASTM A123 or A153 as applicable, retests of a mutually agreeable number of additional members shall be made. Failure of the retest to meet the requirements of ASTM A123 or A153 constitutes ground for rejection of the lot, unless the members are accepted by test on an individual basis.
  - d. Materials that have been rejected for reasons other than embrittlement may be stripped and re-galvanized and again submitted for inspection and test at which time they shall conform to the requirements of this specification.
- 306. REPAIR OF DAMAGED COATING
- 306.1 The maximum area to be repaired is defined in accordance with Section 6.2 of ASTM A123/A123M.
- 306.2 The maximum area to be repaired in the field shall be determined in advance by mutual written agreement of the parties.
- 306.3 Repair areas damaged by welding, flame cutting or during handling, transport or erection by one of the approved methods in accordance with ASTM A780/A780M whenever damage



exceeds 3/16" (5 mm) in width. Minimum thickness requirements for the repair are those described in Section 6.2 of ASTM A123/A123M.

END OF SECTION 050515

## **SECTION 050530**

### **ANCHOR RODS**

#### **PART 1 – GENERAL**

##### 101. EXTENT

101.1 Material and installation of anchor rods shall conform to the requirements of this Section and AISC 303 unless otherwise indicated on the Design Drawings.

##### 102. REFERENCES DOCUMENTS

102.1 Related standards, specifications, manuals, codes, and other publications of nationally recognized organizations are referenced herein. Methods, equipment, and materials shall comply with applicable or specified portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction. References to these documents shall be to the latest issue date of each document, unless otherwise indicated herein or by the Florida Building Code, together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of Contract for the Work.

102.2 ANSI – American National Standards Institute:

- a. B1.1, "Unified Inch Screw Threads"
- b. B18.2.2, "Square and Hex Nuts (Inch Series)"

102.3 AISC – American Institute of Steel Construction

- a. AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

##### 103. SUBMITTALS

103.1 General: In accordance with Section 013323.

103.2 Verification of Anchor Rod Materials: Submit manufacturer's material certifications or the mill test reports to Owner with the delivery of the anchor rods to the Project site.

103.3 Verification of Anchor Rod Locations: Submit documentation to confirm conformity with applicable Codes and Standards.

#### **PART 2 - PRODUCTS**

##### 201. ANCHOR ROD MATERIALS

201.1 Normal Strength: Threaded rods, nuts, and washers per ASTM F1554, Grade 36 or ASTM A307 headed bolts as indicated on the design drawings.

201.2 High Strength: Threaded rods, nuts, and washers per ASTM F1554, Grade 55 or 105. Grade 105 rods which will be hot-dip galvanized shall be heat treated per ASTM F1554. All mechanical testing shall be performed after the heat treatment.

201.3 Anchor Rod Assemblies: Assemblies shall, when indicated, include rods, nuts, washers, caps, plates, and sleeves.

201.4 Finishes: Anchor rods, nuts, washers, plates, and assemblies shall be hot-dip galvanized in accordance with Section 050515 prior to assembly.

### **PART 3 - EXECUTION**

#### 301. QUALITY CONTROL

- 301.1 Anchor rod threads shall be protected against damage. Damaged anchor rods shall be repaired or replaced.
- 301.2 Heating of any anchor rod in the field for bending or other purposes will not be permitted, except that nuts for threaded rods may be tack welded to the plate washers used for embedment in concrete when indicated on the Design Drawings.

#### 302. PROTECTION

- 302.1 During freezing weather, Contractor shall protect work against possible damage resulting from freezing of water which may accumulate in anchor rod sleeves. For rods with sleeves and bottom cup, remove anchor rods before placing antifreeze to ensure that bottom cups will be filled with antifreeze. Protection shall consist of a nonflammable, noncorrosive antifreeze solution such as Ethylene or Propylene Glycol. Freeze protection shall not be removed until just prior to installing grout.

#### 303. SETTING

- 303.1 Templates shall be provided for all anchor rods. Templates shall be carefully designed and constructed of sufficiently thick and rigid material so as to hold the rods to line and elevation as set.
- 303.2 Anchor rods shall be accurately located and set to line and elevation before concrete is poured. Accuracy of position of anchor rods shall be maintained throughout the placing and finishing of concrete to the tolerances given in AISC 303.
- a. Contractor shall survey and verify each anchor location prior to placing concrete. Provide Engineer with spreadsheet record of anchor location coordinates prior to placing concrete.
  - b. Contractor shall survey each anchor location after concrete has cured. Provide Engineer with spreadsheet record of anchor location coordinates.

#### 304. EQUIPMENT MANUFACTURER'S REQUIREMENTS

- 304.1 Wherever an equipment manufacturer provides recommendations on anchor rod installation (such as anchor rod location tolerance, tightening procedures, etc.) that are more restrictive than the requirements specified herein, the equipment manufacturer's recommendations shall be strictly followed.

END OF SECTION 050530



**SECTION 079200**

**JOINT SEALANTS**

**PART 1- GENERAL**

101. **EXTENT**

101.1 The intent of this Section is to define the minimum requirement for sealants and caulking of joints, including joint fillers and accessories according to the Drawings and as specified herein.

102. **REFERENCE DOCUMENTS**

102.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.

102.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of Contract for the Work. Abbreviations listed indicate the form used to identify the reference documents in the specification text.

102.3 ANSI - American National Standards Institute:

- a. A-116.1 - Two-Component Elastomeric Sealing Compounds for the Building Trade.

102.4 ASTM - ASTM International:

- a. C834 - Standard Specifications for Latex Sealants
- b. C920 - Standard Specification for Elastomeric Joint Sealants
- c. C1193 - Standard Guide for Use of Joint Sealants
- d. C1311 - Standard Specification for Solvent Release Sealants
- e. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
- f. D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

103. **SUBMITTALS**

103.1 Contractor shall submit the following documents according to the requirements of Section 013323:

- a. Manufacturer's product data sheets.
- b. Installation instructions.
- c. Material certifications.





**PART 2- PRODUCTS**

201. ACCEPTABLE MANUFACTURERS AND PRODUCTS

201.1 Approved manufacturers:

- a. BASF BASF Corporation
- b. DCC - Dow Corning Corporation
- c. MEAD - W. R. Meadows, Inc.
- d. PECO - Pecora Corporation
- e. SAC Sealed Air Corporation
- f. TREM - Tremco Sealant/Weatherproofing Division of RPM International, Inc.
- g. GE - General Electric Co.
- h. WILL - Willseal

202. MATERIALS

202.1 Sealants (Exterior and Interior): Use only one of the following types of products for entire project. Use in joints 1 inch (25-mm) wide or less wherever movement may occur on interior or exterior:

- a. One component silicone, low-modules, gun grade elastomeric sealant:

DCC, 790  
PECO, 864  
TREM, Spectrum 1  
GE, Silpruf

- b. Two Component Polysulfide, gun grade elastomeric sealant:

BASF, MasterSeal NP 2  
PECO, Synthacalk GC2+

202.2 Sealants (Exterior and Interior-Horizontal Locations Only): Use only one of the following types of products for entire Project. Use in exterior and interior contraction and expansion joints in pavements and slabs. One component urethane, pour grade, self-leveling elastomeric sealant:

- a. BASF, MasterSeal SL 1.
- b. PECO, Urexpan NR-201.

202.3 Caulks (Interior Only):

- a. One part acrylic gun grade. Use where finish painting is required.
- a1. BASF, Sonolac Acrylic Latex.



- a2. PECO, AC-20 Acrylic Latex.
- a3. TREM, Tremflex 834.
- b. One - part silicone rubber sealant: Use where top of backsplash meets wall, around plumbing fixtures, and where else shown or noted.
- b1. DCC No. 786.
- 202.4 Backer Rods: Backer rod for elastomeric sealants. Extruded closed-cell polyethylene foam or polyethylene jacketed polyurethane foam, non-bleeding, non-staining, oversized 30 to 50 percent.
  - a. BASF, MasterSeal 920 Backer Rod.
  - b. MEAD, Backer Rod.
  - c. Sealed Air, Ethafoam.
- 202.5 Joint Cleaner: Type recommended by the manufacturer of the sealing or caulking compound for the specified joint surface and condition.
- 202.6 Bond Breaker: Polyethylene tape; pressure sensitive recommended by sealant manufacturer to suit application.
- 202.7 Joint Primer: Type recommended by the manufacturer of the sealing or caulking compound for the specific joint surface and condition; shall be non-staining.

### **PART 3 - EXECUTION**

- 301. PREPARATION
- 301.1 Thoroughly inspect existing construction and conditions under which the work will be performed. Report to Owner conditions that would adversely affect installation of the work.
- 301.2 Verify that joint dimensions are according to the manufacturer's recommendations.
- 301.3 Clean, prepare and size joints according to manufacturer's printed instructions. Remove loose materials and other foreign matter, which might impair adhesion of sealant or caulking.
- 301.4 Prior to installing sealants in horizontal joints where asphalt impregnated expansion joint fillers or other non-polyethylene joint fillers have already been placed, duct tape or polyethylene tape may be placed directly over the existing filler.
- 301.5 Start of work constitutes acceptance of construction and conditions.
- 302. INSTALLATION
- 302.1 Comply with sealant manufacturer's printed instructions. Install sealant backer rod for liquid elastomeric sealants. Install bond breaker tape wherever recommended by manufacturer to ensure that elastomeric sealants will perform properly.



- 302.2 Install sealants and caulking in uniform, continuous ribbons, without gaps or air pockets. Ensure complete wetting of the joints. Bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
- 302.3 Use masking tape on both sides of joints to prevent contamination of adjacent surfaces and to present a neat, clean, straight joint line.
- 302.4 Install sealants to depths shown; when not shown, within the following limitations:
- a. For pavement and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent (75%) of joint width, but not more than 3/4 inch deep (19 mm) or less than 3/8 inch (10-mm) deep.
  - b. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent (50%) of joint width, but not more than 1/2 inch (12 mm) deep or less than 1/3 inch (8 mm) deep.
  - c. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75 percent (75%) or 125 percent (125%) of joint width.
- 302.5 Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces.
303. COLD WEATHER INSTALLATION OF SEALANT
- 303.1 If sealant is being placed when temperature of surrounding air is 40 deg F (4 deg C) or below, conform to following requirements:
- a. Provide enclosure and artificial heat to preheat surrounding air to 50 deg F (10 deg C) or above for at least twenty-four (24) hours before sealant is placed.
  - b. Mix sealant components within the heated enclosure.
  - c. Maintain temperature of surrounding air at 50 deg F (10 deg C) or above for at least 48 hours after installation of sealant is completed.
  - d. Provide housing, covering, or other protection, and means of providing artificial heat. Maintain housing or covering in place and intact for at least twenty-four (24) hours after artificial heating is discontinued.
304. CURING
- 304.1 Cure sealants and caulking compounds in compliance with manufacturer's printed instructions.



305. CLEANING

- 305.1 Upon completion, carefully examine sealant and caulking work. Remove damaged and defective work and replace with new materials at no additional cost to Owner.
- 305.2 Remove surplus products, containers and rubbish and dispose of off Project site.
- 305.3 Remove spilled or spattered materials from surfaces. When adjacent surfaces or other work has been damaged or stained as a result of sealing and caulking work, repair damage and remove stains to the satisfaction of Owner.

END OF SECTION 079200



**SECTION 099113**  
**COATING SYSTEMS**

**PART 1 - GENERAL**

101.        **EXTENT**

- 101.1        This Section prescribes the minimum requirements for coating systems, including high performance coating systems and powder coating, for piping, vessels, equipment, architectural, and structural elements.
- 101.2        Contractor shall apply a touch-up where the shop coating has been marred, scratched, or otherwise damaged prior to unloading at the Site. Contractor shall apply touch-up where field applied coating has been marred, scratched, or otherwise damaged due to field installation or construction activities.
- 101.3        Ferrous surfaces of piping, vessels, equipment, and structural elements supplied by the Contractor shall be coated in the shop, or field as applicable, after surface preparation with the following exceptions that shall not be painted unless specifically required by the Drawings.
- a.        Joints and surfaces to be field welded (unless weldable primer, approved by Owner, is used).
  - b.        Surfaces in contact with concrete or grout.
  - c.        Milled and other machine-finished surfaces.
  - d.        Galvanized surfaces.
  - e.        Non-ferrous surfaces (such as copper, brass, aluminum, etc.).
  - f.        Stainless steel surfaces.
  - g.        Interior surfaces which are to be covered with a lining.
  - h.        Coating over of nameplates, couplings, shafts and other finished surfaces, gasket surfaces as well as paint on valve stems, motors or electronic equipment is not permitted. Contractor shall remove coating, paint drops, overspray, or inadvertent application, as well as clean the coating off nameplates and machined surfaces, etc., at the Contractor's expense.
- 101.4        Shop coated members that have joints and/or surfaces that will be field welded shall have a 3-inch (75-mm) strip on each side of the joint or field weld location left uncoated. Should the Contractor elect to use weldable primer, the 3-inch (75-mm) strip on each side of the joint or field weld location is not required. Contractor shall submit manufacturer's information on application and chemical composition to Owner for approval prior to use.
- 101.5        Milled surfaces and other machine-finished surfaces shall be protected against corrosion by using lacquer or other suitable material approved by Owner.
- 101.6        Where required by the specification, the Contractor shall provide field touch-up coating for equipment and structural elements described in Article 303.5.



102. REFERENCE DOCUMENTS

- 102.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the applicable additions, addenda, amendments, supplements, thereto, in effect as of the date indicated in Section 014219.
- 102.2 AWWA – American Water Works Association:
- a. D102 – Coating Steel Water Storage Tanks
- 102.3 ANSI – American National Standards Institute:
- a. Z535.1 American National Standard for Safety Colors
- 102.4 ASME – American Society of Mechanical Engineers:
- a. A13.1 - Scheme for the Identification of Piping Systems
- 102.5 ASTM – ASTM International:
- a. A90/A90M – Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
  - b. B6 – Standard Specification for Zinc
  - c. D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications
  - d. D520 – Standard Specification for Zinc Dust Pigment
  - e. D7091 – Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Non-Magnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
  - f. D7378 – Standard Practice for Measurement of Thickness of Applied Coating Powders to Predict Cured Thickness
  - g. D1212 – Standard Test Methods for Measurement of Wet Film Thickness of Organic Coatings
  - h. D4417 – Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel
  - i. E376 – Standard Practice for Measuring Coating Thickness by Magnetic – Field or Eddy – Current (Electromagnetic) Testing Methods
- 102.6 NACE – NACE International:
- a. SP0178 – Design, Fabrication and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service
- 102.7 ISO - International Organization for Standardization



- a. ISO-12944 All Parts – Corrosion Protection of Steel Structures by Protective Paint Systems

103. SUBMITTALS

103.1 Submit the following documents for review according to the submittal requirements of Section 013323 and as follows:

- a. Manufacturer's Product Data Sheets (PDS) and Safety Data Sheets (SDS) for the coating products and application instructions and chemical compositions.
- b. For each finish product specified, two samples representing the actual product, color and finish proposed for use.
- b1.1 Contractor's quality assurance program which describes, as a minimum, the methods and procedures for and associated with:
  - b2. Surface preparation.
  - b3. Selection of ~~blasting sand, grit or shot~~ abrasive blast media (silica sand is not allowed in many facilities)
  - b4. Quality control procedures for personnel performing the cleaning and coating work.
- c. Contractor's qualifications which describe training and authorization as a coating manufacturer's approved or authorized applicator.

104. GENERAL QUALITY CONTROL AND QUALITY ASSURANCE PROVISIONS

104.1 General:

- a. Coating systems shall have a minimum design life of twenty (20) years without recoating unless otherwise specified.
- b. The coating of supplied mechanical and electrical equipment, architectural and structural elements furnished under this Specification shall conform to the requirements of this Section and the governing building codes, with local amendments. The Work shall conform to the codes and standards in effect at the time of contract award. Deviations from these requirements are subject to approval by Owner. In cases where conflicts between the cited codes and this Section exist, the requirements of the more conservative document shall be met. When the codes and this Section do not use consistent requirements and it is not clear which governs, both the codes and this Section shall be checked individually to ensure compliance with each.
- c. For critical applications such as tank linings, a mock-up shall be prepared to evaluate surface preparations and application workmanship which shall be witnessed by the Owner or its designee.
- d. Contractor shall supply materials, equipment and supplies necessary to perform the work. This includes but is not limited to:
  - d1. Surface cleaning equipment, consumables, and supplies.
  - d2. Surface preparation equipment, consumables, and supplies.



- d3. Masking materials, tarps, and barriers.
  - d4. Application equipment, consumables, and supplies.
  - d5. Necessary spare parts to assure uninterrupted work.
  - d6. Heating, cooling, lighting, dehumidification and ventilation equipment as required by coatings manufacturer.
  - d7. Quality Control equipment required to perform environmental monitoring, surface preparation inspection and coating application inspection.
  - d8. Materials and consumables necessary to assure equipment cleanliness and proper operation.
- 104.2 Coating Manufacturers: One coating manufacturer shall be chosen by the Contractor to supply the applied coatings and related materials for the entire Contract. The manufacturer shall have a minimum of ten (10) years' experience in the manufacture of the required coatings.
- 104.3 Applicator: The applicator shall have a minimum of three years' experience in applying the required coating systems and be approved or accepted by the coating system manufacturer.
105. DEFINITIONS
- 105.1 Coating: The term "coating" as used herein includes paint, powder coating, emulsions, primers, enamels, stains, varnishes, sealers, cement-emulsion filler, and other coatings and linings, whether used as prime, intermediate, or finish coat.
- 105.2 Standard coating terms defined in ASTM D16 apply to this Section.
106. DELIVERY, HANDLING AND STORAGE
- 106.1 Material delivered to the Project Site shall be in original, new, and unopened packages and containers bearing manufacturer's name and label.
- 106.2 Materials shall be labeled with the following information:
- a. Product name or title of material.
  - b. Product description (generic classification or binder type).
  - c. Manufacturer's stock number, material batch number(s) and date of manufacture.
  - d. Contents by volume, for pigment and vehicle constituents.
  - e. Thinning instructions.
  - f. Application instructions.
  - g. Color name and number.
  - h. VOC content.





- 106.3 Materials shall be stored in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7.2 deg C). Flammable materials not in use shall be stored in Underwriter's Laboratories, Inc., NFPA or other approved flammable storage cabinet. Reference OSHA 29 CFR 1926 if storage of combustible or flammable liquids exceeds twenty-five (25) gallons (94 L). Containers and cabinets used for storage shall be maintained in a clean condition, free of foreign materials and residue.
- 106.4 "Working" containers shall remain closed or covered, when not in use, and kept in mobile containment away from direct sunlight, "hot work", heat sources, and any confined space work areas where vapor may accumulate and create unsafe working conditions. Mobile containment areas, where working containers are temporarily stored shall not be left unattended, and shall be clearly marked and barricaded
- 106.5 Paint shall be protected from freezing. Storage area shall be kept neat and orderly. Oily rags and waste shall be removed daily. Necessary measures shall be taken to ensure that workers and Work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## **PART 2 – PRODUCTS**

### **201. ACCEPTABLE MANUFACTURERS AND PRODUCTS**

201.1 Acceptable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed below or listed in other Part 2 Articles.

### **202. MATERIALS**

#### **202.1 General:**

- a. Contractor shall provide Owner with a recommended manufacturer's standard coating system for supplied equipment/components (e.g., pumps, valves, electrical equipment, pipe, pipe supports, etc.), for the environment (including potential for Corrosion Under Insulation) and intended service of that equipment or component. The coating system shall include identification of surface preparation, shop or field prime coating, shop or field finish coating, shop touch-up coating requirements, field touch-up requirements and coating materials required for the Work.
- b. Contractor shall provide Owner with a recommended coating system for supplied structural elements for the environment and intended service. Such elements include, but are not limited to, building structural steel, structural steel for supporting equipment, conveyor support steel, auxiliary steel for supporting pipes, cable trays and conduits, hangers, steel associated with gallery work, and concrete building structures including floors, walls, and ceilings. The coating systems shall include identification of surface preparation, shop or field prime coating, shop or field finish coating, shop or field touch-up coating and the specific coating materials required for the Work.
- c. Coating systems shall comply with Table 099113-1
- d. Coatings shall comply with local, State and Federal environmental regulatory limits for Volatile Organic Compounds (VOC's).



- e. Coating products except hot dip galvanizing, zinc plating, and zinc rich primers used on this project shall be certified 100 percent lead free. Zinc rich primers shall be restricted to ASTM D520 Type II or Type III only. Zinc plating shall be according to ASTM B633.

202.2 Coating Systems:

- a. Table 099113-1 defines the applicable coating systems for the Project structures, systems, components, equipment, and surfaces.

**TABLE 099113-1**

**EXTENT OF COATING AND FINISH SYSTEMS**

<u>Item</u>	<u>Coating System &amp; Description</u>	
1. Structural and miscellaneous ferrous steel members.		
a. Steel embedded in concrete.		Hot Dipped Galvanized
b. Marred galvanized areas and field welds on galvanized surfaces.	CS-107	Touch-Up Spray Applied Coating for Hot-Dipped Galvanized Steel
c. GSU transformer grating support steel and grating		Hot Dipped Galvanized
2. Engine and engine hall concrete floor		Surface Hardener and Sealer Prosoco Consolideck LS/CS or approved equal
3. Underground carbon steel piping	CS-232	Fusion bond epoxy coating

203. **SOURCE QUALITY CONTROL**

203.1 Inspections:

- a. Work may be subject to inspection by Owner or their designee and Work found not according to the requirements specified herein shall be satisfactorily redone by Contractor at no additional cost to Owner.
- b. Inspection of surface preparation will be based upon comparison with: “Visual Standard for Abrasive Blast Cleaned Steel,” SSPC-Vis.1. Anchor profile for prepared surfaces shall be measured by use of methods A or C per ASTM D4417.
- c. Inspection of Wet Film Thickness (WFT) shall be based on measuring the average WFT, using a Nordson-type Wet Film Gauge, or an Interchemical-type direct reading wet film thickness gauge, or equal. For the Nordson type gauge, not less than two applications of the gauge shall be made in each area to be tested to determine an average wet film thickness; for the Interchemical-type gauge, not less than two rolls of the gauge in opposite directions per the requirements of ASTM D1212.
- d. Wet-film and dry-film thickness gauges shall be made available at the Contractor’s facility for use by Owner at all times until final acceptance of the coating.
- e. Contractor shall furnish U.S. Department of Commerce; National Institute of Standards and Technology (NIST) certified thickness calibration plates to test the accuracy of dry-film thickness gauge.



- f. Dry film thickness may also be inspected by Owner or their designee for verification of coating thickness. Testing shall be performed according to ASTM D7091 or E376.
- g. Owner or their designee may make random spot checks of materials, equipment, etc., which have been coated, by removing small swatches of coatings to bare material with acetone and examining the surface with a 5-power magnifying glass to observe the absence or presence of rust under the prime coat. The presence of rust or rust stains under such swatches shall be sufficient cause for rejecting the Work, and Contractor shall repair and recoat the Work at the Contractor's own expense.
- h. For surfaces subject to immersion service, finished coating systems shall be subject to "spark testing" to confirm system integrity. The identified pinholes and defects shall be repaired and retested.

**PART 3 – EXECUTION**

301. EXAMINATION

301.1 Contractor shall examine substrates and conditions for compliance with requirements for paint application. Contractor may proceed with paint application only after unsatisfactory conditions have been corrected.

302. SURFACE PREPARATION

302.1 Comply with the coating manufacturer's surface preparation requirements of the specified coating systems listed in Table 099113-1. For internal coatings subject to immersion conditions, assure that weld surfaces conform to NACE SP0178 Weld Preparation Designation "C" unless otherwise specified. Surfaces shall be clean and free from grease, oil, and other materials prior to surface preparation. Ferrous surfaces shall be cleaned and tested for residual chlorides prior to surface preparation.

302.2 Masking, tarping, and other such activities shall be applied or installed prior to coating application. Surfaces not requiring coating shall be protected from overspray, coating drift, inadvertent application, and inadvertent discharge of coating materials.

303. COATING APPLICATION

303.1 General:

- a. Application of coating shall conform to the applicable requirements of SSPC-PA1, "Shop, Field and Maintenance Painting" and to the manufacturer's instructions and recommendations.
- b. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Weather Bureau Psychometric Tables.
- c. No coating shall be applied:
  - c1. When the surrounding air temperature or the temperature of the surface to be coated is below 40 deg F (5 deg C).
  - c2. To wet or damp surfaces.
  - c3. In rain, snow, fog, or mist.



- c4. When the surface to be coated temperature is less than 5 deg F (3 deg C) above the dewpoint.
- c5. When it is expected that the air temperature will drop below 40 deg F (5 deg C) or less than 5 deg F (3 deg C) above the dewpoint within eight hours after application of the coating.
- d. If the above conditions are prevalent, coating shall be delayed or postponed until conditions are favorable. The day's coating work shall be completed in time to permit the film sufficient drying time to prevent damage by atmospheric conditions.

303.2 Material Preparation:

- a. Mix and prepare coating material according to the manufacturer's directions.
- b. Stir material before application to produce a mixture of uniform density and stir as required during application of material. Do not stir surface film into the material. Remove the film and, if necessary, strain the material before using. Manufacturer's induction or "sweat-in time" shall be observed
- c. If the Contractor intends to use thinners other than those recommended by the coatings material manufacturer, the Contractor shall inform Owner and the coating manufacturer of the intended method of application. The coating manufacturer shall then re-evaluate the coating and furnish Owner and the Contractor, in writing, with the required wet film thickness. Contractor shall obtain Owner's approval of the coating manufacturer's required wet film thickness prior to the application of further material.

303.3 Application:

- a. Apply coating materials according to the coating manufacturer's printed instructions. Use applicators and techniques best suited for the type of material being applied.
- b. Contractor shall be responsible for paint compatibility.
- c. Application of coating shall be applied evenly, free of runs or sags, with no evidence of poor workmanship. Finish surfaces shall be free from defects or blemishes.
- d. Contractor shall obtain from the coating manufacturer and submit to Owner, in writing, the Wet Film Thickness (WFT) required to obtain the specified Dry Film Thickness (DFT) for each type of coating material and for each type of application.
- e. The WFT shall be based on applying the material directly from the original containers without thinning. If Owner approves thinners, the WFT applicable to the amount of thinner shall be used.
- f. Contractor shall apply coating materials for each coat of a system in one coat to achieve the specified dry film thickness unless specifically directed by the coating manufacturer. "Tie coats" or "mist coats" are acceptable when recommended by the coating manufacturer.
- g. On-site spray painting is not permitted without prior written approval from Owner.

303.4 Clean Up:



- a. Unused materials, discarded materials, spoiled materials, rags, empty paint material containers, etc. shall be cleaned up, properly stored and removed from the job site. No debris, trash or other such materials may be allowed to accumulate.

303.5 Touch-Up Coating:

- a. Shop or field touch-up coating\* shall be the same as the specified coating material and color as used for the original coating system. The touch-up coating shall be applied to the damaged surface after completion of specified surface preparation and shall meet coating system manufacturers recommendations regarding minimum SSPC preparation methods, surface profile, and touch up and "re-coat" times.
- b. (\*) Damage to inorganic zinc primers shall be touched up with zinc-rich epoxies manufactured and recommended by the same manufacturer for touch-up
- c. Contractor shall ship a sufficient quantity of paint, same as used for the shop applied coats, to the project site for use as touch-up paint.
- d. Touch-up coating shall overlap the original coat by not less than 1 inch (25 mm) to ensure continuity of the coating.
- e. Touch-up repairs to multiple coat systems shall conform, in material and in application, to the manufacturer's requirements of the original system application per each coat thereof; i.e., for a three coat system of primer, intermediate coat, topcoat, repair of each damaged coat shall conform to the manufacturer's recommended touch-up procedure for each material.

304. SAFETY COLOR CODE COATING

304.1 Items scheduled to be coated with safety colors shall be coated in colors complying with ANSI/NEMA Z535.1 ISCC-NBS color designations and block numbers and as specified and approved by Owner. Color coating for safety colors is in addition to coating specified in Table 099113-1. Colors should be non-fading and non-chalking. Where color coating is to be applied to galvanized steel, the color coating shall be applied over the galvanizing according to the coating manufacturers surface preparation recommendations for such surfaces.

304.2 Piping: As specified by ANSI/NEMA Z535.1.

304.3 Fire Hose Cabinets, Extinguishers and Hose Outlet Areas:

- a. Coat fire hose cabinets (excluding hose and hose connections) and branch piping to approximately 5 feet (2 m) on both sides of the fire hose cabinets.
- b. Mounted on Walls: Apply a background panel of Safety Red color extending approximately 12 inches (300 mm) on both sides of the fire hose cabinets.
- c. Mounted on Columns or Posts: Apply a band of Safety Red color completely around the column or post, extending approximately 12 inches (300 mm) above and 12 inches (300 mm) below the facility.
- d. Fire hose cabinets in architecturally-finished areas shall not be coated.

304.4 Dangerous parts of equipment or energized equipment as defined in ANSI 253.1 shall be identified and coated Safety Yellow.



304.5 First Aid Kits, Stretchers, Eye Wash Stations, and Flush Showers shall be coated in Safety Green to the extent indicated, include white lettering.

305. PIPING COLOR CODES

305.1 Surface preparation and painting system shall be according to Table 099113-1.

305.2 Exposed steel piping shall be coated with colors complying with ASME A13.1, ANSI/NEMA Z535.1 or Owner's defined scheme. In case of conflict, Contractor to confirm with Owner color to be applied.

306. FIELD COATING

306.1 Field Touch-Up Coating: Any of the below areas or items shall be cleaned of all dirt, rust, grease, weld-spatter, and any other surface contaminants or imperfections which could initiate coatings failure

- a. Field touch-up coating shall be applied to the following surfaces:
  - a1. Surfaces where shop or field applied coating has been marred, scratched, or otherwise damaged, due to shipping, handling, erection, installation, weathering, etc.
  - a2. Heads of the field bolts and nuts, and adjacent surfaces left uncoated in the shop.
  - a3. Surfaces of field welds and adjacent surfaces left uncoated in the shop and where coating was damaged during the welding process
  - a4. Surfaces of ferrous fasteners not otherwise protected.
  - a5. Exposed fabrication, erection or shipping marks shall be cleaned off and the areas touch-up coated to match the adjacent surfaces.

306.2 Field prime and finish coating shall be as provided where indicated in project specifications. Surface preparation and coating systems shall be per Table 099113-1. Finish color coat shall be as specified by Owner.

306.3 Caulking:

- a. Do not apply coating over Thiokol base or Silicone base rubber sealant caulking. Any silicone or Thiokol based sealant previously applied to substrates requiring coating shall be removed and a coatings compatible caulk/sealant applied and cured before coating
- b. Other caulking materials shall be coated with the same coating as used for adjacent surfaces. Unless otherwise specified herein, the finish coat color shall be as specified by Owner.
- c. Only "paintable" caulks and sealants compatible with the solvents of the coatings systems to be used shall be permitted unless otherwise approved by the owner or its designee

307. COATING SYSTEM MATRIX

307.1 Refer to Table 099113-1 for the items to be coated and the specified coating system to be used.



307.2 Coating System Data Sheets: Refer to the attached coating system data sheets for coating system information and alternative products.



**COATING SYSTEM CS-107**

**TOUCH-UP SPRAY APPLIED COATING FOR HOT-DIPPED GALVANIZED STEEL**

- Description : Touch-up spray applied coating for hot-dipped galvanized steel
- Uses : Surfaces which have been abraded or burned off by welding
- Criteria : Application temperature > 50°F; above ground; underground; underwater; embedded; indoors; outdoors; operating temperature ≤ 750°F; abrasive; non-abrasive; corrosive; non-corrosive; uninsulated
- Surface Preparation : Per coating manufacturer
- Surface Profile : Per coating manufacturer
- Generic Type Touch-up : Zinc rich

<b><u>Approved Suppliers</u></b>	<b><u>Touch-up</u></b>	<b><u>DFT</u></b>
Keeler & Long PPG	Galvanode Primer #6500	2-3
Carboline	Carbozinc 859	3-5
Sherwin Williams	Zinc Clad 5	3-4
Hempel	Organic Zinc Rich 17360	2-4





**COATING SYSTEM CS-232**

**2-COAT EPOXY SHOP APPLIED SYSTEM FOR EXTERNAL CARBON STEEL SURFACES THAT  
 HAVE NOT BEEN PREVIOUSLY COATED**

Description	:	2-coat epoxy shop applied system for external carbon steel surfaces that have not been previously coated
Uses	:	Chemical resistant coating where sulfuric acid spill protection is desired
Criteria	:	Application temperature > 50°F above ground; indoors; operating temperature ≤ 170°F; nonabrasive; corrosive; uninsulated
Surface Preparation	:	SSPC-SP5
Surface Profile	:	3 to 4 mils
Generic Type Primer	:	Epoxy
Generic Type Finish	:	Epoxy

**Approved Suppliers**

**Primer**

**DFT**

Carboline	Plasite 4550	20-60
International	Interzone 954	15-20
PPG	90003	5-7
Devoe - International	Devran 124	20-25
Ceilcote - International	Ceilgard 664	2-5
Keeler & Long - PPG	92003	5-7
Sherwin-Williams	Nova Plate UHS Primer	6-12

**Approved Suppliers**

**Finish**

**DFT**

Carboline	Plasite 4550	20-60
International	Interzone 954	15-20
PPG	97071/97072	15-20
Devoe - International	Devran 124	20-25
Ceilcote - International	Ceilgard 664	6-9
Keeler & Long - PPG	92353KT	15-20
Sherwin-Williams	Nova Plate UHS Primer	10-16



**SECTION 260526**

**GROUNDING**

**PART 1 – GENERAL**

101. **EXTENT**

101.1 The below grade grounding system shall be designed, supplied, and installed by the Contractor in accordance with this specification, the Electrical Installation Drawings and the Electrical Notes and Details Drawings.

101.2 The grounding system components shall include ground rods, cable, and connectors.

101.3 Connections to all equipment frames, equipment neutrals, metal structures, fences, metallic raceway, armored cables, and cable shields shall be included in the grounding system.

102. **RELATED WORK SPECIFIED IN OTHER SECTIONS**

102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:

- a. Section 011100 – Summary of Work
- b. Section 011900 - Site Design Data
- c. Section 013323 – Shop Drawings and Product Data
- d. Section 014219 – Reference Standards
- e. Section 014500 – Quality Control
- f. Section 337119 – Underground Electrical Ductruns and Manholes
- g. Section 312333 – Excavation and Backfill for Underground Utilities

103. **REFERENCE DOCUMENTS**

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents indicated in Section 014219, in addition to federal, state, or local codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with applicable additions, addenda, amendments, supplements, thereto, in effect as of the date indicated in Section 014219.

103.2 IEEE - Institute of Electrical and Electronics Engineers:

- a. P3003.1 - Recommended Practice for System Grounding of Industrial and Commercial Power Systems



- b. P3003.2 - Recommended Practice for Equipment Grounding and Bonding in Industrial and Commercial Power Systems
  - c. 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
  - d. 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding
  - e. 1050 - Guide for Instrumentation and Control Equipment Grounding in Generating Stations
  - f. C2 - The National Electrical Safety Code (NESC)
- 103.3 NECA - National Electrical Contractors Association:
- a. 1 - Standard Practices for Good Workmanship in Electrical Construction
- 103.4 NFPA - National Fire Protection Agency
- a. 70 - National Electrical Code (NEC)
- 103.5 OSHA - Occupational Safety and Health Act of 1970
104. TECHNICAL REQUIREMENTS
- 104.1 The grounding system shall be designed and installed to provide a continuous and low impedance path with adequate thermal capacity to allow ground fault currents to return to their sources, reduce potential gradients to values the average person can withstand without injury, and limit potentials to which equipment and apparatus are exposed.
- 104.2 The Facility grounding grid system will consist of buried stranded high conductivity copper conductors to IEEE 80. Where ground rods are used, they will be high conductivity copper clad to IEEE 80.
- 104.3 Below Grade:
- a. A minimum of two interconnections shall be made to adjacent existing grounding systems.
  - b. Foundation rebar and 10% of steel H-piles shall be connected to the grounding system.
  - c. Connections to structural steel, to permanent outdoor structures or to be embedded in concrete, buried in earth, or otherwise made inaccessible shall be made using the exothermic weld process.
  - d. Contractor shall provide protective covers or enclosures for ground cables coiled for future connection.
105. SUBMITTALS
- 105.1 Submit documents for review in accordance with the submittal requirements of Section 013323.



**PART 2 – PRODUCTS**

201. PRODUCTS

- 201.1 Compression connections shall be Burndy Hyground type.
- 201.2 Exothermic welding process shall be “Cadweld” type manufactured by Erico Products, Inc.

**PART 3 – EXECUTION**

301. INSTALLATION

- 301.1 Contractor shall perform all required installation and related activities as defined in Section 011100 of this specification. For component locations and installation requirements, see the attached Electrical Installation and Electrical Notes and Details Drawings.
- 301.2 Surfaces where ground connections are to be made must be thoroughly cleaned. Oxides and dust may be removed by emery cloth, steel wool, or by filing. Grease and oil shall be removed with a good solvent or suitable cleaning fluid as agreed to by the Owner.
- 301.3 Before installing compression lugs or connectors, the exposed conductor to be terminated or spliced shall be carefully inspected to ensure that no foreign material is present on the surface. If the conductor has been exposed for several days, it shall be wire brushed to remove any oxide formed on the surface.
- 301.4 The Contractor shall notify the Owner before concealment of all electrical work which will be embedded in concrete or buried in earth.

302. TESTING

- 302.1 Contractor shall test differential voltage to adjacent grid prior to making interconnections to ensure safe working conditions.

END OF SECTION 260526



**SECTION 264200**  
**CATHODIC PROTECTION**

**PART 1 - GENERAL**

101.            **EXTENT**

- 101.1            This Section prescribes the minimum requirements to design, supply, install, and test a cathodic protection system with passive subsystems including the following:
- a.            Power cables
  - b.            Anodes
  - c.            Anode backfill material
  - d.            Terminal blocks
  - e.            Bond and test cabling
  - f.            Bonding connections
  - g.            Test stations and reference half-cells
  - h.            Nameplates
  - i.            Accessories
  - j.            Any material required for a complete installation.
  - k.            The project specific materials and equipment quantities and attributes (System Structure and Component safety, quality, etc., classification) are shown on the Project Drawings, equipment
- 101.2            Cathodic Protection System Design:
- a.            The cathodic protection system design shall be signed by a NACE Cathodic Protection Specialist.
  - b.            The cathodic protection system prevents the electrochemical corrosion of the exterior surfaces of ferrous piping or other structures buried in soil, condenser and heat exchanger water boxes, and intake structures. Corrosion shall be prevented by making the protected surfaces cathodic.
  - c.            Cathodic protection system shall be designed to protect the underground ferrous piping systems, specifically all new fuel gas, ammonia and lube oil piping and new ferrous tanks. Contractor's vendor shall be a company specializing in cathodic protection equipment and services.
  - c1.           Details regarding the structures that need to be cathodically protected (material, size, coating type, service, etc.) are provided in Attachment 5 - Mechanical Design Drawings.
  - c2.           Geotechnical report containing soil condition information is provided in Attachment 3 - Geotechnical Report.



- d. The design life of the facility and the required number of years cathodic protection to be provided shall be twenty (20) years (equal to station design life).
- e. The cathodic protection system shall be designed to operate and perform satisfactorily under the operating and environmental conditions specified without premature aging and/or need to replace components or parts more frequently than the equipment is designed for.
- f. Cathodic protection system shall be accomplished with galvanic (sacrificial) anode current systems.
- g. The cathodic protection system shall be designed and installed in a manner eliminating the risks of stray current corrosion to other buried pipe or other metallic structures.
- h. Contractor shall test existing piping system to determine if there are any sections of buried pipes that are isolated. If isolated sections of buried pipes are present, steps shall be taken to ensure that these pipes are bonded together and made to be electrically continuous.
- i. The cathodic protection system shall conform to the latest edition of the following NACE standards where applicable.
- j. Reference half-cells (copper/copper sulfate, zinc) shall be installed as required. Reference half-cell extension cabling shall be routed and terminated at the test station located adjacent to the pipe run.
- k. A test station is required at each anode bed for measurement of anode current and structure to soil potential. A test station is required at each casing pipe location.
- l. Base Cathodic Protection designs on historical knowledge and specific field tests made at the proposed construction site. Tests should include but not be limited to:
  - l1. Soil or water corrosivity (resistivity)
  - l2. Potential surveys
  - l3. Stray current interference potential
  - l4. Water chemistry/corrosivity (pH)
- 102. FIELD SERVICES
- 102.1 The Contractor shall provide field assistance in conjunction with at least one day of turnover and acceptance testing of the system.
- 103. RELATED WORK SPECIFIED IN OTHER SECTIONS
- 103.1 The Work specified in this Section shall be coordinated with Work specified in the following related sections:
  - a. Section 011100 - Summary of Work
  - b. Section 011900 - Site Design Data



- c. Section 013323 - Submittal Procedures
  - d. Section 014219 - Reference Documents
  - e. Section 014500 - Quality Control
104. REFERENCE DOCUMENTS
- 104.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents indicated in Section 014219, in addition to federal, state, or local codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the applicable additions, addenda, amendments, supplements, thereto, in effect as of the date Contract for the Work.
- 104.2 ANSI - American National Standards Institute:
- a. C37.20.1 - Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear
  - b. ANSI/NFPA 70 - National Electrical Code
  - c. ANSI/ IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
  - d. ANSI/AWWA D104-04 - Automatically Controlled, Impressed-Current Cathodic Protection for the Interior of Steel Water Tanks
- 104.3 ASTM - ASTM International:
- a. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - b. B 418 - Standard Specification for Cast and Wrought Galvanic Zinc Anodes
- 104.4 EPA - Environmental Protection Agency, Code of federal Regulations, Title 40: Protection of the Environment:
- a. Code of Federal Regulations (CFR):
    - a1. 40 CFR 60 - Standards of Performance for New Stationary Sources
    - a2. 40 CFR, Part 280 -Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)
    - a3. 40 CFR, Part 192 -Transportation of Natural Gas and other Gas by Pipeline
    - a4. 40 CFR, Part 195 -Transportation of Hazardous Liquids by Pipeline
- 104.5 ISO -International Organization for Standardization:
- a. 9001 - Quality Management Systems - Requirements



- b. 9002 - Quality Systems Model for Quality Assurance in Production, Installation and Servicing
- 104.6 NACE:
  - a. SP0100 - Cathodic Protection to Control External Corrosion of Concrete Pressure Lines and Mortar-Coated Steel Pipelines for Water or Waste Water Service
  - b. SP0169 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
  - c. SP0177 - Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
  - d. SP0407 - Format, Content, and Guidelines for Developing a Materials Selection Diagram
  - e. RP0193 - External Cathodic Protection of On-Grade Carbon Steel Storage Tank Bottoms
  - f. RP0285 - Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
- 104.7 NECA - National Electrical Contractor Association
  - a. NECA 1 Standard Practices for Good Workmanship in Electrical Construction
- 104.8 NFPA 70 - National Fire Protection Association
  - a. NEC - National Electrical Code
- 104.9 OSHA - Occupational Safety and Health Act of 1970
- 105. SUBMITTALS
- 105.1 Submit documents for review in accordance with Section 013323. The documents required include but are not limited to the following:
  - a. Design Drawings:
    - a1. Equipment layout and arrangement drawings of the overall system.
    - a2. Interface drawings showing the number and amperage of required power sources.
    - a3. Installation drawings.
    - a4. Internal and external wiring drawings.
    - a5. Electrical identification schedule (nameplate lists) including list of wording, symbols, letter size, color coding, tag number, location, and function.





- b. Lists and Data:
  - b1. Catalog Data: Submit catalog data describing the supplied equipment and parts supplied. Include equipment ratings and other data substantiating that materials comply with specified requirements.
  - b2. Part lists shall be complete in every respect with parts identified by the original manufacturer's part number as well as by Contractor's identification number.
  - b3. Spare parts lists' and list of recommended spare parts to be stocked by Owner for a minimum period of eighteen (18) months after acceptance of the Work.
  - b4. Component setpoint lists and calculations.
  - b5. Final complete list of test stations as installed.
- c. Procedures:
  - c1. Procedures for Storage, Handling, and Surface Preparation.
  - c2. Equipment Production Test Procedures.
  - c3. Equipment Performance Test Procedures.
  - c4. Surveillance/Inspection Procedures.
  - c5. Field Test Procedure.

## **PART 2 - PRODUCTS**

- 201. GENERAL
- 201.1 Anodes:
  - a. Galvanic anodes shall be selected appropriately for their application and environment (i.e high silicon cast iron, graphite, mixed metal oxide, etc. for piping systems, precious metal for condenser water boxes, etc.)
- 201.2 Cable:
  - a. All cable used to interconnect anodes, rectifiers, and protected surfaces shall be Type CP with high molecular weight polyethylene (HMWPE) or high density polyethylene insulation rated 600 volts or equal suitable for this installation.
  - b. Minimum size for anode leads shall be #8 AWG and shall have corrosion resistant and waterproof connections. Minimum size for cathodic protection header cable shall be #2 AWG.
  - c. Underground marking tape (2 inches wide) shall be installed twelve (12) inches above and run parallel to buried cathodic protection cable. Marking tape shall read: "CAUTION: BURIED CATHODIC PROTECTION CABLE."
- 201.3 Bonding/Connections:



- a. All anode leads shall have corrosion resistant and water proof connections.
- b. Splices used to connect cathodic protection header cables to anodes and protected structures shall be exothermically welded.
- c. All joints shall be insulated with materials and methods that will equal the dielectric strength of the original cable insulation.
- d. Materials used to repair pipe coating at the pipe lead or joint bond shall be the same as originally used to coat the pipe.

201.4 Test Stations:

- a. Test stations shall be suitable for outdoor installation and weatherproof, Big Fink®, Testox 715, or approved equal.
- b. Test stations shall have a five (5) or eight (8) terminal board and be accessible from both sides when the cover is removed. Terminals shall be nickel plated copper or brass.
- c. Test stations shall be located at each anode bed for buried pipe for measurement of anode current and pipe-to-soil potential.
- d. A test station shall be located at each tank for measurement of anode current and tank bottom-to-soil potential at the center of the tank and the tank periphery.

201.5 Reference Half-Cells:

- a. Permanent reference half-cells shall be installed as required and appropriate for their environment. Reference half-cell extension cabling shall be routed and terminated at the test station.

201.6 Junction Boxes, Shunt Boxes and Bond Boxes:

- a. All junction box, shunt box and bond box enclosures shall be rated NEMA 4X furnished with knockouts and be installed above ground for easy accessibility.

202. PAINTING AND CORROSION PROTECTION OF EQUIPMENT

- 202.1 Painting and corrosion protection of equipment shall be in accordance with the Contractor's standard practice. Finish paint color for exterior surfaces shall be ANSI 70 gray for outdoor location or ANSI 61 for indoor location.

**PART 3 - EXECUTION**

301. INSTALLATION

- 301.1 Contractor shall perform all required installation and related activities as defined in Section 011100 of this specification. For component locations and installation requirements, see the attached Electrical Installation and Electrical Notes and Detail Drawings.
- 301.2 Examination:



- a. Examine surfaces and conditions for compliance with installation tolerances and other conditions affecting performance of the system. Do not proceed with installation until unsatisfactory conditions have been corrected.
- 301.3 Anode Beds:
- a. Contractor shall determine the type, location, spacing, depth, etc. of the anode beds.
  - b. Additional backfill material if required shall be uniformly distributed, compacted, and moistened.
  - c. Where it is undesirable, detrimental, or uneconomical to install anode beds adjacent to underground pipe or to adequately protect numerous underground metallic pipes over a large area, a deep well anode bed shall be located and drilled to meet the protection requirements for underground pipe. A vent pipe shall be routed to a point to safely vent chlorine gas produced by the anode. A guardrail shall be installed to prevent vehicle damage to the wellhead, vent pipe, and electrical connections.
- 301.4 Cable and Splices:
- a. All cathodic protection cables shall be installed a minimum of three (3) feet below grade with a minimum of one (1) foot slack to allow for pipe movement.
  - b. Splice connections shall be sealed and made watertight.
  - c. Restore pipe protective coating after installation of exothermic connections.
- 301.5 Exothermic Connections:
- a. Exothermic connections which pull apart or break loose from pipe when the cable(s) are pulled, struck with a moderate hammer blow, look porous or deformed shall be rejected.
  - b. Connections shall not be buried until the connection has been inspected and covered with the manufacturer's recommended covering.
- 301.6 Pipe Coating:
- a. Contractor shall be responsible that all specified pipe coatings are applied properly, remains undamaged or are repaired as specified to provide a complete and effective corrosion protection system. The Contractor shall use a holiday detector to verify that repaired coating will perform as originally designed prior to backfilling piping.
- 301.7 Test Stations:
- a. Install post type test stations as close as possible to directly above the protected pipeline. If is unsuitable due to vehicular traffic, then an alternative location nearby which provides protection such as behind a pole, tree or other structure is recommended. A ground level traffic box with a cast iron lid marked "CP" may also be used in high traffic areas.
- 301.8 Reference Half-Cells:



- a. Underground reference half-cells shall be stored in a clean, dry environment (above 40 °F) until activation and installation. The reference half-cells shall be installed in moist soil below the frost line and covered with no less than six (6) inches of clean fill free from rocks or other solid objects which may damage the half-cell. The reference half-cells shall be tested according to manufacturer's instructions for proper operation before burial.

302. ADJUSTING AND CLEANING

- 302.1 The cathodic protection system shall be checked to determine if adequate protection is available to the pipes/structures to be protected.
- 302.2 Structure-to-soil potentials shall be measured after the cathodic protection system is placed in-service to verify that adequate potentials (referenced to the appropriate half-cell) exist at all protected surfaces.
- 302.3 The cathodic protection system shall be designed and installed to prevent or minimize the effects of stray current corrosion to surrounding buried pipe or other metallic structures.
- 302.4 The current-off polarization potential shall be measured for all protected underground pipes to determine if hydrogen over-voltage potential may exist which may damage pipe protective coatings.
- 302.5 The structure-to-soil potential of the surrounding structures shall be measured before and after the cathodic protection system is placed in-service to verify that these structures have not been made anodic by the galvanic anode system as a result of construction error or other cause.
- 302.6 Contractor to test installed cathodic protection system to prove effectiveness.

END OF SECTION 264200



## **SECTION 311010**

### **TEMPORARY SEDIMENT CONTROL DURING CONSTRUCTION**

#### **PART 1 - GENERAL**

##### 101. EXTENT

- 101.1 This Specification Section defines the material and installation requirements for temporary sediment control during construction.
- 101.2 The Work shall include, but not be limited to, the following items:
- a. Furnishing all materials.
  - b. Installation of self-supporting silt fence.
  - c. Cleaning and maintenance of silt fence.
  - d. Installation of straw bale check dams or straw bale barriers.
  - e. Cleaning and maintenance of straw bale check dams or straw bale barriers.
  - f. Final cleanup and removal of all temporary facilities.
- 101.3 Requirements for Sediment Control:
- a. The Contractor shall be responsible for control of sediment during construction.
  - b. Temporary sediment control facilities shall be installed where specified on the design drawings and elsewhere where instructed by Owner.
  - c. The Contractor shall be responsible for modifying the sediment control plan as required for the varying construction activities and in conformance with federal, state, and local regulations.
  - d. State permit requires weekly inspection of sediment control. Contractor to provide weekly inspection with completed form to Owner for approval.

##### 102. REFERENCE DOCUMENTS

- 102.1 Standards, Specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.
- 102.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.
- 102.3 Abbreviations listed indicate the form used to identify the reference documents in the Specification text.
- 102.4 ASTM - ASTM International:



- a. A702 - Specification for Steel Fence Posts and Assemblies, Hot Wrought.
  - b. D4355 - Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
  - c. D4491 - Test Methods for Water Permeability of Geotextiles by Permittivity.
  - d. D4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - e. D4751 - Test Method for Determining Apparent Opening Size of a Geotextile.
- 102.5 FHWA - Federal Highway Administration:
- a. FHWA - Geosynthetic Design and Construction Guidelines – Report No. FHWA-HI-95-038.
- 102.6 AASHTO - American Association of State Highway and Transportation Officials:
- a. M111 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - b. M281 - Standard Specification for Steel Fence Posts and Assemblies, Hot-Wrought.
  - c. M288 - Standard Specification for Geotextile Specification for Highway Applications.
103. SUBMITTALS
- 103.1 Contractor shall submit the following drawings and data listed below. Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into Owner's information systems specified by Owner.
- 103.2 Data shall be submitted a minimum of thirty (30) days prior to installation.
- 103.3 Material Certificate Signed by the Manufacturer of Silt Fencing Stating:
- a. Name of manufacturer.
  - b. Chemical composition of filaments or yarns used for the geotextile.
  - c. Specification sheet describing the geotextile.
  - d. Other information required to fully describe the product.
  - e. Guarantee stating that the furnished geotextile meets the requirements of this Specification.
- 103.4 Material Certificate Signed by the Manufacturer of Prefabricated Silt Fences Stating:
- a. Manufacturer's catalog data.
  - b. Manufacturer's installation instructions.
  - c. Manufacturer's preventive maintenance instructions.
  - d. Manufacturer's inspection instructions.



104. QUALITY ASSURANCE

104.1 Materials and construction procedures shall be subject to inspection and testing by Owner. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and installation in compliance with specified requirements.

104.2 Contractor shall give Owner reasonable notice of starting new Work. Work shall not be performed outside the agreed regular working hours without prior approval of Owner.

**PART 2 - PRODUCTS**

201. MATERIALS FOR GEOTEXTILE SILT FENCES

201.1 Classifications:

- a. The geotextile silt fence specified herein is intended for temporary use for sediment control. It is classified by both AASHTO M288 and FHWA as "Self-supporting" Silt fence.

201.2 Geotextile:

- a. The geotextile shall be a woven UV stabilized material specifically designed and manufactured for use in temporary sediment control. Fibers used in the manufacture of geotextiles and the threads used in joining geotextiles by sewing shall consist of long-chain synthetic polymers, composed of at least 85% by weight polyolefins, polyesters, or polyamides. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including selvages. The geotextile shall be free of any treatment or coating which might adversely alter its physical properties after installation.

- b. The geotextile shall conform to the requirements shown in Table 1.

The geotextile manufacturer shall be responsible for establishing and maintaining a quality control program to assure compliance with the requirements of this Specification.

<b>TABLE 1</b>		
<b>PHYSICAL REQUIREMENTS FOR GEOTEXTILE FOR USE IN SILT FENCES</b>		
PROPERTY	ASTM TEST	REQUIREMENT
Grab Strength (lbs)	D4632	90 Minimum
Elongation (%) at Failure	D4632	50% Maximum at 45 lbs.
Apparent Opening Size (mm)	D4751	0.60 Maximum
Permittivity (1/sec)	D4491	0.05
UV Stability at 500 Hours (%)	D4355	70% Minimum

202. ACCEPTABLE SILT FENCE PRODUCTS

202.1 Self-Supporting Geotextile Fence Materials:



- a. The following self-supporting geotextile fence materials meet the requirements of this Specification and are acceptable for use:
  - a1. Typar 3301 – Woven Slit-Film Polypropylene.
  - a2. Thrace-Linq GTF-180SF – Woven Slit-Film Polypropylene.
  - a3. Carthage Mills FX – Woven Slit-Film Polypropylene.
  - a4. Propex, Inc. Geotex 2130 – Woven Slit-Film Polypropylene.
  - a5. Others as approved by Owner.
- 202.2 Manufacturers:
  - a. BBA Fiberweb (Typar), Old Hickory, TN.
  - b. Thrace-Linq, Inc., Summerville, SC.
  - c. Propex, Inc., Chattanooga, TN.
  - d. Carthage Mills, Cincinnati, OH.
- 202.3 Packing, Identification Requirements and Storage:
  - a. Deliver geotextile to the Project Site in rolls each wrapped securely with a heavy duty protective covering. Covering shall bar the entrance of water, vermin and dirt, and shall be adequate for protection against ultraviolet exposure.
  - b. Attach or adhere a tag identifying the following:
    - b1. Manufacturer and product name, number.
    - b2. Date of manufacture of geotextile.
    - b3. Roll identification number.
    - b4. Contractor's order number (matching Bill of Lading).
  - c. Verify that manufacturer includes a label on the inside of the roll core specifying/indicating manufacturer, product name, and roll identification number.
  - d. During periods of shipment and storage, the fabric shall be protected from temperatures greater than 140°F. To the extent possible, the fabric shall be maintained wrapped in the protective covering until ready for use.
  - e. Stakes shall be packaged separately from geotextiles.





### **PART 3 - EXECUTION**

#### **301. INSTALLATION REQUIREMENTS**

##### **301.1 Geotextile Silt Fence:**

- a. The following are guidelines for the location of silt fences when specific locations are not specified on the design drawings:
  - a1. No further than ten (10) feet from the toe of slopes or the end of large graded areas.
  - a2. On natural ground just uphill of cut slopes.
  - a3. On the upstream edge of the bank of a natural drainage course traversing the property.
  - a4. Adjacent to each side of offsite pipeline excavations.
  - a5. Alongside of ditches during construction of permanent erosion control surfacing.

##### **301.2 Silt Fence Construction:**

- a. Staple the geotextile to wooden posts with steel staples on six inch (6") maximum centers. There shall be a minimum of five (5) staples per post. Tie the geotextile to steel posts at the top and middle of the fabric.
- b. The fabric shall be spliced together only at a support post with a minimum six inch (6") overlap and both sides securely fastened to the post.
- c. Construct silt fences with a setback of at least three (3) feet from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and difficult to maintain.
- d. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case shall the reach exceed 500 ft.

##### **301.3 Silt Fence Maintenance:**

- a. After installation, the Contractor shall be responsible for satisfactorily maintaining the silt fence until it is no longer required.
- b. The Contractor shall inspect the silt fence prior to forecast rain, daily during extended rain events, after every rainfall, weekly during the rainy season, and at two (2)-week intervals during the non-rainy season.
- c. The Contractor shall be responsible for replacing portions of the silt fence that tear, start to decompose, or in any way become ineffective.
- d. Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally five (5) to eight (8) months.
- e. Silt fences that are damaged and become unsuitable for the intended purpose shall be removed from the site of work, disposed of, and replaced with new silt fence barriers.



- f. The Contractor shall remove sediment deposits when the deposits reach one-third the height of the silt fence or when heavy runoff or high water is expected. When removing sediment deposits, care shall be taken not to tear the fabric or to dig up the bottom of the geotextile and disturb the anchorage.
- g. Silt fences shall be left in place until the upstream area is permanently stabilized. Until then, the silt fence must be inspected and maintained.
- h. Holes, depressions, or other ground disturbance caused by the removal of the silt fences shall be backfilled and repaired.

301.4 Removal of Silt Fencing:

- a. The Contractor shall be responsible for removal of silt fences when they are no longer needed and for proper disposal of fencing materials.
- b. Silt fences shall not be removed until adequate vegetative growth or other means of erosion protection ensures no additional erosion of the contributing drainage area.
- c. Sediment deposits remaining in place after the silt fence is removed shall be graded to conform to the existing terrain and the area covered with topsoil and seeded or otherwise stabilized.

302. STRAW BALE CHECK DAMS AND BARRIERS

302.1 The following are guidelines for the location of check dams when specific locations are not specified on the design drawings:

- a. Toe of Slope: Bales laid end to end about six (6) feet downhill of the toe of a slope. Straw bale dikes may be used in place of a silt fence at that location.
- b. Erosion Check around Catch Basin: Bales placed in a square or octagonal pattern around a catch basin inlet. Inside face of bale is placed three (3) feet to six (6) feet from the basin inlet.
- c. Swale Check: Two (2) bales shall be placed end-to-end across the swale at 50-foot intervals.
- d. Ditch Check: Three (3) to five (5) bales shall be placed end-to-end at 50 to 100 foot intervals in ditches with intermittent runoff. Ditch checks shall not be used on continuously flowing streams.

302.2 Straw Bale Check Dam Maintenance:

- a. After construction, the Contractor shall be responsible for satisfactorily maintaining straw bale dikes until they are no longer required.
- b. Inspect straw bales prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two (2)-week intervals during the non-rainy season.
- c. Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.



- d. Replace or repair damaged bales as needed.
- e. Repair washouts or other damages as needed.
- f. Sediment that accumulates in the straw bales must be periodically removed in order to maintain effectiveness of the straw bales. Sediment shall be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site if approved by Owner or disposed at an appropriate location.

302.3 Removal of Straw Bales:

- a. The Contractor shall be responsible for removal of straw bales when no longer needed and for proper disposal of the bales.
- b. Bales shall not be removed until the contributing drainage area has been stabilized.
- c. Sediment deposits remaining in place after bales are removed shall be graded to conform to the existing terrain or ditch invert level and then stabilized using permanent stabilization techniques.

END OF SECTION 311010



**SECTION 311521**  
**NON-WOVEN GEOTEXTILES**

**PART 1 - GENERAL**

101. EXTENT

101.1 This Specification Section defines the minimum requirements for the material and installation of non-woven geotextiles in accordance with the design drawings and as specified herein for the following uses:

- a. Geotextile soil separator between soil and aggregate base for asphalt concrete pavements.
- b. Geotextile soil separator between soil and crushed stone road surfacing and area surfacing.
- c. Geotextile bedding for riprap.

101.2 The Work shall include, but not be limited to, the following items:

- a. Furnishing all materials.
- b. Handling and storage.
- c. Preparation of bearing areas as necessary.
- d. Placement, splicing and anchorage.
- e. Repair of holes or tears.
- f. Cleanup.

102. REFERENCE DOCUMENTS

102.1 Standards, Specifications, manuals, codes and other publications of nationally recognized organizations and association are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.

102.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.

102.3 Abbreviations listed indicate the form used to identify the reference documents in the Specification text.

102.4 ASTM - ASTM International:

- a. D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.



- b. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - c. D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
  - d. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  - e. D 4716 - Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - f. D 4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.
  - g. D 4873 - Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples.
  - h. D 4884 - Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
  - i. D 5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
  - j. D 6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50mm Probe.
- 102.5 FHWA - Federal Highway Administration:
- a. Report No. FHWA HI-95-038 - Geosynthetic Design and Construction Guidelines.
- 102.6 IFAI - Industrial Fabrics Association International.
- a. Field Sewing of Geotextiles by V. Diaz and B. Myles, 1989.
103. SUBMITTALS
- 103.1 Contractor shall submit drawings and data as indicated below at least 30 days prior to use. Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into Owner's information systems specified by Owner.
- 103.2 Contractor shall submit the following data:
- a. Manufacturer's literature providing Specifications on the geotextile(s) that will be supplied.
  - b. Manufacturer's certification that geotextile(s) to be supplied comply with the requirements of this technical Specification.
  - c. Manufacturer's Quality Control (MQC) and Construction Quality Control Plans. The MQC plan shall state the frequency that index tests are performed on the geotextile during manufacturing.
  - d. If requested by Owner, four samples of each geotextile suitable for testing.
- 103.3 Contractor shall submit proposed method of underwater installation, if applicable, for Owner review and acceptance.



104. QUALITY ASSURANCE

- 104.1 Materials and construction procedures shall be subject to inspection and testing by an Independent Testing Service employed by the Owner. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and installation in compliance with specified requirements.
- 104.2 Contractor shall give Owner reasonable notice of starting new Work. Work shall not be done outside the agreed regular working hours without prior written approval by Owner.
- 104.3 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance to the specifications.

**PART 2 - PRODUCTS**

201. ACCEPTABLE MANUFACTURERS

- 201.1 Products of the following manufacturers meet the requirements of this section:
- a. US Fabrics, Inc., 3904 Virginia Ave., Cincinnati, OH 45227.  
(Products: US205NW – 8oz/SY, US250NW – 10oz/SY, US300NW – 12oz/SY, US160NW – 6oz/SY)
  - b. Carthage Mills, 4243 Hunt Road, Cincinnati, OH 45242.  
(Products: FX-60HS – 6oz/SY, FX-80HS – 8oz/SY, FX100HS – 10oz/SY, FX-120HS – 12oz/SY)
  - c. Mirafi (TenCate Geosynthetics), 365 S. Holland Dr., Pendergrass, GA 30567.  
(Products: S600 – 6oz/SY, S800 – 8oz/SY, S1000 – 10oz/SY, S1200 – 12oz/SY, S1600 – 16oz/SY, S2000 – 20oz/SY)
  - d. Propex Operating Company, LLC, 6025 Lee Highway, Chattanooga, TN 37422.  
(Products: GEOTEX 601 – 6oz/SY, GEOTEX 801 – 8oz/SY, GEOTEX 1001 – 10oz/SY, GEOTEX 1201 – 10oz/SY)
  - e. Thrace-Linq Inc., 2550 W. 5<sup>th</sup> North St., Summerville, SC 29483.  
(Products: 150EX – 6oz/SY, 180EX – 8oz/SY, 245EX – 10oz/SY, 275EX – 12oz/SY)
  - f. Others as approved by Owner.

202. GEOTEXTILE MATERIALS

- 202.1 Geotextiles shall be non-woven, spun bonded fabric manufactured from long chain polymeric filaments, yarns, staple fibers, or other structural components of polyester or polypropylene formed into a stable network (mesh).
- 202.2 The geotextile shall be colored (non-white) or otherwise treated to prevent the occurrence of snow blindness of handling personnel.



- 202.3 Geotextiles used for soil separators, or for protection for a geomembrane, shall meet the requirements of Table 1, as a minimum. The nominal weight of the geotextile to be used for each installation shall be identified on the design drawings.
203. **ANCHORING PINS**
- 203.1 Pin used for securely anchoring geotextile in place shall be 3/16-inch diameter, eighteen (18) inches long steel pin. Each pin shall be pointed at one end and filled with a 1.5 inch diameter washer at the other end for securing the geotextile fabric in place.

**TABLE 1**  
**GEOTEXTILE INDEX TEST MINIMUM REQUIREMENTS FOR SOIL SEPARATOR**  
**BENEATH PAVEMENT AND RIPRAP BEDDING**  
**NON-WOVEN GEOTEXTILE**

Property	ASTM Test	Minimum Average Roll Value (MARV)		
- Nominal Weight – oz/sq. yd. <sup>(1)</sup>	–	6.0	8.0	10.0
- Mass Per Unit Area – oz/sq. yd. (g/m <sup>2</sup> ) <sup>(1)</sup>	D 5261	6 (203)	8.0 (271)	10.0 (339)
- Apparent Opening Size (AOS) – US Standard Sieve No. (size - mm)	D 4751	70 (0.212)	80 (0.180)	100 (0.150)
- Grab Tensile Strength – lbs (kN)	D 4632	160 (0.710)	200 (0.900)	250 (1.112)
- Elongation at Failure – %	D 4632	50	50	50
- CBR Puncture – lbs (N)	D 6241	433 (1926)	535 (2380)	700 (3114)
- Trapezoidal Tear Strength – lbs (kN)	D 4533	60 (0.270)	80 (0.360)	100 (0.445)
- Permittivity – Sec <sup>-1</sup>	D 4491	1.5	1.5	1.2
- UV Resistance Percent Retained at 500 Hours of Exposure	D 4355	70	70	70

**Note:**

(1) A geotextile shall not be chosen by mass per unit area criteria. The chosen geotextile shall meet all other criteria.

204. **PACKAGING AND IDENTIFICATION REQUIREMENTS**

204.1 Packaging:

- a. Deliver geotextiles to the project site in rolls each wrapped securely with a protective covering installed at the manufacturing facility. The covering shall prevent the entrance of water, vermin, and dirt, and shall be adequate for protection against ultraviolet exposure.



- b. The packaging shall not interfere with handling of the rolls either by slings or by using the central core upon which the geotextile is wound.
- 204.2 Protective Cover: Attach or adhere a tag to the protective cover identifying the following:
- a. Manufacturer and product name/number.
  - b. Date of manufacture of geotextile.
  - c. Roll identification number.
  - d. Contractor's order number (matching Bill of Lading).
  - e. Mass per unit area of geotextile.
  - f. Width, length, and square yard area of the roll.
- 204.3 Labeling:
- a. Manufacturer shall include a label on the inside of the roll core specifying/indicating manufacturer, product name, and roll identification number.
  - b. Details of labeling rolls shall comply with ASTM D4873.

### **PART 3 - EXECUTION**

#### **301. ACCEPTANCE AND STORAGE AT THE PROJECT SITE**

##### **301.1 Handling of Rolls:**

- a. The method of off-loading the geotextiles at the project site shall not cause any damage to the geotextile, its core, nor its protective covering.
- b. Any protective covering that is accidentally damaged or stripped off of a roll shall be immediately repaired or the roll shall be moved to an enclosed facility until the repair can be made.

##### **301.2 Storage at the Project Site:**

- a. Owner will provide on-site storage space in a location near where the geotextile will be placed such that on-site transportation and handling are minimized. The Contractor shall be responsible for protecting the stored material from theft and vandalism.
- b. Rolls of geotextile shall be stored in such a manner that cores are not crushed, the geotextile not damaged, and as required to provide protection from exposure to ultraviolet light, inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious condition.

##### **301.3 Inspection upon Delivery:**

- a. Upon delivery of the materials to the Project site, the Contractor shall conduct a visual inspection of all rolls of geotextile for damage or defects. This inspection shall be done without unrolling any rolls unless damage to the inside of a roll is found or suspected.





- b. Any damage or defects shall be noted and immediately reported to Owner, the Manufacturer and the carrier that transported the material. Any roll, or portion thereof, which, in the judgment of Owner, is seriously damaged, shall be removed from the project site and replaced with complying material at no additional cost to Owner.

302. GENERAL PLACEMENT REQUIREMENTS

- 302.1 The Contractor shall not remove the protective covering from the geotextile rolls to be deployed until immediately prior to deployment to ensure that geotextiles are not excessively exposed to ultraviolet degradation.
- 302.2 During handling, the geotextiles shall be handled in such a manner that the material is not damaged in any way. Damaged material shall not be used.
- 302.3 All necessary precautions shall be taken to prevent damage to the subsoil or underlying layers upon which the geotextile is to be placed. For subsoil layer, construction equipment can be used provided that excess rutting is not created. The maximum allowable rut depth is one inch.
- 302.4 On slopes, the geotextile shall be securely anchored at the top and then rolled down the slope in such a manner as to continually keep the geotextile sheet in tension and keep the geotextile free of wrinkles and folds.
- 302.5 All deployed geotextile shall be weighted with sandbags, old tires, or the equivalent to provide resistance to wind uplift. Such weights shall be installed during deployment and shall remain until replaced with cover material. Uplifted material can be reused only if approved by Owner.
- 302.6 Geotextiles shall only be cut using an upward cutting hook blade. If geotextiles are cut in place, special care shall be taken to protect other geosynthetics from damage which could be caused by cutting the geotextiles.
- 302.7 During placement of geotextiles, care shall be taken not to entrap, in or beneath the geotextile, stones, excessive dust, or moisture that could damage the geomembrane or cause clogging of drains or filters, or hamper subsequent splicing.
- 302.8 Unused portions of rolls or cut sections shall be protected from the elements by recovering with the protective covering. Geotextiles exposed to the elements for more than 14 days shall be removed from the Project Site.

303. INSTALLATION OF GEOTEXTILE SOIL SEPARATOR BENEATH PAVEMENT

- 303.1 Preparation of Bearing Area:
  - a. Immediately prior to placing geotextile, inspect bearing area and correct unacceptable conditions, i.e., debris, loose earth, protruding or loose stones or rocks, dips, or soft spots.
  - b. Retest for compaction densities if more than two (2) days elapse after acceptance of the bearing area or if rain has occurred.
- 303.2 Type and Placement of Geotextile:



- a. Weight of Geotextile: Refer to design drawings for weight of geotextile to be used for each installation.
- b. Material of Geotextile: Refer to design drawings for material of geotextile to be used for installation. If no material is specified, then both polyester and polypropylene are acceptable.
- c. Install Geotextile Soil Separator in accordance with Manufacturer's printed and reviewed recommendations, and as directed by Owner.
- d. Do not place more geotextile than can be covered on the same day as placed. Until completion of the total installation, a strip twenty-four (24) inches wide shall be left uncovered to allow for splicing on the next working day.
- e. Unused portions of rolls or cut sections shall be protected from the elements by recovering with the protective covering. Geotextiles exposed to the elements for more than fourteen (14) days shall be removed from the Project Site.

303.3 Splicing of Geotextiles:

- a. Geotextile shall be spliced by overlapping, sealing, or sewing: however, the same splicing technique shall be used throughout.
- b. If overlapping is used, the minimum overlap distance in both the transverse and longitudinal direction shall be twelve (12) inches beneath the roads.
- c. Sewn or sealed seam splices shall be acceptable if the overlap in the transverse and longitudinal directions is a minimum of 6 inches, and the seam grab tensile strength is equal to the value specified in Table 1 or Table 2.
- d. Contractor shall patch small rips, tears or holes in the geotextile soil separator as allowed by Owner. The patch shall be placed over the damaged area and overlap the edges of the damaged area not less than twelve (12) inches all around for road pavement areas.

303.4 Placement of Base Course Aggregate Under Roads:

- a. Road base course placement shall be done within twenty-four (24) hours of geotextile placement. The time period may be increased, if required, in accordance with the manufacturer's recommendations.
- b. The overlying material shall be deployed in such a manner that excess tensile stress is not placed on the geotextile.
- c. The placement of the base course shall be done in such a manner that the geotextile is not shifted from its intended position and underlying materials are not exposed or damaged.

304. INSTALLATION OF GEOTEXTILE FOR RIPRAP BEDDING

304.1 Preparation of Bearing Surface:

- a. Compact, trim, and dress the slope, ditch cross section, shoreline, or other surface to receive riprap.



- b. Immediately prior to placing geotextile, inspect bearing area and correct unacceptable conditions, i.e., debris, loose earth, protruding or loose stones or rocks, dips, or soft spots.
- c. Obtain Owner's acceptance of bearing surface before placing geotextile.

304.2 Type and Placement of Geotextile:

- a. Type of Geotextile: Refer to design drawings for the weight of geotextile to be used beneath each class of riprap.
- b. Material of Geotextile: Refer to design drawings for material of geotextile to be used for installation. If no material is specified, then both polyester and polypropylene are acceptable.
- c. The terminal ends of geotextile placed on a slope shall be anchored in trenches or aprons at the crest and toe of a slope. On slopes 3H: 1V or flatter, anchoring pins (spacing provided in Table 3) may be used in place of trenches or aprons to anchor the terminal ends of the geotextile.
- d. Geotextile installed on a slope steeper than 3H: 1V shall be secured using anchoring pins except for certain types of ponds where geotextile is used as a protective cover for geomembrane. The pin spacing shall be as follows:

**TABLE 3**  
**ANCHORING PIN SPACING**

Slope	Pin Spacing in All Directions (Feet)
3H:1V or steeper	2
3H:1V to 4H:1V	3
4H:1V	5
Greater than 4H:1V	6

304.3 Splicing of Geotextile:

- a. The geotextile shall be spliced by either sewing or overlapping. All splices shall be subject to the written approval of Owner.
- b. If splicing by overlapping is used, adjacent rolls of geotextile shall be shingle overlapped a minimum of twelve (12) inches in the downslope or downstream direction. If placed underwater, the overlap shall be a minimum of three (3) feet.
- c. Small rips, tears, or holes in the geotextile shall be patched by the Contractor. The patch shall be placed over the damaged area and extend a minimum of three (3) feet beyond the perimeter of the hole, tear, or damage. Patches shall be secured with metal pins.



- d. Sewn splices shall be acceptable if the overlap is a minimum of six (6) inches and the seam grab tensile strength is equal to the minimum value specified in Table 1.
- e. Do not place more geotextile than can be covered with riprap on the same day as placed. Until completion of the total installation, a strip twenty-four (24) inches wide shall be left uncovered to allow for splicing on the next working day.

304.4 Backfill or Covering:

- a. Soil cover or riprap placement shall be done within twenty-four (24) hours of placing geotextile.
- b. The overlying material shall be deployed in such a manner that excess tensile stress is not placed on the geotextile.
- c. If an aggregate bedding layer is to cover the geotextiles, the placement of the aggregate bedding shall be done in such a manner that the geotextile is not shifted from its intended position and underlying materials are not exposed or damaged. On side slopes, this requires aggregate bedding backfill to proceed from the bottom of the slope upward.
- d. Riprap shall be placed as specified in the design drawings.

END OF SECTION 311521



**SECTION 312316**

**EXCAVATION AND BACKFILL FOR FOUNDATIONS**

**PART 1 - GENERAL**

101. **EXTENT**

This Specification Section defines the requirements of Excavation and Backfill for Concrete Foundations.

101.1 The Work shall include, but not be limited to, the following items:

- a. General excavation requirements
- b. Earth excavation.
- c. Dewatering.
- d. Disposal of excavated materials.
- e. Preparation of bearing areas.
- f. Placement of general backfill.
- g. Placement of structural backfill.

101.2 Construction Surveying:

- a. The Contractor shall lay out lines and grades and shall be fully responsible for the correctness of such lines and grades and for proper execution of Work.
- b. Owner reserves the right to verify correctness of lines and grades during progress of the Work. Such verification by Owner will not relieve Contractor of responsibility as herein specified.
- c. The Contractor shall notify Owner of any difference in location of existing construction or conditions from those indicated wherever such difference may affect its Work.
- d. The Contractor shall preserve and maintain benchmarks and reference points established for the project. Should the Contractor, during prosecution of the Work, destroy or remove any benchmark or reference point, the benchmark or reference point shall be reestablished at no cost to Owner.



102. REFERENCE DOCUMENTS

- 102.1 Standards, Specifications, manuals, codes, and other publications of nationally recognized organizations are referenced herein. References to these documents are to the issue date as indicated by the Florida Building Code. If the document is not referenced in the Florida Building Code, then the reference is to the latest issue date of the document together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of the Contract for the Work.
- 102.2 Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.
- 102.3 Abbreviations listed below refer to the applicable organizations or documents.
- 102.4 ASTM - ASTM International:
- a. D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56000 ft-lbf/ft<sup>3</sup> (2700 kN-m/m<sup>3</sup>)).
  - b. D2487 –Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
  - c. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
  - d. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- 102.5 OSHA - Occupational Safety and Health Administration:
- Code of Federal Regulations (CFR), Title 29 – Labor, Subtitle B – Regulations Relating to Labor, Chapter XVII, Occupational Safety and Health Administration, Department of Labor, Part 1926 – Safety and Health Regulations for Construction, Subpart P, Excavations.

103. SUBMITTALS

- 103.1 See Section 013324, List of Submittals, for material testing and submittal requirements.

104. QUALITY ASSURANCE

- 104.1 Construction Quality Assurance:
- a. The Contractor shall examine the areas and conditions under which foundation excavation is to be performed and notify Owner, in writing, of conditions detrimental to the proper and timely completion of the Work.
  - b. Materials and construction procedures shall be subject to inspection and tests conducted by an independent Testing Service hired by Contractor and approved, in writing, by the Owner. Such inspections and tests will not relieve the Contractor of the responsibility for providing materials and placing procedures in compliance with specified requirements.
  - c. Contractor shall give Owner reasonable written notice of starting new Work. Work shall not be done outside the agreed regular working hours without prior written approval of Owner.



- d. The Contractor shall correct deficiencies in excavations or backfill which inspections or laboratory test reports have indicated to be not in compliance with specified requirements. The Testing Inspector shall perform additional tests at the Contractor's expense as may be necessary to reconfirm any noncompliance of the original Work, and as may be necessary to show compliance of corrected Work.
  - e. Errors or flaws in the Work which are identified during construction, and which prevent the proper installation of the Work shall be promptly corrected. The Contractor shall make immediate substitution of the noncomplying materials or shall make field changes to make the noncomplying materials acceptable.
- 104.2 Inspections and Tests:
- a. The Testing Service shall perform the following tests for both Class GF (General Fill) and Class SF (Structural Fill) materials:
    - a1. Suitability of material prior to and during use.
    - a2. Compaction curve and optimum moisture content of each material to be used.
    - a3. Field testing to assure compliance by the Contractor with moisture and density requirements specified herein or indicated on the design drawings.
  - b. The Contractor shall supply to the Testing Inspector adequate quantities of proposed material for test purposes. This material shall be from the same sources as are proposed to obtain material to be used for the Work. Submittal and approval shall be completed before materials are used.
  - c. The Contractor shall allow the Owner and the Testing Inspector access to areas where Work is being performed, off-site material sources for inspections, and shall provide such cooperation as is required for the proper inspection and testing of fieldwork.

## **PART 2 – PRODUCTS**

### 201. BACKFILL MATERIALS

- 201.1 Materials to be used for backfill are divided into two (2) classes, two (2) groups and four (4) types as specified herein. The areas of use of this material shall be as indicated on the design drawings. Material Classifications:
- a. Use Classes:
    - a1. Class GF - General Fill.
    - a2. Class SF - Structural Fill.
  - b. Material Groups:
    - b1. Group G - Granular materials are soils which are classified as coarse-grained soils in the Unified Soil Classification System, ASTM D2487.
    - b2. Group C - Cohesive materials are soils which are classified as fine-grained soils in the Unified Soil Classification System, ASTM D2487.



- c. Fill Types:
  - c1. Type GFG - Class GF, Group G.
  - c2. Type GFC - Class GF, Group C.
  - c3. Type SFG - Class SF, Group G.
  - c4. Type SFC - Class SF, Group C.
- 201.2 Satisfactory Materials for Backfill:
  - a. Granular Materials:
    - a1. Granular materials are satisfactory for use if they contain no more than 1 percent (1%) organic or deleterious material, are free of excess moisture and have a maximum particle size of two (2) inches (50 mm). Granular materials are soils, which are classified as coarse-grained soils in the Unified Soil Classification System, ASTM D2487.
    - a2. Classifications are GW, GP, GM, GC, SW, SP, SM, or SC or combinations of these such as SP-SC. Silty sand (SM) materials used as backfill beneath foundations shall be limited to an average silt content of 15 percent or less. SM material may be used as backfill alongside of and above foundations.
  - b. Cohesive Materials:
    - b1. Cohesive materials are satisfactory for use if they contain no more than 1 percent (1%) organic or deleterious materials, have a maximum particle size of two (2) inches (50 mm), have a Liquid Limit of less than forty (40) and a Plasticity Index of less than twenty (20). Cohesive materials are soils, which are classified as fine-grained soils in the Unified Soil Classification System, ASTM D2487. Classification is CL.
  - c. Soil-Rock Mixtures:
    - c1. Soil-rock mixtures are satisfactory for use if they contain a sufficient soil matrix to prevent nesting of larger pieces and the material contains less than 1 percent (1%) organic or deleterious materials.
    - c2. Restrictions on the use of soil-rock mixtures are as follows:
      - c2.1. Soil rock mixtures with more than 15 percent (15%) of the rocks larger than two (2) inches (50 mm) may not be used in the upper six (6) feet of fills.
      - c2.2. No rocks larger than four (4) inches (100 mm) shall be used in "Structural Fill" or in the upper six (6) feet (1800 mm) of "General Fill".
      - c2.3. Soil-rock mixtures with rocks larger than four (4) inches (100 mm) shall not be used for bedding and backfill within twelve (12) inches (300 mm) of culverts and underground utilities.
      - c2.4. Rock material larger than two (2) inches (50 mm) shall not be used in the upper twelve (12) inches (300 mm) of a "Structural Fill" forming a structural subgrade, road, pavement, or track subgrade.





- c3. Soil-rock mixtures with rocks larger than four (4) inches (100 mm) but no larger than eight (8) inches (200 mm) may be used in fills deeper than six (6) feet (1800 mm). Nesting of larger rock pieces shall not be allowed.
- 201.3 Materials Unsatisfactory for Use as Either General or Structural Backfill:
  - a. Soils classified as silt or organic soils in the Unified Soil Classification System, ASTM D2487. Classifications are ML, MH, PT, OL, and OH.
  - b. Clay soils classified as CH with a Liquid Limit greater than fifty (50).
  - c. Rock materials without a soil matrix in which nesting of rocks could occur.
- 201.4 Other Restrictions on the Use of Materials:
  - a. Any material which is frozen, contains an excessive amount of organic material or trash, or contains large rocks, shall be considered unsatisfactory for use as backfill.
  - b. Backfill soils placed by previous construction shall be considered unsatisfactory unless they meet the requirements for satisfactory material.

### **PART 3 - EXECUTION**

#### 301. EXCAVATION

##### 301.1 General Excavation Requirements:

- a. Excavation includes incidental clearing; excavation and disposal of excavated materials; protection, sheeting, shoring, bracing; dewatering of excavation and Work areas; and preparation of bearing areas, as required to properly install and complete the Work, regardless of the nature of materials encountered in excavating.
- b. Sloping and benching and the maximum slope of excavation side slopes in soil shall be as specified in OSHA CFR Title 29, Chapter XVII, Part 1926 in accordance with the type of soil (Type A, B, or C). However, in no case shall the side slope be steeper than one (1) horizontal to one (1) vertical.
- c. Excavation shall be done under dry conditions by conventional earth moving equipment. Side slopes shall be as indicated on the design drawings, depending on the site soil conditions and depth of excavation. Fill material placed beneath slabs on grade shall be placed to the specified compaction density.
- d. Finished excavated surfaces shall be protected against damage by movement of construction equipment, rain, frost, or other causes, which may impair the bearing capacity of the subgrade.
- e. Work shall not be performed outside of the designated areas. If such Work is incidental to excavation Work, it will not be specifically indicated but shall be performed as part of the Work.

##### 301.2 Classification of Excavation:

- a. Excavation shall be classified as follows:



- a1. Earth Excavation: Excavation of all materials not classified as rock.
  - a2. Rock Excavation: Rock excavation is the excavation of any material that requires the continuous use of drilling and blasting, or drilling, channeling, etc., and includes granite, trap, quartzite, chert, limestone, hard sandstone, hard shale or slate or other similarly hard materials, as well as rocks and boulders 1/2 cubic yard (0.4 cubic meter) or bigger in size.
  - a3. Hand Excavation: Hand excavation shall be used, if required, for trenching or other excavation adjacent to structures or Equipment where the use of mechanical excavating equipment could disturb or damage adjacent structures or Equipment.
- 301.3 Protection and Support:
- a. The Contractor shall provide protection and support required to properly install Work, for protection and support of Work and of adjacent structures and improvements, and as required for the safety of traffic and life.
  - b. Protection and support includes temporary sheeting, bracing, shoring, and where indicated, permanent sheeting, bracing, and shoring. Temporary sheeting, bracing, shoring shall be removed by Contractor when their use is no longer required, unless otherwise indicated.
  - c. Other protection systems shall be in accordance with OSHA CFR Title 29, Chapter XVII, Part 1926.
  - d. Excavation slopes shall be protected and supported, where required, so that the slopes and bottom will be maintained for depth, width and condition indicated, and so that adjacent structures or other construction will be protected from damage caused by any earth or rock movement.
  - e. Protection and support shall be arranged for minimum interference with pipe laying, electrical ductbank installation and other similar Work.
- 301.4 Earth Excavation:
- a. Earth excavation shall be of sufficient dimensions to allow for placing of formwork for concrete, inspection of formwork and surfaces of completed concrete, and for placing and inspecting dampproofing, waterproofing, pipework, electrical ductbanks, etc.
  - b. Earth excavation for foundations carried below the indicated level shall be filled with the same concrete as required for the foundation. No additional payment will be made for fills to remedy over-excavation.
- 301.5 Dewatering: The Contractor shall provide and operate dewatering equipment required for areas excavated by the Contractor and be responsible for maintaining a dry work area.



- 301.6 Disposal of Excavated Material (Suitable for Backfill):
- a. Excavated materials suitable for backfill shall be deposited and stockpiled in quantities required for backfill at locations shown on the plan or as directed by Owner.
  - b. Excess excavated suitable material shall be disposed of off on Project Site for demolition project as directed by Owner.
- 301.7 Disposal of Excavated Material (Not Suitable for Backfill):
- a. Excavated materials not suitable for backfilling shall be disposed of off the Project Site as directed by Owner.
  - b. For material to be disposed of off the Project Site, promptly remove this material as it is excavated; stockpiling of such material is not permitted.
  - c. After completion of backfilling, dispose of any and all excess stockpiles or excess excavated material either off the Project Site as indicated or as directed by Owner.
- 301.8 Preparation of Bearing Areas:
- a. Bearing areas for foundations shall have been inspected and approved before any concrete is placed thereon.
  - b. Proofrolling of the subgrade beneath each foundation shall be performed with appropriate equipment to determine its suitability. Proofrolling shall be performed in the presence of the Testing Engineer to allow for observation of deflection such as pumping or rutting. Soft or unsuitable material shall either be removed and replaced or recompacted.
  - c. If bearing areas are not suitable, the Contractor may be required to carry the excavation deeper to more suitable bearing material and backfill with compacted structural backfill.
  - d. The subgrade shall be compacted to a density of not less than 95 percent (95%) of Modified Proctor per ASTM D1557 at a moisture content of optimum moisture content plus or minus 3 percent (3%).
  - e. If the subgrade material is too dry or too wet to enable satisfactory compaction, it shall be moistened or scarified and dried as required.
  - f. Approved subgrades shall be protected against damage by construction equipment, rain, frost, or other causes, which could impair the bearing capacity of the subgrade. If the bearing capacity is impaired before fill or concrete is placed upon subgrade, scarification, moisture conditioning and/or recompaction shall be performed.
  - g. The bearing area shall be relatively smooth at the time of placement of concrete.
302. BACKFILL
- 302.1 General Placement Requirements for Backfill:
- a. Compacting Equipment:
    - a1. Compacting Equipment shall be of such design, weight, and quality as is required to obtain the densities specified herein or indicated on the design drawings.



- a2. Areas inaccessible to self-propelled compacting equipment shall be compacted or consolidated by hand operated mechanical tampers or vibrators.
- a3. Self-propelled compacting equipment, i.e., sheepsfoot rollers and segmental pad rollers, and hand operated mechanical tampers and vibrators, shall efficiently perform compaction in accordance with this Specification and as indicated on the design drawings.
- b. Placement:
  - b1. Unless otherwise indicated, backfill material shall be placed in uniform layers not over six (6) inches (150 mm) (loose measure) for material compacted using self-propelled equipment and not over three (3) inches (75 mm) (loose measure) for material compacted by hand-operated equipment. The lift thickness may be increased to eight (8) inches (200 mm) (loose measure) with Owner approval when using self-propelled equipment if compaction requirements can consistently be met.
  - b2. The moisture content of the material at the time of compaction shall be plus or minus two percent of optimum moisture content for structural fill and plus or minus 3 percent (3%) for general fill.
  - b3. The Contractor shall add water or dry-out material as required to maintain the specified moisture control.
  - b4. The moisture content of granular materials shall not be used as a criterion for acceptance of the backfill.
  - b5. Placing and compacting of material shall be performed simultaneously on both sides of the components, to be buried in such a manner that will prevent injurious side pressure(s) on the components. Backfill shall be performed so as not to exceed a six (6) inch (150 mm) differential on both sides of the component(s) throughout the placing and compacting on the materials.
  - b6. Fill shall be compacted using hand-operated power tampers until the compacted material is a minimum of twenty-four (24) inches (600 mm) above the top of the buried components. Self-propelled equipment may be used for compaction when the depth of cover over the component(s) is greater than twenty-four (24) inches (600 mm).
  - b7. After a prolonged shutdown, the surfaces to receive fill shall be scarified and moistened to a depth of six (6) inches (150 mm) and then recompacted to the required density unless it can be shown that the required compaction is still present.
  - b8. Prior to placing new fill against existing soil, the existing soil shall be trimmed back sufficiently to expose fresh material which meets both density and moisture content requirements for that material. Compaction of the newly placed fill shall be carried sufficiently beyond the edge of the existing material to bond the two materials together.
- 302.2 Placement of General Backfill:
  - a. General fill shall be used for backfill around and above a foundation when no other foundation will be placed upon it.
  - b. Placing Material: Unless otherwise indicated, Class GF material shall be placed in layers not exceeding eight (8) inches (200 mm) loose thickness and compacted at recommended



moisture contents of plus or minus 3 percent (3%) of optimum moisture content. When granular material is used, the moisture content shall not be used as a criterion for acceptance of the backfill. The Contractor shall add water or dry out material to maintain the optimum moisture content throughout placing and compacting.

- c. Compaction Densities: Material shall be built up to grade elevations indicated on the design drawings with suitable moisture control and compaction throughout placement to produce the following minimum dry densities:
  - c1. Type GFC Material: 90 percent (90%) of the maximum dry density per ASTM D1557.
  - c2. Type GFG Material: 80 percent (80%) of relative density per ASTM D4253 and D4254 for granular material that contains up to 15 percent (15%) by dry weight of soil particles passing a No. 200 (75  $\mu$ m) sieve provided it still has cohesionless and free-draining characteristics. Where the granular material does not meet these criteria, the compacted density shall be 90 percent (90%) of the maximum dry density per ASTM D1557.

302.3 Placement of Structural Backfill:

- a. Structural fill shall be used for fill beneath structures and as backfill around a foundation when it will be supporting other shallower foundations.
- b. Compaction Densities: Material shall be brought up to grade elevation indicated on the design drawings with suitable moisture control and compaction throughout placement, to produce the following minimum dry densities:
  - b1. Type SFC material: 95 percent (95%) of the maximum dry density per ASTM D1557.
  - b2. Type SFG material: 85 percent (85%) of relative density per ASTM D4253 and D4254 for granular material that contains up to 15 percent (15%) by dry weight of soil particles passing a No. 200 sieve provided they still have cohesionless and free-draining characteristics.
  - b3. Where the granular material does not meet these criteria, the compacted density shall be 95 percent (95%) of the maximum dry density per ASTM D1557.
- c. Placing Material:
  - c1. Unless otherwise indicated, Class SF material shall be placed in layers not exceeding six (6) inches (150 mm) loose thickness and compacted at a recommended moisture content of plus or minus 2 percent (2%) of the optimum moisture content. When granular material is used, the moisture content shall not be used as a criterion for acceptance of the backfill.
  - c2. Contractor shall add water or dry-out material to maintain the optimum moisture contents throughout placing and compaction.

END OF SECTION 312316



**SECTION 312333**

**EXCAVATION AND BACKFILL FOR UNDERGROUND UTILITIES**

**PART 1 - GENERAL**

101. EXTENT

- 101.1 The intent of this Specification is to define the material and installation requirements for excavation and backfill of underground utilities.
- 101.2 The Work shall include, but not be limited to, the following:
- a. Supply bedding and backfill materials.
  - b. Surveying for alignment and grades.
  - c. Performing a prior investigation.
  - d. Providing signs and barricades as required.
  - e. Protection of property.
  - f. Protection of drainage facilities and structures.
  - g. Incidental clearing.
  - h. Pavement removal and disposal.
  - i. Trench excavation.
  - j. Topsoil removal.
  - k. Providing protection for the excavation.
  - l. Incidental excavation which may be required for manholes, vaults, valves, or other structures forming a part of the utility system.
  - m. Performing over excavation if required.
  - n. Stockpiling of excavated material.
  - o. Protection, sheeting, shoring and bracing.
  - p. Dewatering of excavations and work areas.
  - q. Bedding and backfill of buried piping and system appurtenances.
  - r. Bedding and backfill of electrical duct banks and conduits.
  - s. Provide a concrete arch or cradle for a gravity sewer pipe if specified on the design drawings.
  - t. Offsite disposal of excess or unsuitable materials.
  - u. Restoration of all disturbed surfaces.



102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:

- a. Section 014308 – Earthwork Testing
- b. Section 033115 – Concrete Work
- c. Section 312335 – Controlled Low-Strength Material (Flowable Backfill)
- d. Section 330301 – Installation of Underground Gravity Sewers

103. REFERENCE DOCUMENTS

103.1 Standards, Specifications, manuals, codes and other publications of nationally recognized organizations are referenced herein. References to these documents are to the issue date as indicated by the Adopted Building Code. If the document is not referenced in the Adopted Building Code, then the reference is to the latest issue date of the document together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of the Contract for the Work.

103.2 Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.

103.3 Internationally recognized standards equivalent to or more restrictive than those listed may be proposed by the Contractor. Contractor must submit the basis for equivalency for all requested alternative Codes and Standards. Acceptance of alternate Codes and Standards shall be determined by Owner and Owner's Engineer prior to use/purchase by the Contractor.

103.4 Abbreviations listed below refer to the applicable organizations or documents.

103.5 ASTM – ASTM International:

- a. A615 – Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.
- b. C150 – Standard Specification for Portland Cement.
- c. C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- d. C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium.
- e. C127 – Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
- f. C136 – Test Method of Sieve Analysis of Fine and Coarse Aggregates.
- g. D448 – Classification for Sizes of Aggregates for Road and Bridge Construction.



- h. D1241 – Specification for Materials for Soil - Aggregate Subbase, Base, and Surface Courses.
  - i. D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
  - j. D 2974 – Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
  - k. D5334 – Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure.
  - l. E11 – Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves.
  - m. OSHA – Occupational Safety and Health Administration:
  - n. Code of Federal Regulations (CFR), Title 29 - Labor, Subtitle B - Regulations Relating to Labor, Chapter XVII, Occupational Safety and Health Administration, Department of Labor, Part 1926 - Safety and Health Regulations for Construction, Subpart P, Excavations.
- 103.6 Florida Department of Transportation:
- a. Standard Specifications for Road and Bridge Construction, Latest.
- 103.7 IEEE – Institute of Electrical and Electronic Engineers:
- a. IEEE Std. 442 – IEEE Guide for Soil Thermal Resistivity Measurement.

104. SUBMITTALS

- 104.1 Contractor shall submit certificates and samples specified at least 30 days prior to use. Contractor’s data shall be submitted via electronic medium in a format compatible for importing into Owner’s information systems specified by Owner.
- 104.2 Material Certificates: “Granular Bedding Material”, “Select Granular Backfill” and “Granular Thermal Backfill”:
- a. Materials Certificates signed by the Material Producer certifying compliance with the following:

<u>Property</u>	<u>ASTM Test</u>	<u>Data Required</u>
Sieve Analysis	C136 and D1140	Percent Passing Selected Sieves
Bulk Specific Gravity	C127	Bulk Specific Gravity
Loss on Ignition	D2974	Percent Loss
Sodium Sulfate Soundness	C88	Percent Loss

- 104.3 Samples: Submit 50-pound samples when requested by Owner.





105. QUALITY ASSURANCE

- 105.1 Materials and placing procedures for bedding and backfill will be subject to inspection and tests conducted by a Testing Service hired by Owner. Tests shall be in accordance with Section 014308, Earthwork Testing. Such inspections and tests will not relieve Contractor of responsibility for providing materials and placing procedures in compliance with specified requirements.
- 105.2 Contractor shall cooperate with the Testing Service and allow reasonable and necessary opportunities and facilities for setting points and making measurements.
- 105.3 Contractor shall give Owner reasonable written notice of starting new Work. Work shall not be done outside the agreed regular working hours without prior written approval of Owner.
- 105.4 Contractor shall correct deficiencies in the Work which inspections and laboratory test reports have indicated to not be in compliance with requirements. Testing Service shall perform additional tests, at Contractor's expense, as may be necessary to reconfirm any noncompliance of the original Work, and to show compliance of corrected Work.

**PART 2 - PRODUCTS**

201. BEDDING AND BACKFILL MATERIALS

- 201.1 Granular Bedding Material:
  - a. "Granular Bedding Material" shall be used as bedding for pipes and electrical duct banks as specified herein.
  - b. "Granular Bedding Material" shall consist of manufactured angular material including crushed stone, stone screenings, and crushed stone-sand mixtures with little or no fines.
  - c. The maximum stone size used as bedding for pipe shall be as follows:

<u>Type of Pipe</u>	<u>Maximum Stone Size</u>
DIWP, Steel	¾-inch
PVC	½-inch
HDPE ≤ 4-inch	½-inch
6-inch to 8-inch	¾-inch
10-inch to 16-inch	1-inch
18-inch and larger	1-½-inch
CHDPE	1-inch

- d. "Granular Bedding Material" shall meet all requirements specified by the Florida Department of Transportation and be free from materials such as organics, cinders, recycled concrete, soft, viable, expansive or other deleterious materials, and meet the following minimum requirements:



- d1. Minimum bulk specific gravity of 2.0 per ASTM C127.
- d2. Maximum loss on ignition of two percent (2%) per ASTM D2974.
- e. Acceptable Gradations: Acceptable gradations of crushed rock are shown in Table 1. Similar gradations specified by the Florida Department of Transportation Standard Specifications are acceptable.
- f. Material classified as sand may be used, provided that it has a maximum size of ½”, no more than 10 percent (10%) passing the No. 200 sieve, and a maximum of 60 percent (60%) of the material is between the No. 4 sieve and the No. 200 sieve.
- g. River run, or rounded, materials are not acceptable.

**TABLE 1**  
**PERCENT PASSING**  
**ASTM D 448**

Nominal Size, Sieves with Square Openings	Size Number	
	67(1)	78(2)
1-1/2”	---	---
1”	100	100
3/4”	90 to 100	100
5/8”	---	---
1/2”	---	90 to 100
3/8”	20 to 55	40 to 75
No 4	0 to 10	5 to 25
No 8	0 to 5	0 to 10
No 16	---	0 to 5
No. 50	---	---

**Notes:**

- (1) Size Number 67 is preferred for bedding ductile iron pipe, steel pipe, reinforced concrete pipe and HDPE pipe larger than six (6) inches. May be used for HDPE pipe larger than ten (10) inches and CHDPE pipe.
- (2) Size Number 78 is preferred for bedding PVC and HDPE pipe up to four (4) inches in diameter.  
 It may also be used for bedding larger diameter HDPE and CHDPE pipe.

**201.2 Select Granular Backfill:**

- a. “Select Granular Backfill” shall be used to backfill trenches in paved areas as specified herein.



- b. “Select Granular Backfill” shall consist of crushed stone or crushed gravel, well graded within the limits of the acceptable gradations.
- c. Material shall be reasonably free from excess of soft and unsound particles and other objectionable matter. At the time of use, “Select Granular Backfill” shall be free of frozen lumps and foreign materials that may have become mixed with it during handling.
- d. Acceptable gradations are: ASTM D1241 - Gradation C or Gradation D (well graded fine road base) or similar gradations specified by the Florida Department of Transportation Standard Specifications.

201.3 Flowable Backfill:

- a. Flowable backfill shall be used for the backfill of excavations beneath trenches, electrical duct banks, and for other excavations that cannot be adequately supported using compacted natural material.
- b. Flowable backfill may be used for other excavations at the discretion of the Contractor and approval of Owner.
- c. Materials for flowable backfill shall be as specified in Section 312335, Controlled Low-Strength Material (Flowable Backfill).

**PART 3 - EXECUTION**

301. CONSTRUCTION SURVEYING

- 301.1 Pipes shall be installed to the lines and grades shown on the design drawings. Contractor shall lay out lines and grades and shall be fully responsible for the correctness of its Work.
- 301.2 Contractor shall be responsible for installing fittings, valves, outlets, manholes, etc., in the locations shown on the design drawings unless directed otherwise by Owner. Valve stems shall be plumb and oriented in a manner to allow proper operation.
- 301.3 Owner reserves the right to verify correctness of lines and grades during progress of the Work.
- 301.4 Contractor shall preserve and maintain survey reference points (monuments, benchmarks, etc.) established by Owner. Should the Contractor damage or destroy a reference point, it shall be re-established at Contractor’s expense.

302. PRIOR INVESTIGATION AND PROTECTION

- 302.1 Prior Investigation:
  - a. Prior to excavation, the Contractor shall make an investigation in the areas of Work to determine the location of utilities and structures.
  - b. Should undocumented or incorrectly documented piping, other utilities or structures be encountered during excavation, the Contractor shall provide written notification to Owner of the location of existing facilities whenever they affect the Work. Contractor shall



cooperate with Owner in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of Owner.

- c. Contractor shall notify Owner, in writing, of any conditions that are detrimental to the timely completion of its Work.

302.2 Signs and Barricades:

- a. The Contractor shall place and maintain adequate barricades, construction signs, lights, and guards as required at all times during the progress of the Work to protect persons from injury and avoid property damage.
- b. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when visibility is poor.
- c. The rules and regulations of OSHA and appropriate authorities with respect to safety provisions shall be observed.

302.3 Protection of Property:

- a. Trees, shrubbery, fences, poles, curbs and other property and surface structures shall be protected during construction unless their removal for purposes of construction is specified on the design drawings.
- b. Any fences, poles or man-made surface improvements which are moved or disturbed by the Contractor shall be restored to the original conditions, after construction is complete, at the Contractor's expense.
- c. Any trees, shrubbery, or other vegetation which are approved for removal in order to facilitate construction shall be removed completely, including stumps and roots.

302.4 Protection of Structures:

- a. Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the Work shall be furnished and installed by the Contractor. Any structures which may have been disturbed shall be restored by the Contractor at the completion of the Work at its expense.

302.5 Protection of Drainage Facilities:

- a. If, in the course of construction, it may be necessary to block a ditch, pipe or other drainage facility, temporary pipes, ditches or other drainage facilities shall be installed to maintain adequate drainage, as approved by Owner. Upon completion of the Work, the temporary facilities shall be removed and the permanent facilities restored.
- b. Soil erosion control methods shall be used to protect ditches and other drainage facilities during construction.



303. SURFACE REMOVAL

303.1 General:

- a. The Contractor shall remove the surface materials only to such widths as will permit a trench to be excavated and which will afford sufficient room for proper execution of the Work.

303.2 Pavement Removal:

- a. Where concrete pavement, sidewalk, asphalt pavement, curbing, or curbing gutter is removed, the width of the removal shall exceed the actual width at the top of the trench by not more than twelve (12) inches on each side of the trench, or a total of two (2) feet wider than the trench.
- b. The dimensions of pavement removed for large appurtenant structures such as manholes shall not exceed the dimensions of the opening required by more than twelve (12) inches in any direction.
- c. Concrete pavement shall be removed to neatly sawed edges. Saw cuts shall be made to a minimum depth of 1-1/2 inches. If a saw cut falls within three (3) feet of a construction joint, cold joints, expansion joints, or edge, the concrete shall be removed to the joint or edge. The edges of existing concrete pavement adjacent to trenches, where damaged subsequent to saw cutting, shall again be saw cut to neat straight lines for the purpose of removing the damaged pavement areas. Such saw cuts shall be parallel to the original saw cuts or shall be cut on an angle which departs from the original saw cut not more than one (1) inch every six (6) inches.
- d. Concrete sidewalks or driveways to be removed shall be neatly sawed in straight lines either parallel to the curb or at right angles to the alignment of the sidewalk. No section to be replaced shall be less than thirty (30) inches in length or width. Curb and gutter shall be sawed to a depth of not less than 1-1/2 inches on a neat line at right angles to the curb face.
- e. Bituminous pavement shall be removed to neat straight lines by saw cutting. Saw cuts shall be made a minimum depth of four (4) inches or thickness of the pavement, whichever is less. The edges of the existing pavement adjacent to trenches, where damaged subsequent to saw cutting, shall again be saw cut to neat straight lines for the purpose of removing damaged pavement areas.
- f. Care shall be taken to protect against fracture and disturbance of pavement beyond reasonable Working limits.

303.3 Topsoil Removal:

- a. Topsoil suitable for final grading and landscaping shall be stockpiled separately in a location specified on the design drawings or by Owner and preserved for later use.

304. EXCAVATION

304.1 General Requirements:



- a. Excavation includes excavation; disposal of excavated materials; protection, sheeting, shoring, and bracing; dewatering of excavation and Work areas; and preparation of bearing areas as required to properly install and complete the Work.
- b. Excavations for appurtenant structures, such as (but not limited to) manholes, catch basins, valve boxes, meter vaults, thrust blocks, and boring pits, for the purposes of excavation, shoring, and bracing, shall be considered to be trench excavations.
- c. Work shall not be performed outside of the designated areas without prior written approval of Owner. If such Work is incidental to excavation Work, it will not be specifically indicated but shall be performed as part of the Work.
- d. Excavation for pipes shall be by open trench unless specified otherwise on the design drawings. However, should the Contractor elect to tunnel or jack any portion not so specified, they shall first obtain written permission from Owner.
- e. Excavation shall be done under dry conditions by earthmoving machinery, provided that by doing so, existing improvements will not be subject to damage.
- f. Hand excavation shall be used for trenching or other excavation adjacent to structures or equipment where the use of mechanical excavating equipment can cause damage to adjacent improvements.
- g. Finished excavated surfaces shall be protected against damage by movement of construction equipment, rain, frost or other causes which may impair the bearing capacity of the subgrade. All mud, unsuitable material and contaminated bedding material shall be removed. Saturated bedding material may be reconditioned, if needed.
- h. Excavated materials suitable for use as bedding or backfill shall be stockpiled on site in a location specified by Owner. Excavated materials unsuitable for use as backfill shall be disposed of off Project site.

304.2 Trench Excavation:

- a. A trench is defined as a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than fifteen (15) feet.
- b. Trenching Work shall be in accordance with OSHA CFR Title 29, Chapter XVII, Part 1926, Subpart P, "Excavations."
- c. Except by permission of Owner, the maximum length of open trench shall be 500 feet. The distance is the collective length at any location, including open excavation, pipe laying, appurtenant construction, and backfill.
- d. Trench excavation shall include any additional amount of excavation required to place bedding material beneath a pipe.
- e. Overexcavation below the indicated or required depth shall be brought up to the correct depth with compacted "Granular Bedding Material." No additional payment will be made for backfills to remedy overexcavation.



- f. A safe means of egress (stairway, ladder, ramps) shall be located in trench excavations that are four (4) feet or more in depth so as to require no more than twenty-five (25) feet of lateral travel for workers.
- g. Trenches shall be provided with a protective system to prevent cave-ins except when:
  - g1. Excavations are less than five (5) feet in depth and an examination of the ground by the Contractor provides no indication of potential cave-in.
- h. Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied to the system.

304.3 Protection Systems:

- a. General:
  - a1. Protection systems include the following:
    - a1.1 Sloping the sides of the trench.
    - a1.2 Sloping and benching the sides of the trench.
    - a1.3 Provision of sheeting, bracing, and shoring, or use of a trench shield.
    - a1.4 A combination of the methods listed above.
  - b. Sloping and Benching System:
    - b1. Sloping and benching and the maximum slope of trench side slopes in soil shall be as specified in OSHA CFR Title 29, Chapter XVII, Part 1926 in accordance with the type of soil (Type A, B, or C). However, in no case shall the side slope be steeper than one (1) horizontal to one (1) vertical.
  - c. Other Protection Systems:
    - c1. Other protection systems, which include sheeting and bracing, shoring, and use of a trench shield, shall be provided by the Contractor when sloping is not possible or as required for the safety of traffic or life.
    - c2. Other protection systems shall be in accordance with OSHA CFR Title 29, Chapter XVII, Part 1926.
    - c3. The Contractor shall be responsible for determining what protection and shoring must be provided to support loads to which Work may be subjected including construction equipment and the operation of such equipment. The Contractor shall be responsible for the adequacy and safety of such protection and support.

304.4 Width of Excavation:

- a. The bottom width of the trench shall be as required to permit the pipe to be properly laid and joined and the backfill to be placed as specified.



- b. The width of trenching for multiple pipe runs shall be as shown on the design drawings. Where the width of the trench is not specified, the minimum trench widths shall be as follows:

Outside Diameter of Pipe (OD)	Minimum Trench Width
3 to 16 inches	OD plus 12 inches
18 to 42 inches	OD plus 18 inches

- c. Trenches shall be of extra width, when required, to permit the placement of timber supports, sheeting, bracing, and appurtenances.

304.5 Unsuitable Trench Bottom Soils:

- a. When, in the opinion of Owner, soft or unstable trench bottom soils are encountered below the depth of bedding specified, the material shall be overexcavated up to 2'-0" and replaced with "Granular Bedding Material" compacted to a minimum dry density of 95 percent (95%) per ASTM D1557 or Flowable Backfill. When the trench bottom materials are unstable to a degree that, in the opinion of Owner, they cannot be removed, a foundation shall be constructed for the pipe as directed by Owner.

304.6 Stockpiling Excavated Material:

- a. All excavated material shall be piled in a manner that will not endanger the Work and that will not obstruct streets, sidewalks, driveways, ditches, natural water courses or other drainage pathways.
- b. No stockpiled material shall be placed closer than two (2) feet from the edge of an excavation.
- c. Excavated material suitable for backfilling shall be stockpiled on the Project Site where directed by Owner.
- d. Material unacceptable for backfilling shall be immediately removed and placed in an onsite or offsite disposal area as directed by Owner.

304.7 Dewatering:

- a. Contractor shall provide and operate dewatering equipment required for areas excavated by Contractor, and be responsible for maintaining a dry Work area. Dewatering equipment shall be in constantly attended operation on a twenty-four (24) hour basis until their operation can be safely halted.
- b. The Contractor shall submit the proposed method for disposal of trench water to Owner for approval.
- c. No sanitary sewer shall be used for disposal of trench water.
- d. No water containing settleable solids shall be discharged into storm sewers.
- e. Provisions shall be made to prevent floating of the pipe. At no time shall trench water be allowed to enter the pipe.





- f. Dewatering sufficient to maintain the water level twelve (12) inches below the trench bottom or base of bedding course shall be accomplished prior to pipe laying and joining.

305. GENERAL REQUIREMENTS FOR BEDDING AND BACKFILL

305.1 Definitions:

a. Bedding:

- a1. Bedding shall be defined as that material supporting, surrounding, and extending to one foot above the top of the pipe. Where Flowable Backfill is specified to cover the pipe, the top of the concrete shall be considered the top of the bedding.
- a2. Bedding for manholes, catch basins, and vaults shall be defined as material placed and compacted beneath the structure.
- a3. Fill of excavations made beneath a pipe manhole or other drainage structure to replace unsuitable material shall be considered as bedding.

b. Backfill:

- b1. Backfill shall be defined as starting one foot above the top of the pipe or conduit, or the Flowable Backfill, or the concrete bedding over the pipe or conduit. All material below that point shall be considered as bedding.
- b2. Backfill for cast-in-place or precast structures, such as manholes, catch basins, vaults, etc., shall be considered as starting at the top of bedding for the structure.

305.2 Compacting Equipment:

- a. Compacting equipment shall be of such design, weight, and quality as is required to obtain the densities specified herein or indicated on the design drawings.
- b. Areas inaccessible to self-propelled compacting equipment shall be compacted or consolidated by hand-operated mechanical tampers or vibrators.
- c. No plea by Contractor that the equipment that is available at the Project Site cannot produce the densities specified will be accepted. Contractor shall furnish equipment as required.

305.3 Placement:

- a. Temporary internal bracing used for shipping, handling, or installing pipe shall be removed prior to placing bedding.
- b. Bedding or backfill material shall not be placed on a frozen surface. No snow, ice or frozen earth shall be contained in the bedding or backfill materials.

305.4 Testing:

- a. The Independent Testing Service employed by Owner shall conduct tests of placement thickness and compaction.
- b. Testing shall be in accordance with Section 014308, Earthwork Testing.



306. BEDDING FOR PIPES

306.1 Bedding for Gravity Sewer Pipe:

- a. Installation in Firm, Stable Granular Foundation Soils:
  - a1. Where the natural soil on which the pipe is to be bedded is granular material suitable in its natural state for shaping and bedding a pipe, and the in-place material does not contain stones larger than specified in Paragraph 201.1, no granular cradle is required.
  - a2. For pressure pipe, install on a flat bottom trench.
  - a3. For sewer pipe, the bottom of the trench shall be excavated and shaped to accurately conform to 0.6 of the outside diameter of the pipe.
  - a4. For jointed pipe, provide excavated bell holes at each joint.
  - a5. If the foundation soils contain rocks larger than specified above, provide a cradle as specified for cohesive soils.
- b. Installation in Unyielding Material:
  - b1. Construct a granular cradle for the pipe prior to placement of the pipe.
  - b2. Overexcavate the trench beneath the pipe as follows:

Height of Cover over the Top of the Pipe	Minimum Depth of Overexcavation
Less than 16 feet	8 inches minimum

- b3. Place and compact “Granular Bedding Material” to the outside bottom of the pipe and across the full width of the trench.
- b4. For jointed pipe, provide excavated bell holes at each joint.
- c. Installation in Soft Foundation Soils:
  - c1. If soft or unsuitable subgrade materials containing ash, cinders, refuse, organic material, or unsuitable material is encountered, such material shall be removed to a minimum of twelve (12) inches beneath the bottom of the pipe or to a depth specified by Owner.
  - c2. Place and compact “Granular Bedding Material” to the outside bottom of the pipe and across the full width of the trench.

306.2 Bedding for Pressure Pipe Where Flowable Backfill is Not Specified:

- a. Installation in Firm, Stable Granular Foundation Soils:
  - a1. For pipe excavations in firm, stable granular foundation soils with stone sizes smaller than specified in Paragraph 201.1, no granular cradle is required.
  - a2. Install the pipe on a flat bottom trench.



- a3. For jointed pipe, provide excavated bell holes at each joint.
- a4. If the foundation soil contains stones larger than specified in Paragraph 201.1, provide a cradle as specified for cohesive soils.
- b. Installation in Unyielding Material:
  - b1. Construct a granular cradle prior to placement of the pipe.
  - b2. Overexcavate the trench to provide a minimum depth of cradle of 6 inches for pipe size less than or equal to twenty-four (24) inches in diameter and nine (9) inches deep for larger size pipes.
  - b3. Place and compact “granular bedding material” to the outside bottom of the pipe and across the full width of the trench.
  - b4. For jointed pipe, provide excavated bell holes at each joint.
- c. Installation in Unsuitable Subgrade Materials:
  - c1. If soft or unsuitable foundation subgrade materials are encountered, overexcavate and provide a granular cradle as specified for gravity sewer pipe.
- 306.3 Bedding for Manholes, Catch Basins, and other Structures:
  - a. Bedding for manholes and catch basins shall be provided as specified in Section 330301, Installation of Underground Gravity Sewers. Placement and compaction shall be as specified herein.
  - b. Bedding for vaults and other structures shall be as specified for manholes.
- 306.4 Placement and Compaction:
  - a. Bedding alongside and above the pipe shall proceed as soon as possible. Joints shall not be covered until the pipe has been tested.
  - b. Bedding shall be compacted by mechanical means. Compaction by ponding or jetting shall not be permitted.
  - c. Any blocking used to assist pipe installation shall be removed.
  - d. Unless sheeting or shoring is to be cut off and left in place, compaction of bedding for pipe shall be accomplished after sheeting or shoring has been removed from the bedding zone. If removal of sheeting or shoring below the top of the pipe is not possible before bedding is installed, the sheeting or shoring below the top of the pipe shall be left in place.
  - e. Compacted “Granular Bedding Material” shall be placed to a minimum of twelve (12) inches above the top of the pipe.



- f. The in-place density of compacted bedding material is the criterion for acceptance of the bedding. The bedding material shall be initially placed in uniform layers not over six (6) inches thick (loose measure) for material compacted using self-propelled equipment and not over three (3) inches thick (loose measure) for material compacted using hand-operated equipment. A thicker lift may be used if compaction tests run on material placed using the thicker lift show that in-place density requirements are being met.
- g. Bedding alongside and above the pipe shall be compacted using hand-operated power tampers.
- h. Care shall be exercised in placing and compacting material around pipe to maintain the material approximately at the same level, not in excess of a six (6) inch differential, on both sides of the pipe, throughout the placing and compacting of the material.
- i. Placing and compacting of material shall be performed simultaneously on both sides of pipe in such manner to prevent injurious side pressures on piping.

306.5 Bedding Compaction Requirements:

- a. Unless specified otherwise on the design drawings bedding material shall be compacted to the following minimum percent of dry density as determined by ASTM D1557 at a moisture content within plus or minus 3 percent (3%) of optimum water content. Note: The moisture content of the compacted material shall not be a criterion for acceptance of the bedding.
- b. Bedding for rigid pipe shall be compacted to a minimum of 95 percent (95%) of dry density.
- c. Bedding for flexible pipe shall be compacted to a minimum of 95 percent (95%) of dry density.
- d. Bedding for manholes, catch basins, and vaults shall be compacted to a minimum of 95 percent (95%) of dry density.

307. BEDDING FOR CONCRETE ENCASED ELECTRICAL DUCT BANKS, DIRECT BURIED CONDUIT, AND DIRECT BURIED CABLE

307.1 Bedding Material:

- a. Bedding material for concrete encased electrical duct banks shall be native material excavated from the trench unless the design drawings specify fluidized or Granular Thermal Backfill.
- b. Bedding material placed within twelve (12) inches of concrete encased duct banks shall not contain more than 1 percent organic or deleterious material and have a maximum particle size of two (2) inches.
- c. Bedding material placed around (within six (6) inches) direct burial cable and direct buried conduit may be material excavated from the trench provided that it is free from debris and rocks larger than 1-1/2 inches.

307.2 Bedding for Concrete Encased Electrical Duct Banks:



- a. Excavate the trench to the bottom of the duct bank specified on the design drawings. Provision for a granular bedding beneath duct banks is not required unless specified on the design drawings.
- b. If the trench is overexcavated, backfill the overexcavation with native material compacted to a minimum dry density of 95 percent per ASTM D1557.
- c. Place and compact bedding material alongside (within two (2) feet) and to twelve (12) inches above electrical duct banks as specified below. Lean concrete or Flowable Backfill may be used in place of granular bedding material for backfilling ducts.

307.3 Placement and Compaction:

- a. The in-place density of compacted bedding material is the criterion for acceptance of the material. Bedding material for electrical ducts shall be placed in uniform layers not over six (6) inches thick (loose measure) for material compacted using self-propelled equipment and not over three (3) inches thick (loose measure) for material compacted using hand-operated equipment. A thicker lift may be used if compaction tests run on material placed using the thicker lift show that in-place density requirements are being met.
- b. Bedding shall be compacted to the minimum percent of dry density specified below as determined by ASTM D1557 at a moisture content within plus or minus 3 percent (3%) of optimum moisture content. Note: The moisture content of the compacted material shall not be a criterion for acceptance of the bedding material if it is classified as granular material.
- c. Bedding for concrete encased electrical ducts, conduit or cable installed beneath permanent pavement or structures shall be compacted to a minimum of 95 percent (95%) of dry density.
- d. Bedding for concrete encased electrical ducts, conduit or cable installed elsewhere shall be compacted to a minimum of 90 percent (90%) of dry density.

308. BACKFILL

308.1 Backfill of Trenches Beneath Pavement:

- a. The upper three (3) feet of backfill for trenches and excavations for pipes, manholes, catch basins, and electrical ducts installed beneath permanent asphalt or concrete pavement, or sidewalks shall be with "Select Granular Backfill."
- b. Backfill between the top of the bedding and the bottom of the "Select Granular Backfill" shall be with material removed from the excavation.

308.2 Backfill of Trenches at Other Locations:

- a. Backfill for trenches and excavations for structures such as manholes and catch basins in other locations where there are no pavements shall be material removed from the excavation, subject to the following restrictions:



- a1. For narrow trenches, rocks greater than six (6) inches in any dimension shall not be permitted in backfill. Rocks larger than 2-1/2 inches but less than six (6) inches shall be permitted in the backfill and placed between one (1) foot above the top of the duct bank, conduit or cable and one (1) foot below finished surface.
- a2. When the trench is wider than three (3) feet, rocks not exceeding twelve (12) inches in any dimension, which originate from the trench, shall be permitted in the backfill from the top of the bedding layer to five (5) feet below the finished surface.
- a3. Rocks greater than 2-1/2 inches in any dimension shall not be permitted in backfill placed within one foot of pavement.
- a4. Backfill shall not contain frozen material.
- a5. Backfill shall not contain debris of any kind.

308.3 Backfill of Excavations Beneath Existing Tunnels and Electrical Concrete Encased Duct Banks:

- a. Backfill shall be with controlled low-strength material (CLSM) or flowable backfill in accordance with Section 312335, Controlled Low-Strength Material (Flowable Fill) unless the design drawings indicate the use of Fluidized Thermal Backfill.
- b. The limits of placement of Flowable Backfill shall be as specified on the design drawings.

308.4 Placement and Compaction:

- a. Backfill shall be placed and compacted by mechanical means. Compaction by ponding and jetting shall not be permitted.
- b. Material for backfill shall be placed in horizontal layers of thickness not exceeding the thickness listed below. Each layer shall be evenly spread, moistened as required, and then tamped or rolled as required to obtain the specified compaction:

<u>Type of Equipment</u>	<u>Maximum Lift Thickness-Loose Measure</u>
Vibratory equipment (vibratory plates, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers)	8 inches
Rolling equipment non-vibratory sheepsfoot, smooth-wheeled, pneumatic tired	8 inches
Hand-directed mechanical tampers	4 inches

- c. Backfill shall be compacted using hand-operated power tampers until the compacted material is a minimum of twenty-four (24) inches above the top of the pipe. Self-propelled equipment may be used for compaction when the depth of cover over the pipe is greater than twenty-four (24) inches.
- d. The backfill above a concrete arch or cradle shall not be placed nor sheeting pulled less than forty (40) hours after placement. For a concrete arch or cradle constructed using



high early strength concrete, backfill shall not be placed nor sheeting pulled less than eighteen (18) hours after placement.

- e. For backfill against cast-in-place structures or appurtenances constructed of concrete without admixtures to obtain high early strength, backfill may be placed when the concrete has attained 80 percent (80%) of the design strength as verified by cylinder break tests. If no break tests are made to verify concrete strengths, the periods of time after which the Contractor may place backfill against or over the top of the structure are as follows:

Operation	Against Sides of Structure (Days)	Over Top of Structure (Days)
Placement of loose backfill	5	21
Densification of backfill	7	28

308.5 Backfill Compaction Requirements:

- a. Unless specified otherwise on the design drawings or directed by Owner, trench backfill shall be compacted to the following minimum percent of dry density as determined by ASTM D1557 at a moisture content within plus or minus 3 percent (3%) of optimum water content. Note: The moisture content of the compacted material shall not be a criterion for acceptance of the backfill if it is classified as granular material.
- b. 90 percent (90%) density between the top of the bedding and the upper three (3) feet of the trench measured from the finished grade.
- c. 95 percent (95%) density in the following areas:
  - c1. In the upper three (3) feet of the trench measured from the pavement surface or finished grade.
  - c2. Within engineered embankments.
  - c3. Where lateral support is required for existing or new structures.
  - c4. Beneath structures.

309. DISPOSAL OF EXCESS MATERIAL

- 309.1 After completion of backfilling, dispose of all excess stockpiles of excess excavated, useable, clean material on or off the project site in a location specified by Owner.

310. RESTORATION OF SURFACES

- 310.1 Restoration of surfaces includes construction of new surfaces to replace the surfaces damaged as part of a utility installation.
- 310.2 The type of surface restoration required shall be shown on the design drawings.



311.           AS-BUILT MARKUP

311.1           Underground construction drawings to be marked up with revised coordinates if different than the IFC drawings.

END OF SECTION 312333





**SECTION 312335**

**CONTROLLED LOW-STRENGTH MATERIAL (FLOWABLE BACKFILL)**

**PART 1 - GENERAL**

101. EXTENT

- 101.1 This Specification Section defines the material and installation requirements for CLSM (Controlled Low-Strength Material or flowable backfill) to be used for backfilling underground pipes and in other locations as specified on the design drawings.
- 101.2 The Work shall include, but not be limited to, the following items:
- a. Furnish all materials.
  - b. Submit mix designs for approval.
  - c. Furnish and install forms as required.
  - d. Place CLSM.
  - e. Protect backfill after placement.
  - f. Repair of Work not meeting the requirements of this section or the Design Drawings.
  - g. Offsite removal and disposal of all surplus or out-of-specification materials.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

- 102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:
- a. Section 312333 – Excavation and Backfill for Underground Utilities.

103. REFERENCE DOCUMENTS

- 103.1 Standards, Specifications, manuals, codes, and other publications of nationally recognized organizations are referenced herein. References to these documents are to the issue date as indicated by the Adopted Building Code. If the document is not referenced in the Adopted Building Code, then the reference is to the latest issue date of the document together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of the Contract for the Work.
- 103.2 Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.



- 103.3 Internationally recognized standards equivalent to or more restrictive than those listed may be proposed by the Contractor. Contractor must submit the basis for equivalency for all requested alternative Codes and Standards. Acceptance of alternate Codes and Standards shall be determined by Owner and Owner's Engineer prior to use/purchase by the Contractor.
- 103.4 Abbreviations listed below refer to the applicable organizations or documents.
- 103.5 ASTM - ASTM International:
- a. C33 - Specification for Concrete Aggregates.
  - b. C88 - Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
  - c. C94 - Specification for Ready-Mixed Concrete.
  - d. C136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - e. C143 - Test Method for Slump of Hydraulic Cement Concrete.
  - f. C150 - Standard Specification for Portland Cement.
  - g. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
  - h. D448 - Classification for Sizes of Aggregates for Road and Bridge Construction.
  - i. D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
  - j. D5971 - Standard Practice for Sampling Freshly Mixed Controlled Low-Strength Material.
  - k. D6023 - Standard Test Method for Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM).
  - l. D6024 - Standard Test Method for Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application.
  - m. D6103 - Standard Test Method for Flow Consistency of Controlled Low Strength Material (CSLM).
104. SUBMITTALS
- 104.1 Contractor shall submit drawings and data as specified. Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into Owner's information systems specified by Owner.
- 104.2 Mix Designs:
- a. Within thirty (30) calendar days prior to the scheduled placement of CLSM, the Contractor shall submit the proposed job mix design and test results for approval.
  - b. A separate mix design shall be submitted for each proposed type of CLSM.



- c. Each mix design shall be for a specific type of CLSM meeting the density guidelines and strength requirements of Table 1. The mix design for each mixture shall be based on certified tests and shall establish the following:
    - c1. Source of all ingredient materials.
    - c2. Gradation of the aggregate.
    - c3. Density, strength, absolute volumes, specific gravities, unit weights, and any other values used in the mix design process.
    - c4. A specific weight of cement.
    - c5. A specific weight of fly ash.
    - c6. A specific weight of bottom ash and/or fine natural aggregate.
    - c7. A specific percentage of admixture (if applicable).
    - c8. A target flow, or slump (if applicable), and strength.
  - d. Certification (notarized statement) by the producer of the mix that the mix meets the required specifications.
  - e. Certification (notarized statement) from the fly ash Supplier that the fly ash conforms to the requirements specified herein.
- 104.3 Substitution of Materials:
- a. The source of the fly ash, bottom ash, and fine aggregate shall not be changed without prior written approval and corresponding mix design testing.
- 104.4 Standard Mix Designs:
- a. A mix design developed by the State Department of Transportation or a commercial mix developed by a local materials Contractor conforming to the requirements of this specification is acceptable upon approval.
- 104.5 Sequence of Installation:
- a. The Contractor shall submit its plan for the sequence of installation of CLSM for approval.
  - b. The Contractor's plan shall include:
    - b1. Placement technique.
    - b2. Lift height.
    - b3. Time between lifts.
    - b4. Description of forms.
    - b5. Use of dikes.
    - b6. Description of equipment.



105. QUALITY ASSURANCE

105.1 Testing Services:

- a. Materials and placement will be subject to tests and inspection conducted by a Testing Service hired by Owner. The Testing Service shall perform in-place and laboratory tests to ensure compliance with these specifications. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and placement in compliance with this section.

105.2 Tests Required:

- a. A flow consistency test shall be performed on the first truckload and subsequently thereafter with each compressive strength sample.
- b. Tests for compressive strength shall be performed for each day's delivery of material, but not less than one for each fifty (50) cubic yards or part thereof placed. If the quantity delivered in one day is between ten (10) and fifty (50) cubic yards, one set of tests shall be performed.
- c. The method of sampling for flow consistency and compressive strength shall be in accordance with ASTM D4832 and D5971.
- d. Tests shall be made for flow consistency in accordance with ASTM D6103. When larger aggregate or higher strength material is used, the slump test shall be performed in accordance with ASTM C143 within five (5) minutes of obtaining the sample. Flow consistency or slump tests shall be within the specified limits or the material shall be rejected.
- e. Tests shall be made for compressive strength in accordance with ASTM D4832. These tests shall consist of a minimum of four (4) cylinders taken from the same truck. One seven (7) day and two twenty-eight (28) day tests shall be performed by the laboratory, with the results submitted to Owner as soon as possible after the tests are completed. The twenty-eight (28) day strength is defined as the average of two (2) or more cylinder breaks. The Contractor shall be notified in writing of the test results. One spare cylinder shall be made and used as directed later.
- f. Tests shall be made for the unit weight in accordance with ASTM D6023.
- g. The ball drop test shall be performed in accordance with ASTM D6024 to determine the readiness of the CLSM to accept loads prior to adding a temporary or permanent-wearing surface. If the diameter of the indentation is less than or equal to three (3) inches, then the CLSM is suitable for the load application. If the diameter of the indentation is greater than three (3) inches, then the CLSM is not ready for the load application. One test shall be performed in each area of load application.

105.3 Correction of Deficiencies:

- a. If the CLSM does not meet the twenty-eight (28) day compressive strength requirement specified in Table 1, the Contractor shall adjust the mixture to be used for future pours as required to meet those requirements.



- b. The Testing Service shall perform additional tests, at the Contractor's expense, as may be necessary to reconfirm any noncompliance of the original Work, and to show compliance of corrected Work.

**PART 2 - PRODUCTS**

201. CLSM MIXTURES

201.1 Mixtures:

- a. CLSM mixtures shall conform to the requirements given in Table 1.

**TABLE 1**

<b><u>PROPERTIES &amp; CRITERIA</u></b>	<b><u>TEST (ASTM)</u></b>	<b><u>TYPE A</u></b>	<b><u>TYPE B</u></b>	<b><u>TYPE C</u></b>
FLOW CONSISTENCY (inches)	D 6103	>8	>8	>8
SLUMP (inches)	C 143	7-11	7-11	7-11
DENSITY (pcf)	D 6023	95-110	120-135	125 minimum
COMPRESSIVE STRENGTH (psi)				
7 Days (minimum)	D 4832	30-50	30-50	500
28 Days	D 4832	70-125 (1)	70-125 (1)	900-1000

**Notes:**

- 1. The material shall have a maximum twenty-eight (28) day compressive strength of 125 psi so that it can be easily removed in the future, if necessary.

201.2 Use:

- a. The type of CLSM and extent of the CLSM installation will be as defined on the design drawings.
- b. CLSM shall not be provided except where specified on the design drawings or where directed by Owner.
- c. When CLSM is used as backfill around buried electric utilities and duct runs, it shall meet the properties required per Section 312333, Excavation and Backfill for Underground Utilities.

202. GUIDELINES FOR USE

202.1 Type A and Type B CLSMs are similar in quality and use. The mixes are interchangeable.

202.2 CLSM Type C is used for permanent fills and structural backfills where later excavation is not anticipated and is not interchangeable with Types A and B.



203. OTHER MATERIALS

203.1 Cement:

- a. Type I Portland Cement in accordance with ASTM C150.

203.2 Fly Ash:

- a. Type "C" or "F" fly ash in accordance with ASTM C618.

203.3 Fine Aggregate:

- a. Fine Aggregate in accordance with ASTM C33 except, the material shall have a maximum loss of 20 percent (20%) in the Sodium Sulfate Soundness Test, ASTM C88.

203.4 Bottom Ash:

- a. Coal ash having a maximum loss of 20 percent (20%) in the Sodium Sulfate Soundness Test, ASTM C88.

203.5 Water:

- a. Water shall meet the requirements for water for ready-mixed concrete specified in ASTM C94.

203.6 Admixtures:

- a. May be used when specifically approved. No air entrainment admixture is required.

203.7 Geotextile:

- a. Geotextiles shall be non-woven polypropylene or polyester, weighing a minimum of 4-oz./square yard.

204. MATERIAL ADJUSTMENTS

- 204.1 Owner reserves the right to require adjustment of the proportion of materials in the field for flowability, to maintain solid suspension of the mix and other criteria. No additional compensation shall be paid to the Contractor for mix adjustments.

205. FORMWORK

- 205.1 When formwork is used, it shall be capable of withstanding a lateral fluid pressure equal to the total weight of the unhardened CLSM with a minimum factor of safety of 1.3.

**PART 3 - EXECUTION**

301. PLACING CLSM

301.1 Forms and Dikes:

- a. Provide forms or dikes as required to contain the CLSM as it is placed.
- b. Forms shall comply with the requirements as specified herein.



- c. Dikes may be made using the CLSM design mix with the water content reduced as required to enable mounding of the mix. The stiffer mix shall have a flow consistency of at least four (4) inches or a slump of at least three (3) inches for adequate consolidation and to minimize honeycombing. The dikes can be incorporated as a part of the total CLSM deposit.

301.2 General Placement Requirements:

- a. CLSM shall not be placed prior to obtaining approval from Owner.
- b. CLSM shall not be placed when the temperature of the material is less than 50 degrees F.
- c. Placement may not begin unless the air temperature is at least 35 degrees F and rising. Placement shall stop when the air temperature is 40 degrees F and falling.
- d. CLSM shall not be placed over frozen ground.
- e. The in-place material shall be protected from freezing until the next lift is placed, or for a minimum of twenty-four (24) hours. The surface of completed fill shall not be left exposed under freezing temperatures. At a minimum, an insulating cover shall be placed on the finished fill surface.
- f. The finished surface shall be protected from damage.

301.3 Placement:

- a. The CLSM material shall be placed directly from the truck chute into the trench. No vibration or compaction is required.
- b. The maximum thickness shall be one four (4) foot lift in any twenty-four (24) hour period unless approved by Owner.
- c. A new lift shall not be placed over preceding lift until the preceding lift has hardened sufficiently to support foot traffic.
- d. The speed of placement of the CLSM shall be controlled so that the surface bleed water dissipates properly.
- e. If lumps are present in the mix, the material shall be remixed as necessary or another method can be used to break up the lumps.
- f. CLSM shall not be placed through water. If an excavation cannot be dewatered, place the fill by a tremie procedure. CLSM damaged by flowing water shall be removed and replaced. Special protection for light to moderate rain is not required but material shall not be placed during a heavy rainfall.

301.4 Pipe Bedding and Backfill:

- a. Adequate support shall be provided to maintain the minimum specified thickness of bedding between the trench bottom and the bottom of the pipe and to protect the pipe from damage, movement, or improper alignment.



- b. If possible, a joint for a pressure pipe shall not be located within the volume to be backfilled with CLSM. If a pipe joint must be located within the CLSM, the joint shall be pressure tested and accepted prior to placing the CLSM.
- c. The pipe shall be protected from intrusion of CLSM into the pipe.
- d. Protection shall be provided against floating of the pipe. Where necessary, place CLSM in lifts or provide weights, ballast, or structural tie-downs to hold down the pipe until the CLSM has set. If tie-downs are not provided, the first layer of backfill shall stop at one-fourth the height of the pipe, the second layer at one-half the height of the pipe. The remainder of the trench may be backfilled in accordance with the requirements specified herein.
- e. The backfill shall be distributed evenly on each side of a pipe to prevent movement.
- f. If future pipe repair or replacement is planned, a geotextile shall be placed around the pipe prior to placing the CLSM to ease separation of the backfill from the pipe.

301.5 Utility Trench Backfill:

- a. Adequate structural tie-downs or weights shall be provided where required to hold down utility conduits or ducts to prevent floating until the CLSM has set.
- b. Adequate support shall be provided to maintain proper alignment of the utility during placement of the CLSM.

301.6 Structural Backfill:

- a. When backfilling under and around foundations, the CLSM shall be placed in lifts so that the lateral pressures due to the backfill do not exceed the strength of the structure. Side slopes shall be stepped to prevent wedging action of the backfill against the structure.
- b. Lift placement shall be in accordance with the requirements specified herein.
- c. A geotextile shall be provided as a separator between foundation drains and the CLSM to prevent contamination of the drainage material.
- d. Existing structures, drainage facilities, utilities, etc., which are intended to stay within the fill area shall be protected from movement, damage, or misalignment during placement of the CLSM. Damaged items shall be replaced by the Contractor at no additional cost to Owner.

302. PROTECTION

- 302.1 The Contractor shall furnish and maintain protection for CLSM until it has hardened and the surface bleed water has dissipated and the surface is dry.
- 302.2 The CLSM shall not be opened to foot traffic or forms removed for a minimum of twenty-four (24) hours after being placed.
- 302.3 Granular fill shall not be placed and compacted over the CLSM for a minimum of forty-eight (48) hours after the CLSM is placed, or until a minimum compressive strength of twenty-five (25) psi has been attained. Work may begin sooner if the ball drop test is



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Controlled Low-Strength Material



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performed in accordance with ASTM D6024 and the requirements of the tests required herein are satisfied.

END OF SECTION 312335

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**SECTION 316213**  
**PRESTRESSED PRECAST CONCRETE DRIVEN PILE**

**PART 1 - GENERAL**

101.           EXTENT

- 101.1           The fabrication and installation of prestressed precast concrete piles shall conform to the requirements of this Section unless otherwise indicated on the design drawings or as required for the Work.
- 101.2           Contractor shall, when required by Owner, perform initial earthwork to excavate to the bottom of pile-supported foundations to establish a working grade for pile installation and final cutoff. Bottom of pile-supported foundations and/or top of piles shall be as indicated on the design drawings. Excavated material shall be removed off the Project site. When a temporary on-site stockpile area is requested, it shall be stockpiled at a designated area as directed by Owner before being hauled away.
- 101.3           Contractor shall furnish all material, labor, tools and equipment necessary to fabricate and install the quantity of piles as indicated on the design drawings. The load carrying capacity and depth of penetration for the piles shall be as specified in Article 102 of this specification section and the design drawings.
- 101.4           Contractor shall fabricate the piles conforming to PCI MNL-116 and as specified in Articles 105, 108, and 201 through 204.
- 101.5           Contractor shall perform the Wave Equation Analysis to select the proper hammer and energy, and to estimate pile drivability for both driving stress and final set criteria at ultimate pile compression load for the given site specific conditions prior to pre-production pile load test program.
- 101.6           Contractor shall perform pile load testing as specified in Article 307 of this specification section. The installation of the production piles shall be based on the results of the pile load test program after acceptance by Owner and Engineer.
- 101.7           The location and quantity of the piles to be installed shall be as indicated on the design drawings. Contractor shall contact the station personnel to identify all underground utilities in the area of Work. Contractor shall be responsible for staking the pile locations using the reference bench marks provided by the Owner. Any interference with the underground utilities shall be brought to the Owner's attention for immediate resolution.
- 101.8           Contractor shall provide all required prequalification documents for acceptance.
- 101.9           Contractor shall provide details of all materials per the required submittals.
- 101.10           Contractor shall remove and dispose of all debris, cutoffs and excessive material at completion of Work at an off-site facility.
- 101.11           Contractor shall perform as-built survey of the completed piles.



101.12 Contractor shall provide a report at the conclusion of the Work that records the data obtained during pile fabrication, installation, including pile driving records, quantity, materials used, and equipment.

102. DESIGN CRITERIA

102.1 The actual pile design capacities for production piles will be verified based on the results of the pile load tests. Refer to design drawings for minimum design allowable capacities of piles.

102.2 Tip Elevation: Shall be as shown on the design drawings or as determined by the approved final set driving criteria based on the outcome of the test pile installation and pile load test results. It is anticipated that the piles are to be installed reaching practical refusal into very dense cemented sand with limestone fragments.

102.3 The structural components of the piles including concrete and reinforcement are designed in accordance with Florida Department of Transportation (FDOT) Design Standards for square prestressed concrete piles.

103. SOIL DATA AND TOPOGRAPHY

103.1 Geotechnical information for this project is provided as Attachment 3 to this specification. Soil borings in the area of pile foundations are SB-100, SB-101, SB-102, SB-103, SB-104, Boring Log No. Point 5, Boring Log No. Point 6, Boring Log No. Point 7, and Boring Log No. Point 8. This information is furnished for Contractor's convenience; in using it, Contractor assumes the risk, as Owner and the Engineer assume no responsibility for accuracy of information indicated thereon. Contractor will be permitted to make its own soil investigation, at no cost to Owner.

104. LINES AND GRADES

104.1 Contractor shall lay out lines and grades from existing base lines and bench marks on the property and be fully responsible for correctness of such lines and grades and for proper execution of the Work to such lines and grades.

104.2 Owner reserves the right to verify correctness of lines and grades during progress of work. Such verification by Owner will not relieve Contractor of responsibility as specified foregoing.

104.3 Contractor shall notify the Engineer of any differences in location of existing Work from that indicated, wherever such differences may affect new Work.

104.4 Contractor shall preserve and maintain all bench marks and reference points established by Owner. Should Contractor, during prosecution of Work, destroy or remove any bench marks and/or reference points established by Owner, the cost to Owner of reestablishing these bench marks and/or reference points will be charged to Contractor.

104.5 Contractor shall set out and install marker pins for the pile positions.

105. QUALIFICATIONS

105.1 The piling fabricator shall have been regularly engaged in the production of prestressed precast concrete piles for a period of not less than five (5) years, and show a quality capability through certification with PCI (Plant Certification Program), or on FDOT's List of



Producers with Accepted Quality Control Programs for prestressed concrete products production facility.

105.2 The CONTRACTOR shall have a minimum of five (5) years of experience installing prestressed precast concrete piles.

105.3 The field work and data analysis of the Dynamic Testing Consultant shall be performed by, or under the direct supervision of a Professional Engineer licensed in the State of Florida, with a minimum of ten (10) years' experience in the performance and evaluation of dynamic testing procedures.

106. REFERENCED DOCUMENTS

106.1 General:

- a. Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. References to these documents shall be to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, etc., thereto, in effect as of the date of Contract for the Work.
- b. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.
- c. Abbreviations listed indicate the form used to identify the reference documents in the specification text.

106.2 ACI – American Concrete Institute:

- a. 315 – Details and Detailing of Concrete Reinforcement.
- b. 318 – Building Code Requirements for Structural Concrete.

106.3 ASTM – ASTM International:

- a. A82 – Standard Specification for Steel Wire, Plain for Concrete Reinforcement.
- b. A416 – Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete.
- c. A421 – Standard Specification for Stress-Relieved Steel Wire for Prestressed Concrete.
- d. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- e. C 150 – Standard Specification for Portland Cement.
- f. C 226 – Standard Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement
- g. C 595 – Standard Specification for Blended Hydraulic Cements.



- h. D3740 – Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- i. D3966 – Standard Test Methods for Deep Foundations Under Lateral Loads.
- j. D4945 – Standard Test Method for High-Strain Dynamic Testing of Deep Foundations.
- 106.4 AWS – American Welding Society:
  - a. D1.4 – Structural Welding Code –Steel Reinforcing Bars.
- 106.5 FDOT – Florida Department of Transportation:
  - a. Standard Specification for Road and Bridge Construction.
  - b. Design Standards for Square Prestressed Concrete Piles (Index No. 20600 & 20614).
- 106.6 PCI – Prestressed Concrete Institute:
  - a. MNL-116 – Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
  - b. MNL-120 – PCI Design Handbook, Precast and Prestressed Concrete
- 106.7 ICC – International Code Council
  - a. Adopted Building Code, FBC 2020 – Florida Building Code
- 107. SUBMITTALS
- 107.1 Submit the following documents to the Owner and Engineer prior to start of site mobilization for review:
  - a. Pile driving equipment description in accordance with the requirements of Article 302 of this specification section.
  - b. Results of the Wave Equation Analysis to select proper hammer and energy required to drive the piles to their design depth and capacity without damaging the piles for the given site specific conditions.
  - c. Shop Drawings indicating reinforcing details, erection details, build-up details, splice details if any, and special embedded or attached lifting devices. Shop drawings shall indicate pick-up and support points for piles. Reinforcing details shall conform to ACI 315.
  - d. Prior to pile installation:
    - d1. Submit fabrication records including concrete records for each member indicating date, time and duration of casting, mix proportions, mixing water corrections, slump, air content, method of curing, ambient temperature during curing, duration of curing, concrete strength at time of detensioning, and twenty-eight (28)- -day concrete strength.
    - d2. Tensioning and detensioning records indicating date and time of each load, stress, and elongation of strand group under loading and unloading.



- e. A construction quality control plan for all aspects of installation. The plan shall also address what actions will be taken if early refusal is encountered.
- 107.2 Submit the following documents to the Owner at completion of work:
- a. Records of pile installation in accordance with the requirements of Article 306 of this specification section.
108. **CONSTRUCTION QUALITY CONTROL**
- 108.1 Material used for construction shall be new and certified as being the ASTM grade specified (or approved equivalent) by physical and chemical test reports. Unless otherwise specified by the Owner, material used for construction shall be as specified herein and/or selected by the Contractor, based on its experience as to what is the most suitable for use in the service described herein. The Contractor's material selection shall be subject to the review and written approval of the Owner.
- 108.2 Owner will engage an independent testing and inspection agency (construction observation firm) who is in compliance with ASTM D3740 to observe and record the pile installation work in progress. Contractor's cooperation is required in this matter.
- 108.3 Contractor shall use care in handling the materials for pile fabrication, delivering, erection, and installation to ensure they are not damaged during the course of the Work.
- 108.4 Piles shall be manufactured in a plant with an established quality control program as attested to by a current certification in the PCI "Certification Program for Quality Control" (PCI certified plant) or on FDOT's List of Producers with Accepted Quality Control Programs for prestressed concrete products production facility and/or fabricate the piling in accordance with PCI MNL-116.

## **PART 2 – PRODUCTS**

201. **GENERAL REQUIREMENTS**
- 201.1 Piles shall conform to FDOT Design Standards for Square Prestressed Concrete Piles (Index No. 20600 & 20614) or equivalent later versions.
- 201.2 Construction of piles shall conform to FDOT "Standard Specification for Road and Bridge Construction".
- 201.3 General Requirements:
- a. Prestressed reinforced-concrete piles shall be solid, shall be cast as monolithic units of homogeneous high-strength concrete, (Class III in accordance with FDOT Standard Specifications) from butt to tip, and shall be stressed with high-tensile, uncoated, cold-drawn, stressed-relieved steel strands.
  - b. Design criteria shall be in accordance with PCI Manual MNL-120.
  - c. Piles shall be structurally capable of supporting the minimum design capacity as indicated on the design drawings.



- d. Piles shall be designed to withstand stresses associated with handling, storage, and pile driving.
- e. The ends of all piles and the corners of square piles shall be chamfered.
- f. Piles shall present a true, smooth, and even surface free from any surface blemishes.

201.4 Fabrication Tolerance:

- a. Conform to FDOT Standard Specifications and PCI MNL-116, unless stated herein otherwise.
- b. Pile outside width: +3/8" or -1/4".
- c. Pile concrete cover over reinforcing steel: +1/4" or -1/2".

202. PRESTRESSING STEEL REINFORCEMENT

- 202.1 Prestressing steel shall be seven-wire low-relaxation steel strand conforming to ASTM A416, or stress-relieved wire conforming to ASTM A421, Type WA.
- 202.2 The minimum ultimate strength shall be 270,000 pounds per square inch (psi).
- 202.3 Prestressing steel shall be free from grease, oil, wax, paint, soil, dirt, loose rust, kinks, bends, or other defects.

203. NON-PRESTRESSED STEEL REINFORCEMENT

- 203.1 Non-prestressed reinforcing steel shall conform to ASTM A615, Grade 60.
- 203.2 Steel for ties and spirals shall conform to ASTM A82.
- 203.3 Welding of reinforcing steel shall not be performed without prior written approval by the Owner, and then only to be performed in accordance with AWS D1.4.

204. CONCRETE

- 204.1 Cement: ASTM C 150, C226 or C595. Type IV cement shall not be used. The tricalcium aluminate content of the cement shall be limited to a maximum amount not in excess of 8 percent (8%). Cement type shall consider sulfate exposure in soil per ACI 318.
- 204.2 Concrete design mix and its ingredients shall conform to FDOT Standard Specifications.
- 204.3 The use of calcium chloride is not permitted.
- 204.4 Piles shall be constructed of dense concrete possessing a minimum ultimate compressive strength of 6,000 psi in twenty-eight (28) days.
- 204.5 Records of pile concrete shall conform to FDOT Standard Specifications and be submitted to Owner prior to delivering to the site for installation.

**PART 3 – EXECUTION**



301. PILE HANDLING AND STORAGE

- 301.1 Unless special lifting devices are attached for pick-up, pick-up points shall be clearly and plainly marked on all piles after removal of forms, and all lifting shall be performed at these points.
- 301.2 Piles shall be lifted and handled by a suitable bridge or sling where required, which shall be attached to the pick-up points.
- 301.3 Special care shall be provided in handling and transporting concrete piles to prevent any appreciable buckling of the pile or cracking of the concrete.
- 301.4 Storage areas for prestressed piles shall be stabilized, and a suitable base shall be provided, so that differential settlement or twisting of pile shall not occur.
- 301.5 Stacked piles will not be permitted unless Contractor provides appropriately separated and supported battens placed across the full width of each bearing point.
- 301.6 Battens used for storage of piles shall be arranged in vertical planes at a distance not greater than the width of the pile from designated pick-up points.

302. PILE DRIVING EQUIPMENT

- 302.1 Use proper hammer of type and capacity required to achieve the specified design capacity, as determined from the results of the Wave Equation Analysis to prevent overstressing and damaging the piles.
- 302.2 The use of sonic or vibratory hammers is not permitted.
- 302.3 Diesel hammer may be used provided that the energy output can be controlled and monitored. The method to be used to monitor the energy (setting, pressure and stroke) shall be submitted with the proposal.
- 302.4 Operate hammer at all times to maintain the speed recommended by manufacturer.
- 302.5 Pile drivers with firmly supported fixed leads extending down to the lowest point that the hammer must reach are acceptable; short leads suspended from a line and braced only by lines will not be acceptable unless piles are rigidly braced and held in alignment by suitable guide frames prior to pile driving. Leads with spear (auger) points fixed to the lower lead end, embedded in the ground adjacent to the pile and fixed or suspended from the pile driving rig are acceptable, provided the leads remain stationary during pile driving.
  - a. The boiler or compressor capacities for the steam- or air-operated hammers shall be sufficient to operate the hammer continuously at the full-rated speed and energy.
  - b. For the steam- or air-operated pile hammers, the Contractor shall provide a pressure gauge to be located on the hammer steam or air line in a position such that it can be clearly read by the pile driver operator.
  - c. For the double-acting diesel hammer, the Contractor shall provide a bounce chamber pressure gauge to be located in a position such that it can be clearly read by the pile driver operator.





- d. For a single-acting diesel hammer, the Contractor shall mark the ram as approved by the Owner and its Inspector to permit determination of the stroke, unless an acceptable device is provided to automatically determine the stroke.
- 302.6 The type and quantity of equipment furnished shall be sufficient to complete the Work within the specified time. If at any time during the Work, the Owner determines that satisfactory results are not being obtained with Contractor's equipment, equipment of other rated capacity meeting Owner's approval shall be supplied and used.
- 302.7 The same type, energy rating and operating rate of the hammer used to drive the test piles shall be used for all production piles.
- 302.8 Capblock (Hammer Cushion) and Pile Cushion: Fabricate of aluminum and plastic laminized discs stacked alternately in a steel housing with steel top and bottom plates. If approved by Owner, a one-piece hardwood block with the grain parallel to the axis, enclosed in a tight-fitting steel housing, may be used. The selection of the cushion shall be based on establishing a satisfactory driving criterion through the Wave Equation Analysis and verified by the pile load testing. The same type and size of hammer cushion used to drive the test piles shall also be used for all production piles.
- 302.9 The capblock or cushion materials shall be replaced during driving if it has been damaged, highly compressed, charred, burned, or has become spongy or deteriorated in any manner.
- 302.10 Use a suitable driving head to prevent excessive upsetting or damaging of pile heads under driving.
- 302.11 Templates: Provide a fixed steel pile template adequate to maintain the pile in proper position and alignment during driving in accordance with FDOT Standard Specification Section 455.
- 303. INSTALLATION OF PILES
- 303.1 Piles shall not be driven until twenty-eight (28) days have elapsed from the time of casting or the Contractor shall provide documented evidence that the pile has attained its intended minimum ultimate compressive strength.
- 303.2 Preaugering or jetting of piles will not be permitted unless approved by the Owner and Engineer. The use of an air-driven hammer that has not been operated for three hours or more or fresh pile cushion material, just before final penetration, will not be permitted.
- 303.3 Pile shall be marked clearly with per foot scale and every inch for the final set before being driven.
- 303.4 Drive piles in a sequential operation, which will minimize heaving of adjacent piles.
- 303.5 No method requiring force to correct the position or alignment of any pile during driving will be permitted.
- 303.6 Drive piles to the minimum penetration length specified on the design drawings and to the approved minimum driving resistance, as determined by the pre-production pile load testing. The minimum driving resistance will be determined utilizing the U.S. Department of Transportation, Federal Highway Administration's Wave Equation Analysis of Pile Driving (WEAP) for the pile hammer and associated capblock-cushion materials and properties performed by the Contractor, and as verified by the load test results.



- 303.7 After piles have been driven, check to determine if any piles have heaved due to driving of adjacent piles. Redrive piles that have heaved more than 1/8" as directed by Owner; cost of re-driving shall be included in the Contract Price.
- 303.8 Drive piles per driving criteria without interruption unless prevented by unforeseen causes or if directed by the Owner.
- 303.9 The final driving resistance (set) shall be established during the pile load test program.
- 303.10 Immediately after pile is completely driven, check for alignment, tolerance and damage if any.

304. PILE CUTOFF

- 304.1 Cut off top of piles at design elevations indicated, only after there is no danger from upheaval. Make cuts at right angles to vertical axis of piles with proper tools without damaging the pile. All cutoffs shall become property of Contractor and shall be removed by him from the Project Site.
- 304.2 The detail of pile top connection to foundation/pile cap shall be as indicated on design drawings.

305. TOLERANCES FOR PILE INSTALLATION

- 305.1 Installation tolerances shall conform to the design drawing notes.
- 305.2 If piles are installed out of plan position or out of plumb or elevation, notify the Owner, in writing, immediately. The Owner may accept the out of tolerance piles on a case by case basis. If not accepted, the Contractor shall submit remediation proposals to the Owner for review before proceeding. If the alternate proposal is not accepted, install additional piles as requested to properly provide for load conditions and to avoid overstressing of piles. Damaged or unacceptable out of tolerance piles shall be cut off below grade and abandoned and new piles shall be driven at offset locations determined by the Engineer. No payment will be allowed for additional piles required by any of the foregoing causes, or required by improper driving.

306. RECORDS OF PILE CONSTRUCTION

- 306.1 During course of the Work, both the Contractor and the Independent Testing Agency shall maintain a complete record of pile installation, submit the pile installation record daily during installation and at completion of pile work. Submit record drawings which shall include the following data for each pile:
  - a. Type of and size of pile. Pile driven length, ground surface/working grade elevation, pile tip elevation, and cutoff elevation. Pile splicing details if used.
  - b. Date, time, duration of driving, rate of penetration, and number of blows for every foot of penetration, including the blows per inch for the last twelve (12) inches.
  - c. Type of equipment used to install the piles including size, energy, and efficiency of hammer, capblock cushion data (material and dimensions).
  - d. Pressure gauge readings or hammer ram stroke, energy setting, hammer speed in blows per minute during driving, etc.



- e. Actual location of piles as driven (as-built), with variations from plan locations indicated.
- f. Variations in plumbness or batter. Variations in elevation.
- g. Any unusual phenomena encountered in driving piles, including data for heaving and re-driving heaved piles.
- h. Complete final records of pile construction which includes pile fabrication/casting records (maintained and submitted by Contractor's qualified fabricator) and installation records due within one (1) week of completing Work.

307. PRE-PRODUCTION PILE LOAD TESTING

- 307.1 Contractor shall retain a qualified independent Dynamic Testing Consultant to perform high-strain dynamic pile testing using the PDA per ASTM D4945 on a separate (sacrificial non-production) pile installed for testing purposes at a designated location selected by Owner.
- 307.2 CAPWAP analyses shall be performed after the field testing to determine the mobilized capacity that is at least twice the pile design capacity after any possible relaxation, at the design pile penetration depth, and at a practical driving refusal when it occurs.
- 307.3 Production pile driving criteria shall be established based on the results of the pile load testing as approved by Owner and Engineer.
- 307.4 Dynamic testing requires attaching two strain transducers and two accelerometers to the pile usually 1.5 to 3 pile diameters below the pile head during initial driving or at a convenient location during restrike testing when required by Owner. A cable connects the sensors on the pile with the Pile Driving Analyzer located at ground level at a safe distance from the pile. The equipment shall conform to the requirements of ASTM D4945.
- 307.5 Detailed reports prepared by the Dynamic Testing Consultant for testing performed on pre-production test pile shall at a minimum document the following:
- a. The signature and seal (final versions only) of the Dynamic Testing Consultant's responsible Professional Engineer (licensed in the State of Florida).
  - b. The methods utilized to obtain and evaluate the field data.
  - c. Results and findings of the dynamic high-strain dynamic testing, including: impact energy, fall height, displacement, skin friction and end bearing pile capacity mobilized by each test.
  - d. The CAPWAP output from all high-strain dynamic tests.
  - e. Observations and conclusions of Dynamic Pile Consultant regarding pile testing program, pile integrity, defects if any and pile carrying capacities.
  - f. The reports shall document all other applicable reporting requirements of ASTM D4945.
- 307.6 LATERAL LOAD TEST
- a. Perform the lateral load test on the same test pile after the dynamic test is completed successfully (provided the pile is not structurally damaged and not laterally disturbed) in accordance with the applicable requirements of ASTM D3966 unless otherwise indicated on the design drawings.



- b. Testing shall be performed for a free-head condition.
- c. The required free-head design allowable lateral capacity to be tested in accordance with ASTM D3966 is 7.0 kips.
- d. Test loads shall be applied in accordance with the standard loading procedures (Procedure A) specified in ASTM D3966.
- e. Test pile shall also be loaded according to the Excess Loading procedure (Procedure B) specified in ASTM D3966 until pile failure occurs. The maximum test load shall be at least three (3) times the design allowable load.
- f. Failure of the test pile is defined as the load at which horizontal displacement continues to increase without any further increase in load.
- g. Monitor head movement and rotation using a minimum of two (2) dial/displacement gauges mounted to an independent frame located to suit test conditions. One dial/displacement gauge shall be at or near ground level and the other shall be 12" to 18" higher along the axis of the pile. Dial/displacement gauges shall be mounted perpendicular to the longitudinal axis of the pile to assure at least three (3) inches of lateral pile displacement, in the direction the lateral force is applied, can be monitored.
- h. As a minimum, at the beginning and end of each load increment or decrement, record the reading from all dial/displacement gauges.
- i. The allowable lateral load shall be established in accordance with the FBC 2020 – Florida Building Code.

END OF SECTION 316213



**SECTION 330301**  
**INSTALLATION OF UNDERGROUND GRAVITY SEWERS**

**PART 1 – GENERAL**

101. **EXTENT**

101.1 This Specification Section defines the minimum requirements for pipe laying, jointing, and testing for gravity sewers, manholes, and catch basins installed underground in accordance with the design drawings and specified herein.

101.2 Sewers Included:

- a. Storm Water Sewers.
- b. Sanitary Sewers.
- c. Oily Water Sewers.

101.3 The work shall include, but not be limited to, the following items:

- a. Furnish all materials.
- b. Provide submittals as specified.
- c. Surveying to establish lines and grades.
- d. Dewatering of excavations.
- e. Installation and jointing of pipe.
- f. Installation of polyethylene tubes.
- g. Installation of manholes, catch basins, and cleanouts.
- h. Installation of temporary plugs as required.
- i. Cleaning of finished sewers.
- j. Acceptance testing of installed sewers.

102. **RELATED WORK SPECIFIED IN OTHER SECTIONS**

102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:

- a. Section 312333 – Excavation and Backfill for Underground Utilities
- b. Section 330302 – Installation of HDPE Pressure Water and Sewer Piping

103. **REFERENCE DOCUMENTS**

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state or local codes having jurisdiction.



- 103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of the Contract for the Work.
- 103.3 Abbreviations listed indicate the form used to identify the reference documents in the specification text.
- 103.4 ASTM - ASTM International:
- a. A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
  - b. A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
  - c. C33 – Standard Specification for Concrete Aggregates.
  - d. C150 – Standard Specification for Portland Cement.
  - e. C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
  - f. C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
  - g. C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
  - h. C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
  - i. C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
  - j. C 103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
  - k. C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
  - l. D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
  - m. D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
  - n. F1417 - Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air.
- 103.5 AWWA - American Water Works Association:
- a. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Water Pipe Systems.
  - b. ANSI/AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.



104. SUBMITTALS

104.1 Contractor shall submit drawings and data as listed below. Contractor's drawings and data shall be submitted via electronic medium in a format compatible for importing into Owner's information systems specified by Owner.

104.2 Pressure Test, Leak Tests and Deflection Tests:

- a. Contractor shall provide forms indicating the following for each initial leak test and all retests performed:
  - a1. Date and time.
  - a2. Portion of line being tested.
  - a3. Type of test.
  - a4. Duration of test.
  - a5. Test results.
- b. Flexible Watertight Connections for Sanitary Sewers and Oily Water Sewers: Contractor shall submit the proposed method and equipment for making flexible watertight connections for pipes at manholes in sanitary and oily water sewers.
- c. Manufacturer's Installation Instructions: Contractor shall indicate special Manufacturer's instructions and procedures required to install products specified.

105. QUALITY ASSURANCE

105.1 Materials, construction procedures, and testing shall be subject to inspection and tests conducted by an Independent Testing Service employed by the Owner. Such inspections and tests will not relieve the Contractor of its responsibility for providing materials and installation in compliance with specified requirements.

105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The Contractor shall correct the deficiencies that are not in compliance to this Specification per conducted inspections and tests.

**PART 2 - PRODUCTS**

201. MATERIALS

201.1 Sewer pipe materials shall be as specified in Design Drawings.

201.2 Cement Grout:

- a. Cement grout shall be used for the following purposes:
  - a1. Mortar bed for inside base of manholes.
  - a2. Grout for filling lift holes in precast concrete pipe and manhole elements.
- b. Grout shall consist of one part Type I Portland Cement in accordance with ASTM C150 and three parts sand in accordance with ASTM C33 with a minimum amount of water to



ensure workability. The water-cement ratio shall not be less than 0.50 by weight. All grouts shall have a minimum compressive strength of 4000 psi at twenty-eight (28) days.

- 201.3 Polyethylene tubes for encasing Cast-Iron Soil Pipe or Ductile-Iron Water Pipe shall be in accordance with AWWA C105, ASTM A74, or ASTM A674. Either 8-mil thick linear low-density polyethylene or 4-mil thick cross-laminated high-density polyethylene tubes are acceptable.
- 201.4 Butyl rubber sealant shall be supplied in extruded rope form. The material shall comply with the composition and physical requirements specified in ASTM C990. The rope used for sealing tongue and groove manhole sections shall be of suitable cross section to fill the annular space when the sections are joined. The rope used for setting grade rings and manhole covers shall be a minimum of 1 inch x 1 inch. Press Seal EZ-STIK, or approved equal.

### **PART 3 - EXECUTION**

#### **301. GENERAL INSTALLATION REQUIREMENTS**

- 301.1 Surveying and Identification of Existing Underground Utilities:
- a. The Contractor shall be responsible for all surveying to establish line and grade of the sewers and identifying existing underground piping.
  - b. The Contractor shall notify the appropriate building department or water reclamation district a minimum of two (2) working days, or more if required by permit, prior to the start of work. Prior to the start of work, the Contractor shall establish the location of existing underground pipes, conduits or cables adjoining or crossing proposed construction.
- 301.2 Trench excavation and backfill shall be in accordance with Section 312333, Excavation and Backfill for Underground Utilities.
- 301.3 Dewatering:
- a. The Contractor shall dewater trench excavations to maintain the water level twelve (12) inches below the trench bottom or base of the bedding course. Dewatering shall be accomplished prior to pipe laying and jointing. The dewatering operation shall be carried out so that the bottom of the trench is firm during the pipe laying operation and so that the strength of the soil under or alongside the trench is not weakened.
  - b. The Contractor shall exercise caution when terminating the dewatering operation to avoid disturbing the pipe installation.
- 301.4 Handling of Pipe and Fittings:
- a. Pipe sections shall be handled and placed using appropriate equipment to prevent damage to the pipe. To avoid damage, the pipe should not be dropped. When using equipment to unload or move the pipe, a fork extension can be used. Chains or wire ropes shall not be used to lift the pipe. The use of nylon slings is acceptable. If slings are used, pipe shall be picked up from two or more places on the pipe. Any damaged sections shall be removed and replaced.





- b. The pipe and fittings shall be inspected by the Contractor for defects before being installed.
- c. Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during the handling and laying operations. Any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and relaid.
- d. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by Owner to ensure absolute cleanliness inside the pipe.

301.5 Installation of Pipe:

- a. Installation of pipe shall proceed only after the trench has been dewatered and the pipe bedding has been installed.
- b. Pipe shall be installed to the lines and grades shown on the design drawings. Pipes shall be laid with straight alignments and at a continuous slope. Curvilinear alignments are not allowed unless specified on the design drawings. No breaks in slope are allowed except at manholes and at bends in laterals where a cleanout for the downstream lateral has been provided.
- c. All sewer pipes shall be installed with the bell end forward or upgrade to prevent bedding material from entering the joint. Suitable excavation shall be made for the socket, coupling, or bell to prevent point loading of the bells or couplers of laid pipe and to establish full-length support of the pipe barrel.
- d. All laid pipes shall be retained in position to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place.
- e. At least three batterboards shall be maintained in position during all pipe-laying operations, unless a laser beam is used.
- f. The pipe bedding shall be placed so that the entire length of the pipe will have full bearing. No blocking of any kind shall be used to adjust the pipe to grade except when used with concrete encasement.

301.6 Installation Tolerances:

- a. Pipe sections shall be laid and joined so that the horizontal offset of the inside of the pipe at any joint shall not be larger than 1-percent (1%) of the inside diameter of the pipe or 3/8-inch, whichever is smaller.
- b. The pipe shall be laid and joined so that the maximum variation from the slope gradient specified on the design drawings is 1/8-inch in ten (10) feet.

302. FIELD JOINTING PIPE

302.1 General Requirements for Making Joints:

- a. Follow Manufacturer's instructions for assembly of joint components, lubrication, and making of joints.



- b. When pipe laying is interrupted, secure the pipe against movement and seal open ends to prevent intrusion of water, mud, or foreign material.
- c. Care shall be taken when handling the pipe after the gasket has been affixed to avoid disturbing the gasket and knocking it out of position or loading it with dirt or other foreign material. Any gasket so disturbed shall be removed, cleaned, and relubricated or replaced, if required before the joining is attempted.
- d. Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand; sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.
- e. Sufficient pressure shall be applied in making the joint to assure that it is home, as described in the installation instructions provided by the pipe manufacturer. Sufficient restraint shall be applied to the pipe to assure that joints once home are held so, until fill material under and alongside the pipe has been sufficiently compacted. At the end of the workday, the last pipe laid shall be blocked in an effective way to prevent creep.
- f. If pipe is specified on the design drawings to be laid on a curved alignment, the pipe shall first be joined in a straight alignment and then deflected, joint by joint. Special care shall be taken in blocking the previously laid pipe to resist the misaligning forces occurring during compression of the joints being made.

302.2 Field Jointing of Cast Iron Soil Pipe with Gasket Joints:

- a. The gasket and gasket seal inside the socket shall be wiped clean before the gasket is inserted. A thin film of lubricant shall be applied to the gasket and the outside of the spigot end of the pipe. Lubricant other than that furnished with the pipe shall not be used. The spigot shall then be positioned inside the socket and shoved home.

302.3 Field Jointing of Ductile Iron Pipe:

- a. Mechanical joints shall be assembled as described in ANSI/AWWA C600.
- b. Bell and spigot push-on joints shall be assembled as described in ANSI/AWWA C600.
- c. Flanged joints shall be firmly and fully bolted with machine bolts of the specified size. Gaskets of the type specified shall be used at all joints.

302.4 Field Jointing of Corrugated HDPE (CHDPE) Pipe:

- a. Pipe sections shall be placed so that markings used for alignment will be facing up. Align markings prior to joining pipe.
- b. When using bell and spigot pipe sections, the bell section shall be inspected to ensure that it is clean and free of grit and mud and that the gasket is properly seated. Insert spigot ends in accordance with Manufacturer's instructions to attain proper insertion depths.
- c. When using split couplings, properly align markings prior to attaching coupling in accordance with Manufacturer's instructions.



- d. Field cutting shall be performed using a handsaw or power pipe cutoff saw. All cuts shall be made in a valley of a corrugation. Do not cut into the sidewall of an annular corrugation. A split coupling can be used as a cutting guide. Beveling the cut pipe prior to installing an “O” ring gasket joint is not necessary.
- 302.5 Field Jointing of Polyvinyl Chloride Pipe:
- a. Field Jointing of Elastomeric Gasket Joints: Mark, or verify that pipe is marked, to indicate the insertion stop position. The spigot end of the pipe shall be inserted into the pipe or fitting bell to that mark. Follow Manufacturer's instructions for joint assembly. Do not exceed Manufacturer's instructions for annular joint deflection.
  - b. Solvent Cement Joints: Joints shall be made in accordance with ASTM D2855 using solvent cement meeting the requirements of ASTM D2564.
- 302.6 Field Jointing of HDPE Smooth Wall Pipe:
- a. For Field Jointing HDPE pressure rated pipe, see Section 330302, Installation of HDPE Pressure Water and Sewer Piping.
- 302.7 Plugs and Cleanouts:
- a. Plugs for pipe branches, stubs or other open ends, which are not to be immediately connected, shall be made of an approved material and shall be secured in place with a joint comparable to the main line joint. Stoppers may be of an integral cast breakout design.
  - b. Provide cleanouts as specified on the design drawings. The top of cleanouts shall be flush with pavement in paved areas and two (2) inches above grade in unpaved areas.
- 302.8 Jointing of Dissimilar Pipes:
- a. Suitable adaptation couplings shall be specified on the design drawings for joining dissimilar pipes. Flexible couplings shall meet the requirements of ASTM C1173.
- 302.9 Connecting to Existing Sanitary Sewer:
- a. When connecting to an existing sanitary sewer when a tee or wye has not been furnished, an “Inserta Tee” core and fitting shall be installed. Disruption of an operating sanitary sewer main by breaking or cutting in a tee or wye is prohibited without prior approval. If connecting to a public main, a representative of the sanitary sewer district shall determine the method of connection on a case-by-case basis prior to the start of construction.
303. INSTALLATION OF POLYETHYLENE TUBES
- 303.1 All Cast Iron Soil Pipe and Ductile Iron Water Pipe and appurtenances shall be encased in polyethylene tubes in accordance with the installation procedures described in ASTM A74, ASTM A674, or AWWA C105. The tube size for each pipe diameter shall be as specified in either of those specifications. Odd shaped appurtenances such as fittings and valves that cannot practically be wrapped in a tube shall be wrapped with a flat sheet of split length of polyethylene tube and taped tight.



- 303.2 Either 8-mil thick linear low-density polyethylene or a 4-mil thick cross-laminated high-density polyethylene film is acceptable.
- 303.3 Polyethylene tubes are manufactured with colored (Class B) polyethylene to allow for color coding of wastewater pipelines. Color-coding shall not be provided unless required by the permitting agency.

304. INSTALLATION OF MANHOLES

- 304.1 Manholes shall be leak-tight and constructed of pre-cast concrete units or cast-in-place concrete as specified on the design drawings.
  - a. Foundation and Bedding:
    - a1. An adequate foundation shall be provided for manholes. If necessary, unsuitable foundation material shall be removed and replaced with Granular Bedding Material as specified in Section 312333, Excavation and Backfill for Underground Utilities.
    - a2. Cast-in-place base sections shall be poured directly on a suitable, stable foundation.
    - a3. Precast base section or riser sections with a cast-in concrete-base shall be provided with a six (6) inch thick (minimum) layer of Granular Bedding Material which covers the entire bottom of the excavation. The bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast base. Granular bedding material shall conform to Granular Bedding Material as specified in Specification Section 312333, Excavation and Backfill for Underground Utilities.
  - b. Base and Risers:
    - b1. Precast manholes shall be constructed with a cast-in-place concrete base, or a base that has been cast-in as part of a bottom riser section as specified on the design drawings.
    - b2. All joints between precast elements shall be sealed with butyl rope joint sealant. Sealing with mortar is not allowed.
    - b3. All lift holes on precast elements for sewer manholes shall be completely filled with a concrete plug and sealed with bitumastic material.
    - b4. The first precast riser section shall be placed on the manhole base structure and carefully adjusted to true grade and alignment with all inlet pipes properly installed to form an integral watertight unit. The first precast riser section shall be uniformly supported by the base and shall not bear directly on any of the pipes. A four (4) inch thick layer of cement grout shall be placed around the exterior circumference of the base and on the inside bottom of the manhole.
    - b5. Additional precast risers shall be placed and aligned to provide vertical sides and a vertical alignment of ladder rungs. The completed manhole shall be rigid, true to dimensions, and be watertight.
    - b6. For manholes installed in paved streets or paved plant areas, not more than twelve (12) inches shall be provided between the top of the cone or precast concrete manhole cover



and the underside of the cast iron manhole frame for adjustment of the frame to street grade.

- b7. For manholes installed in a street or paved area which has not been brought to grade, not less than four inches nor more than sixteen inches shall be provided between the top of the cone or top slab and the underside of the cast iron manhole frame for adjustment of the frame to pavement grade.
- b8. Final adjustment may be made by the use of concrete adjustment rings set in butyl rope joint sealant. Mortar joints shall not be allowed. The height of the adjustment shall not exceed eight (8) inches.
- b9. The top of the manhole cover shall be flush with pavement in streets and paved areas and two (2) inches above grade in unpaved areas.

#### 304.2 Placing Cast Iron Frames and Covers:

- a. Frames placed on concrete surfaces shall be set in butyl rope joint sealant. Grout shall not be used. Frames shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary. Wedges and shims shall be provided as required to assure accurate placing of frames.

#### 304.3 Pipe Connections:

- a. All pipe connections to manholes for sanitary sewers and oily water sewers shall be provided with flexible watertight connections as shown on the design drawings.
- b. All pipe connections to manholes for storm sewers shall be sealed with grout.

#### 304.4 Cleaning:

- a. All newly constructed manholes shall be clean of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulation at the time of testing.

### 305. INSTALLATION OF CATCH BASINS

#### 305.1 General:

- a. Catch basins shall be leak tight and constructed of pre-cast or cast-in-place concrete units to the dimensions and requirements specified on the design drawings.
- b. To provide for drainage of road base and rock surfacing, catch basins shall be provided with four - 2 to 2-½ inch diameter holes at 90 degrees of separation located 18 inches to 24 inches below final grade. During backfill, a 12 inch x 12 inch (minimum) piece of 6 oz/sy or heavier non-woven geotextile shall be placed next to the catch basin outside of each hole.

#### 305.2 Installing Concrete Catch Basins:

- a. Precast basins shall be placed on a layer of well-graded Granular Bedding Material as specified in Specification Section 312333, Excavation and Backfill for Underground Utilities not less than six (6) inches thick covering the entire bottom of the excavation.



The bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast element.

- b. Precast catch basins shall be placed and aligned vertically.
- c. Catch basins installed adjacent to roads and in rock surfaced areas shall be backfilled from twelve (12) inches below the drain holes to grade using 1/2 inch to 3/4 inch open graded crushed stone all around to provide subgrade drainage.

305.3 Placing Castings:

- a. Castings shall be set using butyl rope joint sealant. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary. Wedges or shims shall be provided as required to assure accurate placing of the frames.

305.4 Inlet and Outlet Pipes:

- a. All pipe connections shall be grouted in-place, smoothed, and tuck pointed.

305.5 Cleaning:

- a. All newly constructed catch basins and street inlets shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of testing and inspection.

306. ACCEPTANCE TESTING OF INSTALLED SEWERS

306.1 Gravity Sewers Requiring Testing:

- a. All pipe, manholes, catch basins and other appurtenances on the following gravity sewer systems shall be tested for tightness:
  - a1. Sanitary sewers.
  - a2. Storm water sewers twenty-four (24) inches in diameter and smaller.
  - a3. Oily water sewers.
- b. The first 500 feet of storm sewer piping larger than twenty-four (24) inches in diameter shall be tested. If favorable testing results are obtained on the initial test, Owner, at their option, may waive testing of pipe larger than twenty-four (24) inches in diameter and substitute visual inspections. If any of the initial tests on the first sections fail, then all pipes larger than twenty-four (24) inches in diameter shall be tested.

306.2 Testing Requirements:

- a. Testing of gravity sewers twenty-four (24) inches in diameter and smaller shall be in accordance with one of the following methods:
  - a1. Before backfilling, sewers shall be tested for water exfiltration as specified herein.
  - a2. After backfilling, sewers above the groundwater shall be tested for water exfiltration as specified herein. Sewers below the groundwater level shall be tested for water infiltration as specified herein.



- a3. An air pressure test for metallic or concrete piping systems may be substituted for the water exfiltration test if approved by Owner: air pressure testing for plastic piping systems is not allowed.
  - b. Gravity sewers larger than twenty-four (24) inches in diameter:
    - b1. Test metallic or concrete pipes using the air pressure test if pipe is above the groundwater level: air pressure testing for plastic piping systems is not allowed.
    - b2. Test metallic or concrete pipes using the water infiltration test if pipe is below the groundwater level: air pressure testing for plastic piping systems is not allowed.
  - c. Sewers constructed with Thermoplastic Pipe (PVC, HDPE): In addition to the exfiltration and infiltration tests specified above, thermoplastic pipe gravity sewers shall also be tested for deflection if specified by the local governing agency.
- 306.3 Test Sections:
- a. Water exfiltration and infiltration tests shall be conducted from manhole to manhole or between more than two (2) manholes. Laterals tying to the main or to manholes shall be included in the testing. The length of sewer pipe tested at one time shall not exceed 700 feet.
  - b. Deflection of Thermoplastic Pipe:
    - b1. The test sections shall consist of the entire length of the initial 1200 feet of sewer mains plus not less than 10 percent (10%) of the sewer laterals.
    - b2. In the event that 10 percent (10%) or more of the initial length of sewer tested exceeds the allowable deflection limits, the entire length of sewer shall be tested.
- 306.4 Testing Schedule:
- a. All tests shall be completed and approved prior to placing of permanent surfacing.
  - b. Unless otherwise authorized by Owner, the Contractor shall commence testing for water infiltration or water exfiltration within fifteen (15) days after sewer installation has been completed.
- 306.5 Water Exfiltration Test Procedure for All Types of Pipes (patterned after ASTM C969):
- a. Conduct tests between two manholes.
  - b. Determine the groundwater elevation at both ends of the test section. If the groundwater level is less than two (2) feet above the crown of the pipe measured from the highest elevation of the sewer, the exfiltration test shall be used in lieu of the infiltration test.
  - c. Plug all pipe inlets and outlets into the upstream and downstream manholes that will not be included in the test.



- d. Fill the sewer lines with water to a minimum of two (2) feet above the crown of the pipe at the upper manhole and allow the pipe and manholes to remain saturated for a period long enough to allow water absorption by the pipe and manholes. The minimum absorption period is four (4) hours; the maximum absorption period is seventy-two (72) hours.
  - e. After the absorption period, fill the upper manhole to two (2) feet above the crown of the pipe or at least two (2) feet above the existing groundwater level whichever is higher and proceed with testing.
  - f. Measure the leakage loss over a timed test period. The minimum test period shall be one (1) hour. The maximum test period shall not exceed twenty-four (24) hours.
  - g. If the measured rate of leakage is less than or equal to the allowable leakage, the section of sewer tested is acceptable.
  - h. If the test section fails, it shall be repaired and retested. The groundwater elevation shall be redetermined immediately prior to each test.
  - i. Exfiltration Test Leakage Criteria:
    - i1. For exfiltration testing, the allowable leakage limit, including manholes, is 200 gallons per inch of internal pipe diameter per mile of pipe per twenty-four (24) hours when the average head on the test section is three (3) feet or less.
    - i2. When the average head on the test section is greater than three (3) feet, the allowable leakage shall be multiplied by the ratio of the square root of the average test head to the square root of the base head of three (3) feet  $(\sqrt{h} / \sqrt{3})$ .
    - i3. The average head on the test section is the sum of the head above the crown of the pipe at the upstream manhole plus the head above the crown of the pipe at the downstream manhole, divided by two (2).
    - i4. Manholes may be tested separately. Allowable leakage is 0.1 gallons per foot of diameter per foot of head per hour.
- 306.6 Water Infiltration Test Procedure for All Types of Pipes (patterned after ASTM C969):
- a. Conduct tests between manholes.
  - b. Stop all dewatering operations and allow the groundwater to return to its natural level. Infiltration testing shall not be used unless the groundwater level is at least two (2) feet above the crown of the pipe for the entire length of the test section.
  - c. Plug all pipe inlets and outlets discharging into manholes that will not be included in the test.
  - d. Measure the groundwater elevation and determine the average head over the test section.
  - e. Measure the infiltration leakage at the downstream manhole of the test section (best accomplished by filling a container of known volume or by using a weir).





- f. If the measured rate of leakage is less than or equal to the allowable leakage, the section of sewer tested is acceptable.
- g. If the test section fails it shall be repaired and retested.
- h. Infiltration Test Leakage Criteria:
  - h1. For infiltration testing, the allowable leakage limits, including manholes, is 200 gallons per inch of internal pipe diameter per mile of pipe per twenty-four (24) hours when the average head on the test section is six (6) feet or less.
  - h2. When the average groundwater level on the test section is greater than six (6) feet, the allowable leakage shall be increased in proportion to the ratio of the square root of the average groundwater head to the square root of the base head of six (6) feet  $(\sqrt{h} / \sqrt{6})$ .
  - h3. The average head on the test section is the sum of the head above the crown of the pipe at the upstream manhole plus the head above the crown of the pipe at the downstream manhole, divided by two (2).
  - h4. Manholes may be tested separately with an allowance of 0.1 gal per foot of diameter per foot of head per hour.
- 306.7 Low Pressure Air Test Procedure for Concrete and Cast Iron Pipe twenty-four (24) inches in Diameter and Smaller (patterned after ASTM C924, with Written Owner Acceptance):
  - a. The section of the sewer to be tested shall have the trench backfilled to at least two (2) feet above the top of all pipes.
  - b. The sewer shall be cleaned prior to testing.
  - c. Wet the surface of the concrete pipe to minimize the passing of air through the walls of dry pipe. When testing other types of pipe, only the concrete manholes need to be wetted.
  - d. Plug all pipe outlets and laterals with pneumatic plugs. One cap or plug shall have an inlet top for connecting a hose.
  - e. The test compares the time required for the air pressure to drop 1 psig (from 3.5 psig to 2.5 psig) to the minimum test times listed in Table 1.

**TABLE 1**  
**MINIMUM TEST TIME FOR VARIOUS**  
**PIPE SIZES**

Nominal Pipe Size, inches	T (Time), minutes Minimum/100 feet
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6



- f. Add air until the internal pressure for the test section is raised to 4 psig. Hold the pressure at between 4.0 and 3.5 psig to allow the air pressure to stabilize. If the groundwater is above the crown of the pipe, increase the pressure 0.43-psi above 3.5 psig for every foot of depth of groundwater to offset the depth of the groundwater over the sewer line. Note: If the groundwater level is two feet or more above the top of the pipe at the upstream manhole and/or if the air pressure required for a test is greater than 5 psig, the air test method shall not be used. In that event, use the water infiltration test.
- g. When the pressure has stabilized and is above the test pressure of 3.5 psig, commence the test by allowing the pressure to drop to 3.5 psig, at which point the time recording is initiated. Record the drop in pressure for the test period.
- h. If the drop is 1 psi or less during the test period, then the section of sewer tested is acceptable. If the pressure drop is more than 1 psi during the test period, inspect, evaluate and retest the line to determine the cause of excessive air loss.
- i. Failure of this air test procedure shall not preclude acceptance by water infiltration or water exfiltration testing.
- j. To determine the required test time for testing a sewer system involving different diameters, each length of lateral pipe is converted into an equivalent length of main sewer and each equivalent length is added to the test length of the main sewer. The minimum test time for the total system is then computed using Formulas 1 and 2.

**Formulas 1 and 2**

$$L_e = \Sigma (d^2 / D^2) \quad \text{Formula 1}$$

$$T_T = (L + L_e) (T/100) \quad \text{Formula 2}$$

Where:

T = minimum test time per 100 feet of pipe for pressure to drop from 3.5 to 2.5 psig. (Table 1)

T<sub>T</sub> = minimum test time for total system, minutes.

D = Inside diameter of the main sewer, inches.

d = inside diameter of lateral, inches.

L = length of main sewer, feet.

L<sub>e</sub> = total volume of all laterals connected to the main sewer expressed as an equivalent length of main sewer, feet.

l = total length of each diameter lateral, feet.

306.8 Deflection Testing for Thermoplastic Pipe:

- a. After the sewer is installed and completely backfilled, the sewers shall be tested for excess deflection by pulling a rigid ball or mandrel through the pipe from manhole to manhole. The ball or mandrel shall have a diameter equal to 95 percent (95%) of the



inside or base diameter of the pipe as established by the ASTM standard to which the pipe is manufactured.

- b. Wherever possible and practical, the testing shall initiate at the downstream lines and proceed towards the upstream lines.
- c. Where deflection is found to be in excess of allowable, the Contractor shall excavate to the point of excess deflection and carefully compact around the pipe where excess deflection was found. The line shall then be retested for deflection. Should the deflected pipe fail to return to the original size (inside diameter) the line shall be replaced.
- d. No pipe shall exceed a deflection of more than 5 percent (5%) of its internal diameter.

END OF SECTION 330301



**SECTION 330302**  
**INSTALLATION OF HDPE PRESSURE WATER**  
**AND SEWER PIPING**

**PART 1 – GENERAL**

101.            EXTENT
- 101.1           This Specification Section defines the requirements for pipe laying, jointing, and testing for pressure water and sewer piping constructed using High Density Polyethylene (HDPE) pipe.
- 101.2           Systems included:
- a.            Water piping.
  - b.            Storm sewer, sanitary sewer, and oily water sewer.
- 101.3           The work shall include, but not be limited to, the following items as indicated on the design drawings and as specified herein:
- a.            Furnish all materials.
  - b.            Provide submittals as specified.
  - c.            Surveying to establish lines and grades.
  - d.            Trench excavation and backfill.
  - e.            Dewatering of excavations (if required).
  - f.            Handling of pipe and fittings.
  - g.            Installation of pipe.
  - h.            Joining HDPE pipe.
  - i.            Valve and valve box installation (if specified).
  - j.            Installation of pressure cleanouts.
  - k.            Cleaning of finished pipes.
  - l.            Acceptance testing of HDPE pipe.
  - m.           Performing operating tests.
  - n.            Witness of tests.
  - o.            Prepare test records.
  - p.            Cleanup.



102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:

- a. Section 312333 – Excavation and Backfill for Underground Utilities

103. REFERENCED DOCUMENTS

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of Contract for the Work.

103.3 The following abbreviations are used in the text of these sections to reference these organizations.

103.4 ASTM – ASTM International:

- a. F2164 – Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
- b. F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

103.5 AWWA – American Water Works Association

- a. ANSI/AWWA C651 – AWWA Standard for Disinfecting Water Mains.

104. SUBMITTALS

104.1 Contractor Submittals Prior to Construction:

- a. Operator qualifications to perform welding to make joints.
- b. Proposed fusion welding procedures and fusion weld joint parameters.
- c. Size of apparatus or equipment, heating tool surface temperature, and interface pressure.
- d. Items of the procedure that shall be discussed include:
  - d1. How the pipe components to be joined are secured during the welding process.
  - d2. How the pipe components to be joined are faced to ensure the pipe end faces are clean and have no detectable gaps between the pipe components to be joined.
  - d3. How the pipe components to be joined are aligned with each other to minimize size inequality between the pipe walls. Pipe components shall be aligned such that the outer diameters of the pipe ends match.



- d4. Heating tools to be used capable of simultaneously heating both pipe component ends and furnished with a thermometer for monitoring the pipe's internal temperature, and how the heating tools to be used are installed in the butt fusion machine to ensure full contact with the pipe component ends is made and the appropriate melt bead size is formed.
  - d5. How the pipe components are joined with sufficient fusion force to form a double rollback bead against the pipe wall, and how the fusion force is determined.
  - d6. How the new joints are held immobile under fusion force to allow for cooling, and how the proper cooling time was determined.
  - d7. Evidence of visual inspections of joints against manufacturer recommended guidelines for butt fusion bead size and appearance.
  - e. Proposed melt bead width for each pipe diameter to be fabricated if different from Table 1.
  - f. Manufacturer's material certificates for each pressure piping system.
  - g. If an electronic method will be used, provide the method that will be used for electronically recording each heat fusion welded joint.
- 104.2 The Contractor shall submit the following items after tests are complete:
- a. If electronic logging is used, provide a log indicating the location of each joint with electronic data recorder information and visual examination and inspection results indicating compliance with design joint parameters. Log shall include locations and work done to correct failed joints.
  - b. If electronic logging is not used:
    - b1. Present a log indicating the location of each joint that did not pass visual examination.
    - b2. Define in writing, the work done to correct the improper fusion weld(s).
    - b3. Provide written results of operating tests. See Paragraphs 315 and 316.
    - b4. Provide written results of pressure tests. See Paragraph 317.
- 104.3 Disinfecting Pipe:
- a. Plans and descriptions of the arrangement and method to be used for disinfecting the pipes, including a description of the method and fittings to be used for injecting chlorine, for flushing the pipes, form of chlorine to be used, location where flushing water will be drained, the proposed number of samples, and method for taking samples.
- 104.4 Biological Tests:
- a. Certification of taking samples. Provide the following:
    - a1. Location sample taken.
    - a2. Volume of sample.



- a3. Date and time.
  - a4. Signature of person taking samples.
  - b. Forms from Certified Laboratory indicating results of biological tests performed.
105. QUALITY ASSURANCE
- 105.1 Materials, construction procedures, and testing shall be subject to inspection and tests conducted by an Independent Testing Service employed by the Owner. Such inspections and tests will not relieve the Contractor of its responsibility for providing materials and installation in compliance with specified requirements.
- 105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance to this Specification.

## **PART 2 – PRODUCTS**

### 201. PIPE MATERIALS

- 201.1 HDPE pipe materials shall be as specified on the design drawings.

## **PART 3 – EXECUTION**

### 301. SURVEYING

- 301.1 The Contractor shall be responsible for all surveying to establish line and grade of the piping.

### 302. TRENCH EXCAVATION AND BACKFILL

- 302.1 Trench excavation and backfill shall be in accordance with Section 312333, Excavation and Backfill for Underground Utilities.

### 303. DEWATERING

- 303.1 Dewatering sufficient to maintain the water level twelve (12) inches below the trench bottom shall be accomplished prior to pipe laying and jointing. The dewatering operation shall be carried out so that the bottom of the trench is firm during the piping laying operation and so that the strength of the soil under or alongside the trench is not weakened.
- 303.2 Exercise caution when terminating the dewatering operation to avoid disturbing the pipe installation.

### 304. HANDLING OF PIPE AND FITTINGS

- 304.1 Pipe and fittings shall be handled in such manner that will prevent damage to the materials. Accidental damage to a pipe shall be repaired to the satisfaction of the Owner or be removed from the job and the methods of handling shall be corrected by the Contractor to prevent further damage.



- 304.2 The pipe and fittings shall be inspected by the Contractor for defects before being installed.
- 304.3 Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during the handling and laying operations. Any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and relaid.
- 304.4 At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means to ensure absolute cleanliness inside the pipe.
305. OPERATOR EXPERIENCE FOR MAKING JOINTS
- 305.1 Skill and knowledge on the part of the operator are required to obtain a good quality joint. This skill and knowledge is obtained by making joints in accordance with proven procedures under the guidance of skilled operators. Evaluate operator proficiency by testing sample joints.
- 305.2 The party responsible for the joining of polyethylene pipe and fittings shall ensure that detailed procedures developed in conjunction with applicable codes and regulations and the manufacturers of the pipe, fittings, and joining equipment involved, including the safety precautions to be followed, are issued before actual joining operations begin.
306. JOINTS FOR HIGH DENSITY POLYETHYLENE (HDPE) PIPE
- 306.1 Sections of HDPE pipe shall be joined together by the thermal butt fusion method in accordance with Procedure 2, ASTM F2620.
- 306.2 The hot plate butt fusion procedure shall be performed using an apparatus and setup parameters complying with ASTM F2620.
307. MELT BEAD SIZE
- 307.1 ASTM F 2620 recommends the melt bead size shown in Table 1.

**TABLE 1**  
**APPROXIMATE MELT BEAD SIZES**

<u>Pipe Size</u>	<u>Approximate Melt Bead Size</u>
1-1/4" and smaller	1/32" – 1/16"
Above 1-1/4" through 3"	1/16"
Above 3" through 8"	1/8" – 3/16"
Above 8" through 12"	3/16" – 1/4"
Above 12" through 24"	1/4" – 7/16"

308. BENT STRAP TEST JOINTS
- 308.1 A bent strap test shall be made on all sizes of pipe up to twelve inch (12") diameter. The test need not be used on larger pipe. The test shall be made on the first butt fusion of each size of pipe up to twelve inch (12") diameter for each fusion machine operator.
- 308.2 The test is performed to verify operator procedure, equipment set-up, and field fusion quality by making and testing a trial fusion. The trail fusion is allowed to cool completely;





then test straps are cut out and bent strap tested in accordance with ASTM F2620 and appropriate annexes. If the bent strap test of the trial fusion fails at the joint, any field fusions represented by the trial fusion shall be redone.

- 308.3 Procedure:
- a. Using waste pieces of pipe, a joint shall be prepared and then butt fusion welded and allowed to cool to ambient temperature. The cooling period shall not be less than one (1) hour.
  - b. A test strap shall be cut from the specimen. Cut the sample into a minimum of three (3) straps.
    - b1. The width of the strap shall be 1-1/2 times the pipe wall thickness, but not less than one (1) inch.
    - b2. The length of the strap on each side of the fusion weld shall be fifteen (15) times the pipe wall thickness, but not less than six (6) inches.
  - c. Visually inspect the sample joint and compare it to pictures of an acceptable joint. See ASTM F2620 for pictures of acceptable joints.
  - d. The cut shall be bent so that the ends of the strap touch. If any separation, cracks, or voids are observed at the fusion, the fusion is unacceptable and indicates poor fusion quality.
  - e. If failure occurs, fusion procedures or machine set-up shall be changed and a new trial fusion weld and new bent strap specimen prepared and tested.
  - f. The Testing Service shall witness all bent strap tests.
  - g. Field fusion of pipe shall not proceed until a test joint has passed the bent strap test and visual inspection indicates that the fusion beads and "V" groove are the correct size.

309. INSTALLATION OF PIPE

- 309.1 Installation of pipe shall proceed only after the trench has been dewatered and the pipe bedding has been installed.
- 309.2 Pipe shall be installed to the lines and grades shown on the design drawings. Pipes shall be laid with straight alignments. Curvilinear alignments are not allowed unless specified on the design drawings. HDPE pipe shall be snaked in the trench to provide the excess length recommended by the Manufacturer.
- 309.3 The pipe bedding shall be placed so that the entire length of the pipe will have full bearing. No blocking of any kind shall be used to adjust the pipe to grade.
- 309.4 Pipe sections shall be laid and jointed so that the misalignment of the inside of the pipe at any joint shall not be larger than 10 percent of the wall thickness of the pipe.



310. PLUGS AND CLEANOUTS

- 310.1 Plugs for pipe branches, stubs or other open ends which are not to be immediately connected shall be made of an approved material and shall be secured in place with a joint comparable to a pipe joint.
- 310.2 Provide pressure cleanouts on pressure sewer piping as specified on the design drawings.

311. TEMPORARY PLUGS

- 311.1 Temporary plugs required for testing shall be installed where necessary.
- 311.2 All temporary plugs shall be removed after testing is complete.

312. CONNECTIONS OF SEWER FORCE MAINS TO MANHOLES OR SUMPS

- 312.1 Each sewer force main shall be provided with a leak proof pipe-to-wall penetration seal, Link-Seal or approved equal, where the pipe connects to a manhole or sump. Install pipe-to-wall penetration seals in accordance with Manufacturer's instructions.

313. VISUAL INSPECTIONS OF HDPE PIPE DURING INSTALLATION

- 313.1 General: All pipe shall be visually inspected during installation for the following:

- a. Surface damage.
- b. Weld quality.

- 313.2 Surface Damage:

- a. Surface damage to a pipe that occurs during handling or installation shall be minimized. The maximum acceptable depth of damage is 10 percent of wall thickness of the pipe. If excessive damage occurs, the damaged portions of pipe shall be cut out and replaced. Deep, sharp notches may be filled with extrudite and dressed smooth.
- b. Butt fusion on misalignment shall not exceed 10 percent (10%) of the pipe wall thicknesses. Misaligned butt fusions shall be cut out and redone.

- 313.3 Butt-Fusion Joint Weld Quality:

- a. All butt fusion welded joints shall be visually inspected to ensure joint quality. The size and shape of the fusion beads shall be used as an indicator of joint quality. Specifically:
  - a1. The double bead width shall be 2 to 2-1/2 times the height of the bead measured from the pipe surface.
  - a2. Both beads shall be uniform in size and shape around the joint.
  - a3. The depth of the "V" between the two beads shall not be more than half the bead height.
- b. If the "V" groove is too deep a "cold" fusion may have occurred (uneven heating or insufficient heating time or excessive pressure during heating or excessive pressure during joining). A non-uniform bead shape around the pipe indicates uneven heating.



- c. A joint with cold fusion or a non-uniform bead is a poor quality joint that shall be removed (cut-out) and remade.

313.4 Records:

- a. If no electronic data logging is used, a written record shall be kept of all visual inspections. The record shall be submitted at the end of the project.
- b. If electronic data logging is used, each joint shall be recorded and documented during the heat fusion process with a McElroy Datalogger or approved equal. Joints shall be marked with a unique identification number for reference and inspection by the Owner.

314. CLEANING OF FINISHED PIPES

- 314.1 All finished pipes shall be cleaned with water and flushed prior to pressure testing.

315. ACCEPTANCE TESTING OF HDPE PRESSURE LINES

315.1 Test Requirements:

- a. The test procedure consists of two steps: the initial expansion phase and the test phase.
- b. Air testing is prohibited.
- c. Hydrostatic testing shall follow procedures specified in ASTM F2164.

315.2 Restrain Against Movement:

- a. Before applying pressure, all piping and all components in the test section must be restrained. This means that if piping or parts move or separate during the test, it will not result in damage or injury. Never conduct leak tests on unrestrained piping.
- a1. Heat fusion joints must be properly cooled before testing.
- a2. Mechanical connections must be completely installed and tightened per manufacturer's instructions.
- a3. If backfill provides restraint, it must be properly placed and compacted. Joints and connections may be exposed for inspection.
- a4. End closures must be suitable for pressure service and pressure-rated for the test pressure.
- a5. Ensure that all connections to test equipment are secure. Disconnect or isolate all low pressure filling lines and all other parts that are not to be subjected to test pressure. Restrain, isolate, or remove expansion joints before leak testing.



315.3 Test Section:

- a. Testing may be conducted on the full system or in sections. Test section length is determined by the capacity of the testing equipment. Lower capacity pressurizing or filling equipment may not be capable of completing the testing within permissible time limits. If so, use higher capacity test equipment or select a shorter test section.
- b. Before applying test pressure, allow time for the test fluid and the test section to equalize to a common temperature.
- c. Components such as caps, valves, blind flanges, manual or automatic air release devices, vents, and other devices that are used to isolate the test section from other parts of the system, to purge air from the system, and to isolate components that are not to be subjected to test pressure are generally needed.
- d. Although section isolation and closure components may only be connected to the test section for the duration of the test, the joint between the test section and a closure or isolation component should be at least as strong as joints in the test section. Additional restraint may be required.
- e. Air release devices should be located at all high points along the test section.
- f. Excessively worn or deteriorated equipment is unsuitable and is not to be used.

315.4 Test Pressure:

- a. The hydrostatic test pressure of the piping system shall be 1.5 times the operating pressure of the pipe. Test pressure shall not exceed rated capacity of caps, valves, plugs, or other appurtenances in the piping system.
- b. If the operating pressure is within 20 percent (20%) of the Standard Pressure Rating of the pipe, the hydrostatic test pressure shall be 1.5 times the standard pressure rating of the pipe at 73.4°F at the lowest point in the test section. Table 2 lists standard pressure ratings of HDPE pipe based on the Standard Dimension Ratio (SDR) of the pipe.
- c. Thicker pieces of pipe installed beneath roads shall not be considered in determining the hydrostatic test pressure of the pipe.



**TABLE 2**  
**STANDARD PRESSURE RATINGS**  
**PSIG AT 73.4°F**  
**HYDROSTATIC DESIGN BASIS EQUALS 800 PSI**

SDR	21	17	15.5	13.5	11	9
Rating	80	100	110	128	160	200

315.5

Test Restrictions:

- a. The total test time, including initial pressurization, initial expansion and time at test pressure and time to depressurize the test section, must not exceed eight (8) hours.
- b. If the test is not completed due to leakage, equipment failure, or for any other reason, the test section shall be depressurized completely and be allowed to "relax" for a minimum period of eight (8) hours before the section is re-pressurized.
- c. When testing at system design pressure or less, test duration including time to pressurize, time for initial expansion, time at test pressure and time to depressurize should be limited to a practical time period. The test section shall not be left unsupervised at any time during leak testing.
- d. The temperature of the test medium and the pipe test section should be the same, and should be at ambient temperature. Before applying the test pressure, allow time for the temperature of the test medium and the pipe test section to equalize.

315.6

Pressure Testing in the Trench:

- a. Before the test is conducted, all pipes shall be partially backfilled, but with the pipe joints exposed for examination. If the joints are covered with backfill prior to testing, the Contractor remains responsible for locating and correcting any leakage in excess of that permitted.
- b. When local conditions require that the trench be backfilled immediately after the pipe has been laid, and the pressure test may commence after backfilling has been completed and at least seven days after the last concrete thrust block or bearing pad has been cast.
- c. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure.
- d. When testing against existing closed valves, the test pressure shall not exceed the rated test pressure of the valve when a section being tested includes closed gate valves. Any reduction in the test pressure shall be approved by the Owner. If a reduced test pressure is not approved the Contractor shall remove the existing valve and insert a blind flange or restrained plug to test against.



- 315.7 Testing Outside of the Trench:
- a. If approved by the Owner pressure testing may be conducted after joining is complete before laying the pipe in the trench.
  - b. Pipe tested outside of the trench shall be anchored such that it will not move when pressure is applied. The Contractor shall be responsible for ensuring that normal safety precautions are observed for above ground pressure tests.
- 315.8 Procedure for Pressure Test:
- a. Each section of pipe to be tested shall be slowly filled with clean water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner at the low end of the portion of the system being tested.
  - b. The pump pipe connection to the pipe and all necessary apparatus including gauges and meters shall be furnished by the Contractor.
  - c. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, venting may be provided by loosening flanges, using equipment vents, or providing taps, if necessary, at high points. Retighten any loosened flanges or vents and tightly plug all taps before applying pressure.
  - d. Use at least one calibrated pressure gage or sensor accurate to within two percent of full scale. It is preferred that the gage or sensor full scale value not be more than twice the test pressure, and that scale graduations be no greater than two percent of the full scale value. Using a valved tee, a gage cock for bleeding, a pressure snubber, and a duplicate, back-up pressure gage are recommended. A continuous pressure-recording device may be required.
  - e. Locate the test pressure gage or sensor to monitor test pressure at the lowest point in the test section. Pressure may be monitored at other points in the test section as well.
- 315.9 Temperature Equalization:
- a. Allow the test section and the test liquid to equalize to a common temperature.
- 315.10 Pressurizing – Initial Expansion Phase:
- a. When the test pressure is applied to a water filled pipe, the pipe expands. During the initial expansion of the pipe under test, sufficient makeup water must be added to the system in hourly intervals for three (3) hours to maintain the test pressure. After about four (4) hours, initial expansion should be complete and the test phase can begin.
  - b. If the test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage, entrapped air, or open valving, or the pressurizing equipment may be inadequate for the size of the test section. If such faults exist, discontinue pressurizing, and correct the faults before continuing.
  - c. Add make-up water as necessary to maintain maximum test pressure for four (4) hours.



- d. All exposed pipe, fittings, valves, and joints shall be examined carefully during the initial expansion phase of the test. Any damaged or defective pipe, fittings, valves, or joints that are discovered during or following the pressure test shall be repaired or replaced by the Contractor with new material, and the pressure test shall be repeated until satisfactory results are achieved.

315.11 Hydrostatic Leak Testing:

- a. The hydrostatic leak test procedure consists of filling the pipe, an initial expansion phase, a test phase, and depressurizing the pipe. There are two alternatives for the test phase.
- b. Filling: Fill the restrained test section completely with the test liquid:
  - b1. Ensure that there is no air trapped in the test section. Failure with entrapped air can result in an explosive release and result in serious bodily injury.
  - b2. Use equipment vents at high points to remove air.
- c. Initial Expansion Phase:
  - c1. Gradually pressurize the test section to the test pressure for three hours. During the initial expansion phase, polyethylene pipe will expand slightly. Additional test liquid will be required to maintain pressure. It is not necessary to monitor the amount of water added during the initial expansion phase.

315.12 Test Phase:

- a. Test Phase – Alternate 1:
  - a1. Immediately following the initial expansion phase, reduce test pressure by 10 psi, and stop adding test liquid. If test pressure remains steady (within five percent (5%) of the target value) for one hour, no leakage is indicated.
- b. Test Phase – Alternate 2:
  - b1. This alternative is applicable when the test pressure is 150% of the system design pressure.
  - b2. Immediately following the initial expansion phase, monitor the amount of make-up water required to maintain test pressure for three hours. The test pressure shall be maintained for three hours unless directed otherwise by the Owner. If the amount of make-up water needed to maintain test pressure does not exceed the amount in Table 3, no leakage is indicated.



**TABLE 3**  
**TEST PHASE – ALTERNATE 2**  
**MAKE-UP WATER ALLOWANCE**

Nominal Pipe Size (in.)	Make-Up Water Allowance for Test Phase – Alternate 2 (U.S. Gal/100 ft of pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
1-1/4	0.06	0.10	0.16
1-1/2	0.07	0.10	0.17
2	0.07	0.11	0.19
3	0.10	0.15	0.25
4	0.13	0.25	0.40
5	0.21	0.41	0.62
6	0.3	0.6	0.9
8	0.5	1.0	1.5
10	0.8	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.0	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3

315.13 Testing at Reduced Temperatures:

- a. The amount of expansion that takes place during pressure testing is dependent on the temperature of the pipe during testing. When testing of pipe takes place at temperatures below 73.4°F the amount of makeup water shown in Table 3 shall be multiplied by a correction factor obtained from Table 4. Interpolate figures shown in the table for intermediate temperatures.

**TABLE 4**  
**REDUCED TEMPERATURE MULTIPLIER**

Temperature of Pipe °F	Correction Factor
-20	0.05
-10	0.11
32	0.22
50	0.42
68	0.75
73.4	1.00

315.14 The temperature of the pipe shall be taken as the average of the temperature of the water pumped into the pipe and the temperature of the pipe immediately before testing (ambient air temperature).

315.15 Testing at Elevated Temperatures:





- a. All plastic pipes have reduced strength at elevated temperatures. The test pressure must be reduced when the test section is at an elevated temperature either from service conditions or from environmental conditions such as being warmed by the sun.
- b. Multiply the test pressure by the multiplier shown in Table 5 to determine the allowable elevated temperature test pressure.

**TABLE 5**  
**ELEVATED TEMPERATURE MULTIPLIER**

<u>Test Section Temperature, °F</u>	<u>Multiplier</u>
≤ 80	1.00
≤ 90	0.90
≤ 100	0.80
≤ 110	0.75
≤ 120	0.65
≤ 130	0.60
≤ 140	0.50

Notes:

- (1) Use the 80°F multiplier for 80°F and lower temperatures.
- (2) The maximum service temperature for HDPE pressure pipe is 140°F.

316. FINAL INSPECTION

- 316.1 No pipe shall be put into service until inspected and approved by the Owner.
- 316.2 During the test period, if makeup water is less than shown in Table 3, there are no visual leaks, and there are no significant pressure drops, the pipe passes the test. If the amount of water added to the test section is greater than the amount shown in the table, leakage has occurred.

317. OPERATING TESTS

- 317.1 Operating Tests:
  - a. The Contractor shall perform the following operating test in the presence of the Owner. If possible the tests shall be performed with pumps running.
  - a1. Fully open and close all valves under system working pressure to ensure proper operation.

318. WITNESS OF TESTS

- 318.1 Witness:
  - a. All system pressure tests, leakage, and operating tests shall be performed by the Contractor in the presence of the Testing Service or the Owner.
- 318.2 Test Schedule:



- a. The Contractor shall inform the Testing Service and the Owner a minimum of twenty-four (24) hours in advance of any operation or test to be witnessed by them.

319. TEST RECORDS

319.1 Documentation of pressure testing shall include the following information:

- a. The test liquid:
- b. Backflow prevention devices, if used.
- c. The test pressure:
- c1. The type of test gages in the test section.
- c2. The placement of test gages in the test section, such as test gage location distances and elevations from the beginning of the section.
- c3. Test gage calibration records.
- c4. Test pressures recorded during the test.
- c5. Any adjustments made to test pressure for elevated temperature.
- d. The test duration.
- e. A description of the test section length, elevations, and site location.
- f. A description of the test section components.
- g. Description of any leaks or failures and the corrective actions taken.
- h. The date and time of day of the test.
- i. The identification of the party conducting the test.

320. DISINFECTION OF POTABLE WATER PIPING

320.1 Extent of Disinfection:

- a. All potable water piping and repaired portions of lines and building service connections shall be disinfected before being placed into service.
- a1. Disinfection shall be in accordance with AWWA C651 and as specified herein.

320.2 Flushing:

- a. Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have become lodged in the pipe. A tap shall be provided at the end of the main which is large enough to develop a velocity of at least 2.5 feet per second in the main.
- b. All taps required for chlorination or flushing purposes, or for temporary or permanent release of air shall be furnished by the Contractor.



- 320.3 Requirement of Chlorine:
- a. All lines shall be chlorinated so that the initial chlorine residual is not less than the dosage recommended in AWWA C651.
  - b. A chlorine residual of not less than 10 mg/l shall remain in the water after standing twenty-four (24) hours in the pipe.
  - c. Initial and residual chlorine contents shall be verified by tests. If tests show that the final chlorine residual is too low, the pipes shall be rechlorinated.
- 320.4 Method of Chlorination:
- a. Chlorine shall be applied by one of the following methods:
    - a1. Tablet method as described in AWWA C651. Tablet disinfection is best suited to short extensions (up to 2500 feet ) and smaller diameter mains (up to twelve (12) inches ). Since preliminary flushing must be eliminated in using this method, it should be utilized only when scrupulous cleanliness has been used in construction. It shall be used if trench water or foreign material has entered the main or if the water is below 41°F.
    - a2. Continuous Feed Method as Described in AWWA C651 using Calcium Hypochloride Granules.
    - a3. Slug method as described in AWWA C651 using Calcium Hypochloride Granules.
- 320.5 Preventing Reverse Flow: Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.
- 320.6 Chlorinating Valves and Appurtenances: All valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent.
- 320.7 Final Flushing and Testing:
- a. Following chlorinating, all treated water shall be thoroughly flushed from the pipe until water in the pipe has a chlorine residual of less than 1 ppm (1 mg/l). If the source of supply is chlorinated, then the tests shall show a residual of not in excess of the chlorine content carried in that system.
  - b. Discharge chlorinated and flush water to a sanitary sewer system. Chlorinated water shall not be discharged to a storm sewer system. If in doubt regarding the disposal of chlorinated water, contact the local regulatory agency for guidance.
- 320.8 Repetition of Flushing and Testing: Should the initial disinfection result in unsatisfactory bacterial tests, the original chlorination procedure shall be repeated by the Contractor until water samples pass bacteriological tests.
321. BACTERIOLOGICAL TESTING
- 321.1 Water samples shall be collected from the system on at least two (2) consecutive days, taken at least twenty-four (24) hours apart, and analyzed for the presence of bacteria. The tests shall be performed in a state licensed testing laboratory in accordance with state codes. Test results shall be transmitted to the Contractor and owner within twenty-four (24) hours of completion of the tests.



322.            CLEANUP

- 322.1           All excess pipe and all excess material from trenching, bedding, or backfill operations shall be removed from the plant site.

END OF SECTION 330302



**SECTION 330303**  
**INSTALLATION OF HDPE POTABLE WATER PIPING**

**PART 1 - GENERAL**

101.            EXTENT
- 101.1           The intent of this specification is to define installation and testing requirements for potable water piping using High Density Polyethylene (HDPE) pipe.
- 101.2           The potable water piping will be used to service a bathroom, kitchen sink, safety shower, and eye wash in the Electrical Building.
- 101.3           The work shall include, but not be limited to, the following items as indicated on the design drawings and as specified herein:
- a.            Furnishing all materials.
  - b.            Provide submittals as specified.
  - c.            Surveying to establish lines and grades.
  - d.            Trench excavation and backfill.
  - e.            Dewatering excavations (if required).
  - f.            Handling of pipe and fittings.
  - g.            Pipe installation.
  - h.            Joining of HDPE pipe.
  - i.            Valve and valve box installation.
  - j.            Water service connections.
  - k.            Air relief valve installation (if specified).
  - l.            Installation of temporary plugs and pressure cleanouts (if required).
  - m.            Thrust restraint installation (if specified).
  - n.            Installation of trace wires.
  - o.            Visual inspection during pipe installation.
  - p.            Cleaning of finished pipes.
  - q.            Pressure testing.
  - r.            Leak testing.
  - s.            Prepare test records.



- t. Disinfection and flushing.
- u. Biological testing.
- v. Cleanup.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:

- a. Section 312333 – Excavation and Backfill for Underground Utilities
- b. Section 330201 – Piping Materials for Underground Sewers and Pressure Water Pipe

103. REFERENCE DOCUMENTS

103.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents, in addition to federal, state, or local codes having jurisdiction.

103.2 References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, and supplements thereto in effect as of the date of Contract for the Work.

103.3 The following abbreviations are used in the rest of these paragraphs to reference these organizations.

103.4 ASTM – ASTM International:

- a. F2164 – Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
- b. F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

103.5 AWWA – American Water Works Association

- a. ANSI/AWWA C651 – AWWA Standard for Disinfecting Water Mains.

104. SUBMITTALS

104.1 Contractor submittals prior to construction:

- a. Operator qualifications to perform welding to make joints.
- b. Size of apparatus or equipment, heating tool surface temperature, and interface pressure.
- c. Proposed fusion welding procedures and fusion weld joint parameters.
- d. Items of the procedure that shall be discussed include:
  - d1. How the pipe components to be joined are secured during the welding process.



- d2. How the pipe components to be joined are faced to ensure the pipe end faces are clean and have no detectable gaps between the pipe components to be joined.
  - d3. How the pipe components to be joined are aligned with each other to minimize size inequality between the pipe walls. Pipe components shall be aligned such that the outer diameter of the pipe ends match.
  - d4. Heating tools to be used capable of simultaneously heating both pipe component ends and furnished with a thermometer for monitoring the pipe's internal temperature, and how the heating tools to be used are installed in the butt fusion machine to ensure full contact with the pipe component ends is made and the appropriate melt bead size is formed.
  - d5. How the pipe components are joined with sufficient fusion force to form a double rollback bead against the pipe wall, and how the fusion force is determined.
  - d6. How the new joints are held immobile under fusion force to allow for cooling, and how the proper cooling time was determined.
  - d7. Evidence of visual inspections of joints against manufacturer recommended guidelines for butt fusion bead size and appearance.
  - e. Proposed melt bead width for each pipe diameter to be fabricated if different from Table 1.
  - f. Manufacturer's material certificates for each pressure piping system.
  - g. If an electronic method will be used, provide the method that will be used for electronically recording each fusion welded joint.
- 104.2 The Contractor shall submit the following items after installation and testing are completed:
- a. If electronic logging will be used, provide a log indicating the location of each joint with electronic data recorder information and visual examination and inspection results indicating compliance with design joint parameters. Log shall include locations and work done to correct failed joints.
  - b. If electronic logging is not used:
    - b1. Present log indicating the location of each joint that did not pass visual examination.
    - b2. Define in writing the work done to correct improper fusion weld(s).
    - b3. Provide forms indicating the following for each initial pressure tests and all retests performed:
      - b3.1 Date and time.
      - b3.2 Portion of line being tested.
      - b3.3 Test pressure.
      - b3.4 Duration of test.



- b3.5 Test results.
- b4. Provide written results of operating tests.
- 104.3 Disinfecting Pipe:
  - a. Plans and descriptions of the arrangement and method to be used for disinfecting the pipes, including a description of the method and fittings to be used for injecting chlorine, for flushing the pipes, form of chlorine to be used, location where flushing water will be drained, the proposed number of samples, and method for taking samples.
- 104.4 Biological Tests:
  - a. Certification of taking samples. Provide the following:
    - a1. Location sample taken.
    - a2. Volume of sample.
    - a3. Date and time.
    - a4. Signature of person taking samples.
  - b. Forms from Certified Laboratory indicating results of biological tests performed.
- 105. QUALITY ASSURANCE
- 105.1 Materials, construction procedures, and testing shall be subject to inspection and tests conducted by an independent Testing Service employed by the Owner. Such inspections and tests will not relieve the Contractor of its responsibility for providing material, placement and testing in compliance with specified requirements.
- 105.2 The Owner reserves the right, at any time before final acceptance, to reject materials or workmanship not complying with specified requirements. The Contractor shall correct the deficiencies which the inspections and tests have indicated are not in compliance to this Specification.

**PART 2 - PRODUCTS**

- 201. PIPING, VALVE AND PIPING SPECIALTIES
- 201.1 Material Specification: See Section 330201, Piping Materials for Underground Sewers and Pressure Water Pipe.
- 201.2 Trace wire for non-metallic pipe shall be a three (3) inch wide detectable underground warning tape with a brightly colored plastic coating imprinted with the words "Caution Sewer Line Below" in large letters. Empire Level Manufacturing Corp. "MagnaTec" or approved equal.





### **PART 3 - EXECUTION**

#### **301. SURVEYING**

301.1 The Contractor shall be responsible for all surveying to establish line and grade of the piping

#### **302. TRENCH EXCAVATION AND BACKFILL**

302.1 Trench excavation and backfill shall be in accordance with Section 312333, Excavation and Backfill for Underground Utilities.

#### **303. DEWATERING**

303.1 Dewatering sufficient to maintain the water level twelve (12) inches below the trench bottom shall be accomplished prior to pipe laying and jointing. The dewatering operation shall be carried out so that the bottom of the trench is firm during the pipe laying operation and so that the strength of the soil under or alongside the trench is not weakened.

303.2 The Contractor shall exercise caution when terminating the dewatering operation to avoid disturbing the pipe installation.

#### **304. HANDLING OF PIPE AND FITTINGS**

304.1 Pipe and fittings shall be handled in such manner to prevent damage to the materials. Accidental damage to a pipe shall be repaired to the satisfaction of the Owner or be removed from the job, and methods of handling shall be corrected by the Contractor to prevent further damage.

304.2 The pipe and fittings shall be inspected by the Contractor for defects before being installed.

304.3 Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations. Any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and relaid.

304.4 At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means to ensure absolute cleanliness inside the pipe.

#### **305. OPERATOR EXPERIENCE FOR MAKING JOINTS**

305.1 Skill and knowledge on the part of the operator are required to obtain a good quality input. This skill and knowledge is obtained by making joints in accordance with proven procedures under the guidance of skilled operators. Evaluate operator proficiency by testing sample joints.

305.2 The party responsible for the joining of polyethylene pipe and fittings shall ensure that detailed procedures developed in conjunction with applicable codes and regulations and the manufacturers of the pipe, fittings, and joining equipment involved, including the safety precautions to be followed, are issued before actual joining operations begin.



306. JOINTS FOR HIGH DENSITY POLYETHYLENE (HDPE) PIPE
- 306.1 Sections of HDPE pipe shall be joined together by the thermal butt fusion method in accordance with Procedure 2, ASTM F2620.

307. MELT BEAD SIZE

- 307.1 ASTM F2620 recommends the melt bead size shown in Table 1.

**TABLE 1**  
**APPROXIMATE MELT BEAD SIZES**

<u>Pipe Size</u>	<u>Approximate Melt Bead Size</u>
Above 1-1/4" through 3"	1/16"
Above 3" through 8"	1/8" – 3/16"

308. BENT STRAP TEST JOINTS

- 308.1 A bent strap test shall be made on all sizes of pipe up to twelve inches (12") diameter. The test need not be used on larger pipe. The test shall be made on the first butt fusion of each size of pipe up to twelve inches (12") diameter for each fusion machine operator.
- 308.2 The test is performed to verify operator procedure, equipment set-up, and field fusion quality by making and testing a trial fusion. The trial fusion is allowed to cool completely; then test straps are cut out and bent strap tested in accordance with ASTM F2620 and appropriate annexes. If the bent strap test of the trial fusion fails at the joint, any field fusions represented by the trial fusion should be redone.
- 308.3 Procedure:
- a. Using waste pieces of pipe, a joint shall be prepared and then butt fusion welded and allowed to cool to ambient temperature. The cooling period shall not be less than one (1) hour.
  - b. A test strap shall be cut from the specimen. Cut the sample into a minimum of three (3) straps.
    - b1. The width of the strap shall be 1-1/2 times the pipe wall thickness, but not less than one (1) inch.
    - b2. The length of the strap on each side of the fusion weld shall be fifteen (15) times the pipe wall thickness, but not less than six (6) inches.
  - c. Visually inspect the sample joint and compare it to the pictures of an acceptable joint. See ASTM F2620 for pictures of acceptable joints.
  - d. The cut shall be bent so that the ends of the strap touch. If any separation, cracks, or voids are observed at the fusion, the fusion is unacceptable and indicates poor fusion quality.



- e. If failure occurs, fusion procedures or machine set-up shall be changed, and a new trial fusion weld and new bent strap specimen prepared and tested.
  - f. The Testing Service shall witness all bent strap tests.
  - g. Field fusion of pipe shall not proceed until a test joint has passed the bent strap test and visual inspection indicates that the fusion beads and "V" groove are the correct size.
309. INSTALLATION OF PIPE
- 309.1 Installation of pipe shall proceed only after the trench has been dewatered and the pipe bedding has been installed.
  - 309.2 Pipe shall be installed to the lines and grades shown on the design drawings. Pipes shall be laid with straight alignments. Curvilinear alignments are not allowed unless specified on the design drawings. HDPE pipe shall be snaked in the trench to provide the excess length recommended by the Manufacturer.
  - 309.3 The pipe bedding shall be placed so that the entire length of pipe will have full bearing. No blocking of any kind shall be used to adjust the pipe to grade.
  - 309.4 Pipe sections shall be laid and jointed so that the misalignment of the inside of the pipe at any joint shall not be larger than ten percent (10%) of the wall thickness of the pipe.
310. AIR RELEASE VALVE
- 310.1 An air release valve shall be provided at all high points in the piping system where specified on the design drawings.
  - 310.2 Install air release valves in accordance with Manufacturer's instruction.
311. TEMPORARY PLUGS
- 311.1 Temporary plugs required for testing shall be installed where necessary.
  - 311.2 All temporary plugs shall be removed after testing is complete.
312. THRUST BLOCKING
- 312.1 Thrust blocking to prevent movement of lines under pressure is not required unless specified on the design drawings. Where specified, blockings shall be Portland Cement Concrete thrust blocks placed between solid ground and the fitting or valve and shall be anchored in such a manner that pipe and fitting joints will be accessible for repairs.
313. INSTALLATION OF TRACE WIRE
- 313.1 Install a continuous detectable trace wire buried six (6) to twelve (12) inches above the top of all non-metallic pipes.



314. VISUAL INSPECTIONS OF HDPE PIPE DURING INSTALLATION

314.1 General: All pipe shall be visually inspected during installation for:

- a. Surface Damage.
- b. Weld Quality.

314.2 Surface Damage:

- a. Surface damage to a pipe that occurs during handling or installation shall be minimized. The maximum acceptable depth of damage is ten percent (10%) of wall thickness of the pipe. If excessive damage occurs, the damaged portions of pipe shall be cut out and replaced. Deep, sharp notches may be filled with extradite and dressed smooth.
- b. Butt fusion on misalignment shall not exceed ten percent (10%) of the pipe wall thickness. Misaligned butt fusions shall be cut out and redone.

314.3 Butt-Fusion Joint Weld Quality:

- a. All butt fusion-welded joints shall be visually inspected to ensure joint quality. The size and shape of the fusion beads shall be used as an indicator of joint quality. Specifically:
  - a1. The double bead width shall be 2 to 2-1/2 times the height of the bead measured from the pipe surface.
  - a2. Both beads shall be uniform in size and shape around the joint.
  - a3. The depth of the "V" between the two beads shall not be more than half the bead height.
- b. If the "V" groove is too deep a "cold" fusion may have occurred (uneven heating or insufficient heating time or excessive pressure during heating or excessive pressure during jointing). A non-uniform bead shape around the pipe indicates uneven heating.
- c. A joint with cold fusion or a non-uniform bead is a poor quality joint that shall be removed (cut-out) and remade.

315. PLUGS

315.1 Plugs for pipe branches, stubs or other open ends which are not to be immediately connected shall be made of an approved material and shall be secured in place with a joint comparable to the pipe joint.

316. CLEANING OF FINISHED PIPES

316.1 All finished pipes shall be cleaned with water and flushed prior to pressure testing.

317. ACCEPTANCE TESTING OF HDPE PRESSURE LINES

317.1 Test Requirements:

- a. The test procedure consists of two steps: the initial expansion phase and the test phase.



- b. Air testing is prohibited.
- c. Hydrostatic testing shall follow procedures specified in the International Plumbing Code.
- d. Potable water shall be used as the test medium.

317.2 Restrain Against Movement:

- a. Before applying pressure, all piping and all components in the test section must be restrained. This means that if piping or parts move or separate during the test, it will not result in damage or injury. Never conduct leak tests on unrestrained piping.
  - a1. Heat fusion joints must be properly cooled before testing.
  - a2. Mechanical connections must be completely installed and tightened per manufacturer's instructions.
  - a3. If backfill provides restraint, it must be properly placed and compacted. Joints and connections may be exposed for inspection.
  - a4. End closures must be suitable for pressure service and pressure-rated for the test pressure.
  - a5. Ensure that all connections to test equipment are secure. Disconnect or isolate all low pressure filling lines and all other parts that are not to be subjected to test pressure. Restrain, isolate, or remove expansion joints before leak testing.

317.3 Test Section:

- a. Testing may be conducted on the full system or in sections. Test section length is determined by the capacity of the testing equipment. Lower capacity pressurizing or filling equipment may not be capable of completing the testing within permissible time limits. If so, use higher capacity test equipment or select a shorter test section.
- b. Before applying test pressure, allow time for the test fluid and the test section to equalize to a common temperature.
- c. Components such as caps, valves, blind flanges, manual or automatic air release devices, vents, and other devices that are used to isolate the test section from other parts of the system, to purge air from the system, and to isolate components that are not to be subjected to test pressure are generally needed.
- d. Although section isolation and closure components may only be connected to the test section for the duration of the test, the joint between the test section and a closure or isolation component should be at least as strong as joints in the test section. Additional restraint may be required.
- e. Air release devices should be located at all high points along the test section.
- f. Excessively worn or deteriorated equipment is unsuitable and is not to be used.



- 317.4 Test Pressure:
- a. The hydrostatic/leak test pressure of the piping system shall be the maximum operating pressure of the pipe.
  - b. Table 2 lists standard pressure ratings of HDPE pipe based on the Standard Dimension Ratio (SDR) of the pipe.
  - c. Thicker pieces of pipe installed beneath railroad tracks on roads shall not be considered in determining the hydrostatic test pressure of the pipe.

**TABLE 2**  
**STANDARD PRESSURE RATINGS**  
**PSIG AT 73.4°F**  
**HYDROSTATIC DESIGN BASIS EQUALS 800 PSI**

SDR	32.5	26	21	17	15.5	13.5	11	9	7.3	6.3
Rating	50	64	80	100	110	128	160	200	250	300

- 317.5 Pressure Testing in the Trench:
- a. Before the test is conducted, all pipes shall be partially backfilled, but with the pipe joints exposed for examination. If the joints are covered with backfill prior to testing, the Contractor remains responsible for locating and correcting any leakage in excess of that permitted.
  - b. When local conditions require that the trench be backfilled immediately after the pipe has been laid, and concrete thrust blocks or pipe supports have been used, the pressure test may commence after backfilling has been completed and at least seven days after the last concrete thrust block or bearing pad has been cast.
  - c. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure.

- 317.6 Testing Outside of the Trench:
- a. If approved by the Owner pressure testing may be conducted after joining is complete before laying the pipe in the trench.
  - b. Pipe tested outside of the trench shall be anchored such that it will not move when pressure is applied. The Contractor shall be responsible for ensuring that normal safety precautions are observed for above ground pressure tests.

- 317.7 Procedure for Pressure Test:
- a. Each section of pipe to be tested shall be slowly filled with clean potable water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner at the low end of the portion of the system being tested.
  - b. The pump pipe connection to the pipe and all necessary apparatus including gauges and meters shall be furnished by the Contractor.



- c. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, venting may be provided by loosening flanges, using equipment vents, or providing taps, if necessary, at high points. Retighten any loosened flanges or vents and tightly plug all taps before applying pressure.
- d. Use at least one calibrated pressure gage or sensor accurate to within two percent (2%) of full scale. It is preferred that the gage or sensor full scale value not be more than twice the test pressure, and that scale graduations be no greater than two percent (2%) of the full scale value. Using a valved tee, a gage cock for bleeding, a pressure snubber, and a duplicate, back-up pressure gage are recommended. A continuous pressure-recording device may be required.
- e. Locate the test pressure gage or sensor to monitor test pressure at the lowest point in the test section. Pressure may be monitored at other points in the test section as well.

317.8 Temperature Equalization:

- a. Allow the test section and the test liquid to equalize to a common temperature.

317.9 Pressurizing – Initial Expansion Phase:

- a. When the test pressure is applied to a water filled pipe, the pipe expands. During the initial expansion of the pipe under test, sufficient makeup water must be added to the system in hourly intervals for three hours to maintain the test pressure. After about four (4) hours, initial expansion should be complete and the test phase can begin.
- b. If the test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, there may be faults such as excessive leakage, entrapped air, or open valving, or the pressurizing equipment may be inadequate for the size of the test section. If such faults exist, discontinue pressurizing, and correct the faults before continuing.
- c. Add make-up water as necessary to maintain initial test pressure for four (4) hours.
- d. All exposed pipe, fittings, valves, and joints shall be examined carefully during the initial expansion phase of the test. Any damaged or defective pipe, fittings, valves, or joints that are discovered during or following the pressure test shall be repaired or replaced by the Contractor with new material, and the pressure test shall be repeated until satisfactory results are achieved.

317.10 Test Phase:

- a. The hydrostatic leak test procedure shall follow the requirements of IPC.

318. FINAL INSPECTION

- 318.1 No pipe shall be put into service until inspected and approved by the Owner.

319. WITNESS OF TESTS

- 319.1 Witness:



- a. All system pressure tests, leakage, and operating tests shall be performed by the Contractor in the presence of the Owner or the Testing Service.

319.2 Test Schedule:

- a. The Contractor shall inform the Owner and the Testing Service a minimum of twenty-four (24) hours in advance of any operation or test to be witnessed by them.

320. TEST RECORDS

320.1 Documentation of pressure testing shall include the following information:

- a. The test liquid.
- b. Backflow prevention devices, if used.
- c. The test pressure:
  - c1. The type of test gages in the test section.
  - c2. The placement of test gages in the test section, such as test gage location distances and elevations from the beginning of the section.
  - c3. Test gage calibration records.
  - c4. Test pressures recorded during the test.
  - c5. Any adjustments made to test pressure for elevated temperature.
- d. The test duration.
- e. A description of the test section length, elevations, and site location.
- f. A description of the test section components.
- g. Description of any leaks or failures and the corrective actions taken.
- h. The date and time of day of the test.
- i. The identification of the party conducting the test.

321. DISINFECTION OF POTABLE WATER PIPING

321.1 Disinfection will be performed by Others.

322. BACTERIOLOGICAL TESTING

322.1 Bacteriological testing will be performed by Others.

323. CLEANUP

323.1 All excess pipe and all excess material from trenching, bedding, or backfill operations shall be removed from the plant site.

END OF SECTION 330303





**SECTION 337119**

**UNDERGROUND ELECTRICAL DUCTRUNS AND MANHOLES**

**PART 1 – GENERAL**

101. EXTENT

- 101.1 This Section covers the requirements for the installation of underground concrete ductruns, embedded conduits and electrical manholes as indicated on the design drawings, and as specified herein.
- 101.2 The Contractor shall supply all material and labor necessary for the complete construction of the concrete ductruns, cable vaults and manholes including the electrical conduit and fittings built-in, concealed or a part of the concrete work, reinforcing steel, excavation and backfill as indicated on the design drawings and as required for the Work.
- 101.3 The Contractor shall notify the Owner before fill, backfill or concrete is placed, or before concealment in any other manner of all electrical work which will be embedded in concrete, buried in earth or otherwise concealed.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

- 102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections and design documents:
- a. Section 312333 - Excavation and Backfill for Underground Utilities.
  - b. Electrical General Notes and Details.

103. REFERENCE DOCUMENTS

- 103.1 General: Related standard specifications are referenced in, but are not limited to, the documents indicated in this Section. The Work performed shall comply with the referenced and applicable requirements of these documents, in addition to federal, state or local codes having jurisdiction.
- 103.2 ACI - American Concrete Institute:
- a. 301 - Specifications for Structural concrete for Buildings.
- 103.3 ANSI - American National Standards Institute:
- a. C 80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.
- 103.4 AASHTO - American Association of State Highway and Transportation Officials:
- a. HB-17 - Standard Specifications for Highway Bridges.
- 103.5 ASTM - ASTM International:
- a. C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
  - b. C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.



- c. C 891- Standard Practice for Installation of Underground Precast Concrete Utility Structures.
- 103.6 NEMA - National Electrical Manufacturers Association:
  - a. Standards Publication TC 2 - Electrical PVC Tubing and Conduit
- 104. **SUBMITTALS**
- 104.1 In accordance with the general submittal requirements, submit to the Owner and the Consulting Engineer, the following for review:
  - a. Shop details and erection drawings.
  - b. Manufacturer's material certifications, mill test reports or certified material test reports, certifying that the products meet or exceed the specified requirements of applicable codes and standards.

## **PART 2 – PRODUCTS**

- 201. **MATERIAL**
- 201.1 Underground conduit will be schedule 80 PVC encased in concrete (steel reinforced under roadways). Elbows and vertical portions of conduit will be mastic coated aluminum to prevent the pulling rope from cutting through the bend during cable installation. Conduit termination at the concrete surface will be mastic coated aluminum.
- 201.2 Conduit Spacers:
  - a. Conduit spacers for conduit construction shall be manufactured by Underground Devices, Inc., Glenview, IL 60025 or approved equal.
  - b. Conduit spacers for plastic conduit construction shall be manufactured by Formex Manufacturing, Inc., Norcross, GA 30071; Carlon Electrical Sciences, Inc., Cleveland, OH 44122, or approved equal.
- 201.3 Cast-In-Place Concrete Requirements for the ductruns and cast-in-place manholes: Conform to the requirements of Section 033115.
- 201.4 Precast Concrete Manholes:
  - a. Furnish precast concrete manhole sections (base barrel sections, risers and conical/eccentric tops, flat slab tops, grade rings, etc.) per ASTM C478:
    - a1. Concrete: minimum 28-day compressive strength of 4000 psi.
    - a2. Manholes shall be furnished with knockouts or correctly placed openings to allow for connection of ductruns as indicated on the design drawings.
  - b. Manholes shall be designed for AASHTO HS-20 wheel loading per AASHTO HB-17, unless otherwise noted on the design drawings.
- 201.5 Manhole Frame and Cover:

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- a. Furnish frame and cover castings true to patterns in form and dimension, and free from pouring faults, sponginess, cracks, blowholes or other defects in locations affecting their strength and value for the service intended.
  - b. Furnish castings conforming to ASTM A48, Class 30B:
  - b1. Machine or grind bearing surfaces of the frames and covers to furnish a uniform, flat, non-rocking seat for the cover on the frame.
  - b2. Furnish cover with the words "ELECTRICAL" cast on the electrical manhole cover.
  - b3. Manhole frames and covers shall be designed for AASHTO HS-20 wheel loading per AASHTO HB-17, unless otherwise noted on the design drawings.
- 201.6 Sealant: Furnish one of the following sealing options for precast concrete manhole sections:
- a. Butyl rubber sealant shall be supplied in extruded rope form. The material shall comply with the composition and physical requirements specified in ASTM C990. The rope used for sealing tongue and groove manhole sections shall be of suitable cross section to fill the annular space when the sections are joined. The rope used for setting grade rings and manhole covers shall be a minimum of one (1) inch by one (1) inch. Use Press Seal EZ-STIK, or approved equal.
  - b. Sealing Gasket: Mastic Gasket as manufactured by RAM-NEK or Kent Seal or approved equal.
- 201.7 Cables installed in the manholes shall be supported on corrosion resistant cable racks or trays as indicated on the design drawings.
- 201.8 Provide a ¼" thick by 2" wide copper bar through the wall section of the manhole for grounding as indicated on the design drawings.

### **PART 3 – EXECUTION**

#### **301. EXCAVATION AND BACKFILL**

- 301.1 Earthwork shall conform to the requirements of Section 312333, unless otherwise indicated on the design drawings.

#### **302. CONCRETE WORK**

- 302.1 Cast-in-place concrete work shall conform to the requirements of Section 033115.
- 302.2 Ductrun arrangement, reinforcement and dimensions shall conform to the details as indicated on the design drawings.
- 302.3 Thickness of concrete between adjacent conduits shall not be less than three (3) inches and the thickness of concrete between the conduits and the outside of the concrete envelope shall not be less than seven (7) inches when the width of the ductrun is forty-eight (48) inches or less and eight (8) inches when the width of the ductrun is more than forty-eight (48) inches for all straight runs and normal curves or bends unless otherwise



indicated on the design drawings. For special conditions (e.g., where conduits cross each other), the distance between adjacent conduits may be reduced to 1½ inches if approved by the Owner.

- 302.4 Wood shall not be permitted to project into the established outside dimensions of the ductrun envelope. Forms shall be removed before backfilling. Wood or wood material shall be removed from the trench prior to backfilling.
- 302.5 Metals shall be placed so that no closed conducting loops are formed around any single conduit or any two phases of a three-phase circuit in a ductrun. Steel wire or reinforcing steel shall not be placed between conduits without the approval of the Owner. When it becomes necessary to place reinforcing between such conduits, non-magnetic manganese reinforcing bars shall be used.
- 302.6 Concrete shall not be placed until the arrangement of the ductruns, conduits and manholes is inspected and accepted by the Owner.
- 302.7 When pouring concrete over plastic utility ducts or other types of plastic conduits, a splash board shall be used to prevent disruption of the ductrun, and to prevent flattening of any of the ducts because of the excessive weight. The concrete pour shall be from one end of the ductrun to the other, to permit the free end of each duct to move without interference. Concrete shall never be poured from both ends to the middle of the run.
- 302.8 Construction joints and bonds between fresh concrete and old concrete or hardened concrete shall conform to the requirements of ACI 301.

303. CONDUIT INSTALLATION

- 303.1 Plastic utility ducts, Type EB (encased burial), shall conform to NEMA Standards Publication TC 2 and UL-651. Plastic utility ducts with belled ends shall be joined together using the solvent cements recommended by the manufacturer. Field cut ends shall be de-burred, wiped clean of dust, dirt, etc., and joined to a belled end with solvent cement.
- 303.2 Plastic or fiberglass utility ducts, and other acceptable types of plastic conduits, that are joined together with couplings, shall be cut off, connected and assembled in accordance with the duct manufacturer's printed instructions.
- 303.3 Type EB plastic utility ducts and other types of plastic conduits shall be assembled with plastic spacers that will support each conduit independently and will hold the conduits securely in place until the concrete is poured and vibrated. The spacer assemblies shall be installed on approximately 5-foot centers unless otherwise indicated on the design drawings.
- 303.4 Conduit joints shall be made watertight and secure. For plastic or fiberglass utility ducts, use the solvent cement recommended by the manufacturer of the plastic conduit.
- 303.5 Precast concrete spacers may be substituted for plastic spacers when using rigid aluminum conduit. The distance between the conduits and the dimensions of the ductrun envelope shall not be less than the dimensions specified on the design drawings or as specified in Paragraph 302.3 of this Section. This type of spacer shall not be used with



- plastic utility ducts or other types of plastic conduits where the weight of the upper conduits, spacers and concrete may deform or flatten the lower conduits.
- 303.6 Threads on aluminum conduits that are cut on the field shall be clean cut taper threads and not running threads. These threads shall be cleaned and the conduit ends should butt together inside of common couplings. The exposed field cut conduit threads shall be treated with galvanizing repair product. All threads shall be painted with Thomas & Betts Co. "KOPR-SHIELD" compound before the couplings are installed.
- 303.7 When using a duplex or double duplex adapters to join conduits with square-cut ends, the inside edges of the square cut ends shall be well reamed, and necessary precautions shall be taken to position and maintain the conduit in the center of the adapter until the joint sealing material has been applied and taken its initial set.
- 303.8 Conduit and couplings shall be made up wrench tight and shall be installed so that complete engagement of all threads into the coupling will occur.
- 303.9 Conduit shall be cut off square with a hacksaw or a power saw. The inside edges of the conduits shall be reamed with a rasp where necessary so there will be no sharp or rough edges on which the sheath or jacket of the cable may be damaged.
- 303.10 Ductruns are normally arranged so that standard manufacturer's bends or curved segments can be used; 11¼ degree, 22½ degree, 45 degree and 90 degree bends or sweeps. When slight offsets are necessary, they may be made by offsetting the conduit at each coupling up to 5 degrees, or by using manufacturer's standard 5 degree offset coupling which provides for offsets up to 5 degrees.
- 303.11 The sum of the bends in any one ductrun (between two manholes) shall not exceed 180 degrees and any one bend shall not exceed 90 degrees.
- 303.12 Each ductrun shall enter the manhole at a 90 degree angle to the face of the manhole to allow the cables to be pulled into the manhole without damage to the cable at the ductrun mouth. Bends in the ductruns shall be made beyond the point where the ductruns might be offset for manhole spacing.
- 303.13 Manholes shall be provided so that ductruns between the same are no more than approximately 300 feet in length unless otherwise indicated on the design drawings.
- 303.14 Where the conduits are indicated to be fanned out from the normal spacing (e.g., at the entrance to a manhole or other terminations), the spreading of the conduits in the ductrun shall be confined to the shortest distance permitted by the offset of the tapered joints or by the use of 5 degree offset couplings.
- 303.15 When offsets greater than 5 degrees are required, or when standard manufacturer's bends or curved segments cannot be used, a standard bend shall be cut to fit.
- 303.16 Center-to-center spacing for conduits shall be for the largest conduit in the ductrun.
- 303.17 Conduit bends shall be formed with mechanical benders such that bends are not flattened or kinked and that the internal diameter of the conduit will not be effectively reduced. Unless otherwise indicated on the design drawings, the minimum radii of bends be as follows:



Nominal Diameter of Conduit	Radius of Bend
2 inches	36 inches
3 inches	36 inches
4 inches	36 inches
5 inches	48 inches
6 inches	48 inches

- 303.18 Conduit joints shall be staggered horizontally and vertically, with adjacent joints separated approximately twelve (12) inches, center to center.
- 303.19 Conduits in ductruns shall be thoroughly swabbed immediately after completion of the concrete pouring. After the concrete has set, but before backfilling, a mandrel four (4) inches long (minimum), having a diameter of the nominal inside diameter of the conduit less ½ inch, shall be pulled through each conduit. The mandrel shall be lead covered or painted white to give indication of any protrusions on the inside of the conduit that might damage the sheath or jacket of cable.
- 303.20 A 3/16 inch diameter polypropylene braided cord shall always be attached to the rear end of the swab or mandrel to replace the rope being pulled out. When not in use, this cord shall be securely fastened at both ends of the duct.
- 303.21 The ends of all conduits shall be suitably plugged or capped at the end of each day's pour to protect them from damage during construction. Ends of conduits which are not to be used for long periods shall be protected from dirt, rodents, etc., by being plugged at both ends with wooden or other suitable plugs. A compound may be used on the plug to make it adhere to the conduit end. A ¼ inch hole shall be drilled in the lower portion of the plug to provide drainage of the conduit.
- 303.22 Should a concrete pour not end at a wall, a vertical bulkhead shall be installed. Reinforcement shall extend at least 4'-2" past the bulkhead. When the work is continued, remove the bulkhead and coat the contact area with grout immediately before placing the concrete. Reinforcement to lap 4'-2".
- 303.23 Electrical ground conductors shall be installed along the top of the ductrun and terminated at each manhole-to-manhole ground rod as indicated on the design drawings.
- 303.24 All conduit (metallic and non-metallic) in a ductrun shall terminate with a coupling that is flush with the concrete surface at all manholes and stub-ups.
- 303.25 All ductruns shall be sloped to insure that proper drainage is maintained. The slope shall be as indicated on the design drawings (typically three (3) inches per every 100 lineal feet).
- 304. INSTALLATION OF CAST-IN-PLACE MANHOLES
- 304.1 Cast-in-place concrete manholes shall follow the requirements of Section 033115 of this Specification.
- 304.2 Subgrade preparation shall follow the requirements of Section 312333 of this Specification.



305. INSTALLATION OF PRECAST CONCRETE MANHOLES

- 305.1 Prepare subgrade in accordance with Section 312333 of this Specification.
- 305.2 Subgrade shall be level and free of projecting stones, rocks, etc.
- 305.3 Manhole bases can be either cast-in-place or precast.
- 305.4 Exercise care to install base level and with full bearing throughout to ensure that completed unit is plumb.
- 305.5 Install precast manhole sections according to ASTM C 891 with sealing gasket to seal joints between sections in strict accordance with manufacturer's printed instructions. Clean joints prior to installation. Entire width of joint shall receive a layer of sealing gasket. Inspect for gaps in sealing surfaces. Correct any gaps before proceeding.
- 305.6 Fill lifting holes and gaps at joints with non-shrink grout.

306. ACCESS COVER AND SUPPORT FRAME

- 306.1 Access cover and its support frame can either be embedded in the cast-in-place concrete manholes, embedded in the precast concrete manhole top section or placed on top of the manhole if the top of the manhole is below grade.
- 306.2 When precast concrete grade rings are used, they shall be set with a mastic and/or grout to provide watertight seal and for the prevention of displacement of rings.
- 306.3 Grade rings shall remain plumb and vertically aligned during backfilling and paving operations.
- 306.4 Install the access cover frame with mastic and/or grout to provide watertight seal and for the prevention of displacement of the access cover frame.

307. IDENTIFICATION OF DUCTRUNS

- 307.1 The top surface of all concrete ductruns shall be colored red, to inform excavating personnel that the ductruns contain electrical cables. The ductruns can be colored by dusting the top surface with red oxide during the initial curing stage.

308. EMBEDDED CONDUIT INSTALLATION

- 308.1 To prevent conduits emerging from the floor slab from becoming safety hazards, they shall be installed so that no part of the bend is above the finished floor line. If this becomes impractical due to insufficient floor finish thickness, the conduit shall be routed so that the bend is parallel to the vertical surface upon which the conduit is to rise. The radii of bends shall not be decreased below the amount specified in Paragraph 303.17 of this Section without the written approval of the Owner.
- 308.2 Open ends of conduits shall be closed by means of plugs or pipe caps that will prevent concrete or other foreign material from entering the conduits. The caps or plugs shall not be removed until the conduits are being extended or the cables are being installed. The use of waste or oakum as a conduit sealing material is not acceptable.



- 308.3 Openings in floors and walls that are left open for conduit installations will be filled with a sand cement concrete mix or a packaged grout mix after the conduits are installed.
- 308.4 All conduit (metallic and non-metallic) shall terminate flush with the concrete floor or wall with a coupling.

END OF SECTION 337119

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**SECTION 400510**  
**ERECTION OF PIPING**

**PART 1 – GENERAL**

101. **EXTENT**

- 101.1 This Section prescribes the requirements for the installation of balance-of-plant “below ground” piping including its appurtenances, fittings, piping specialty items, valves, pipe supports, auxiliary steel and other accessories specified on project drawings, design drawings, data sheets, and/or other documents.
- 101.2 For balance-of-plant two (2) inch and smaller cold piping and tubing (small bore), work shall include, but not be limited to, the following:
- a. Design (based on the project unique “Cold Pipe and Support Design Procedure”), furnish, deliver, receive, unload, store, protect, remove from storage, design, erect and install, field routed balance-of-plant small bore cold piping and tubing including appurtenances and pipe/tube supports including auxiliary support steel. Design shall be subject to acceptance by Owner’s representative prior to start of piping erection. Design shall not block maintenance access, access aisles, exclusion zones, vertical drop zones and equipment removal areas.
  - b. The Installation Contractor’s scope shall include the procurement, erection, and support of all in-pipe appurtenances including but not limited to pipe supports, valves, thermocouple wells, specialty items, fittings, flanges, gaskets, bolts etc.
  - c. Cut into existing pipe systems, when required.
  - d. Furnish necessary welding rod including rod required for training welders and for field erection of two (2) inch and smaller piping and tubing.
  - e. Select the type and quantity of welding rod required for field erection of all piping.
  - f. Perform all NDE as required by applicable code.
  - g. Perform hydrostatic or pneumatic testing as specified or per the applicable code.
  - h. All temporary piping required for hydrostatic testing shall remain the property of the Installation Contractor.
  - i. Note that quantities for two (2) inch and smaller piping, tubing, fittings, specialty items, supports etc., are to be generated by Contractor. Piping composites for buried small bore piping are provided by Consulting Engineer.
- 101.3 For underground buried metallic pipe, work shall include, but not be limited to the following:
- a. Receive, unload, store, protect, remove from storage, erect, and install, underground buried metallic pipe and appurtenances. All erection work shall be performed per the design drawings and documents. See Section 400512.
  - b. Cut into existing pipe systems, when specified on the design drawings or documents.
  - c. Furnish necessary welding rod including rod required for training welders and for field erection of piping.



- d. Select the type and quantity of welding rod required for field erection of all piping.
  - e. Perform all NDE as required by applicable code.
  - f. Perform hydrostatic or pneumatic testing as specified or per the applicable code.
  - g. For buried ferritic steel piping (not encased in concrete), pipe shall be shop coated with a fusion bonded epoxy coating per AWWA C213 to a minimum thickness of sixteen (16) mils.
  - h. For cathodic protection for buried steel pipe see Section 264200.
- 101.4 The project-specific materials and equipment quantities and attributes are shown on the project drawings, equipment list, data sheets, valve design tables (VDT), piping specialty list, piping design tables (PDT), pipe line list, piping specialty list, valve list, instrument list and/or other documents.
102. RELATED WORK SPECIFIED IN OTHER SECTIONS
- 102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:
- a. Section 011900, Site Design Data
  - b. Section 013323, Shop Drawings and Product Data
  - c. Section 013324, List of Submittals
  - d. Section 014219, Reference Documents
  - e. Section 016600, Product, Receiving, Storage, and Handling Requirements
  - f. Section 099113, Finish Painting and Coating Work
  - g. Section 330302, Installation of HDPE Pressure Water Piping and Sewer Piping
  - h. Section 330303, Installation of HDPE Potable Water Piping
  - i. Section 400512, Miscellaneous Shop Fabricated Piping
103. SYSTEM DESCRIPTION OR DESIGN REQUIREMENTS
- 103.1 The piping line numbers shall be used for identification of the lines in all documentation.
- 103.2 Composite drawings will be provided by the Consulting Engineer.
- 103.3 The P&IDs show the piping diagrammatically only and are not to be used for physical layout; however, the composite drawings and the piping diagrams shall be considered together and any work called for or indicated on one and not the other shall be considered as part of the Work, unless otherwise specified.
- 103.4 Change in material, pressure class, size, pipe wall thickness, code jurisdiction, etc., in a line is shown on the composite drawings at the actual point of change. The line numbers shall be used for identification of the lines in all documentation.

104. REFERENCE DOCUMENTS

- 104.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents indicated in Section 014219, in addition to federal, state, or local codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the applicable additions, addenda, amendments, supplements, thereto, in effect as of the date indicated in Section 014219.
- 104.2 Abbreviations listed below and in Section 014219 indicate the form used to identify the referenced documents in the specification text.
- 104.3 ASME – American Society of Mechanical Engineers:
- a. B31.1 – Power Piping
- 104.4 ASTM – ASTM International:
- a. A36 – Standard Specification for Carbon Structural Steel
  - b. A106 – Standard Specification for Carbon Steel Pipe
- 104.5 NFPA – National Fire Protection Association:
- a. 14 – Standard for the Installation of Standpipes and Hose Systems
  - b. 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances
  - c. 56 – Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems
- 104.6 ANSI – American National Standards Institute:
- a. B16.5 – Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard –Revision of ASME B16.5–1996
  - b. B16.34 – Valves – Flanged, Threaded, and Welding End
- 104.7 AWWA – American Water Works Association:
- a. C213 – Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
  - b. C214 – Tape Coating Systems for the Exterior of Steel Water Pipelines.
- 104.8 NACE – NACE International:
- a. RP0274 – High Voltage Electrical Inspection of Pipeline Coatings.
  - b. No. 3 – Joint Surface Preparation, Commercial Blast Cleaning Standard Item No. 21067.
- 104.9 SSPC – Society for Protective Coatings:
- a. SP1 – Solvent Cleaning.

- b. SP3 – Power Tool Cleaning.
- c. SP6 – Commercial Blast Cleaning.
- d. SP10 – Near-White Blast Cleaning.
- e. SP16 – Brush-off Blast Cleaning of Non-Ferrous Metals.
- f. PA2 – Measurement of Dry Paint Thickness with Magnetic Gauges.

105. SUBMITTALS

- 105.1 Submit the following documents and other documents as required, for review in accordance with the submittal requirements of Section 013300:
- a. Test results.
  - b. Erection drawings.
  - c. Name and location of underground protective coating applicator for each type of coating.
  - d. Method and procedure to be used for cleaning, coating, wrapping inspection, and repair for each type of coating. Work shall not be performed prior to review of these procedures.
  - e. As-built drawings.

106. GENERAL QUALITY CONTROL AND QUALITY ASSURANCE PROVISIONS

- 106.1 Comply with all requirements of ASME B31.1 or other designated piping code, as applicable.
- 106.2 Specified Products and Substitutions:
- a. Mention of products or components by name as products of certain manufacturers is made to ensure that the proper quality and/or type are provided. Products of other manufacturers may be offered as substitutes with the Bid Proposal if the Installation Contractor furnishes proof to the Engineers that the proposed substitute products are equal to or better than the specified products in quality, performance, design, and suitability for the intended use. Any purchase of proposed substitute products by the Installation Contractor prior to acceptance by the Engineers will be at the Installation Contractor's own risk.
- 106.3 Underground protective coating work is subject to inspection by Owner's representative, and any work found not in accordance with the specification shall be cause for rejection and shall be redone to Owner's satisfaction at the Installation Contractor's expense. The cost of any testing desired by Owner's representative will be borne by Owner. Such inspection and testing shall not relieve the Installation Contractor of its responsibility to perform its work in accordance with the requirements specified.

107. DEFINITIONS

- 107.1 The term "piping" used in this specification includes straight pipe, pipe bends, tees, reducers, sockets, flanges, bolts, gaskets, specialties, and other fittings.
- 107.2 Large Bore Piping – piping or tubing 21/2 inches and larger.
- 107.3 Small Bore Piping – piping or tubing 2 inches and smaller.

- 107.4 Cold Pipe – Pipe with maximum design temperature of 250°F.
- 107.5 Hot Pipe – Pipe with design temperature over 250°F.
- 107.6 Underground Buried Metallic Pipe – Steel or non-ferrous pipe utilized for: lube oil, anhydrous ammonia and fuel gas.
- 107.7 Piping & Instrumentation Diagrams (P&IDs) – This document provides the diagrammatical representation of the piping system. P&IDs include the piping line numbers, valve numbers, specialty numbers, equipment numbers, piping code breaks, Piping Design Tables, and design conditions.
- 107.8 Piping Design Tables (PDT) – This document provides the dimensional and material requirements for the designated pipelines. The PDTs also reference the applicable valve design table. The PDTs are organized by ANSI pressure class ratings (i.e., PDT 0300 corresponds to ANSI Pressure Class 300; valves and flanges are required to be ANSI Class 300).
- 107.9 Piping Line List – This document contains a numeric listing of all pipe lines designated on the P&IDs and Design Drawings. The list contains the Pipe Line Number, Furnish Specification and Installation Specification, P&ID Number, Piping Design Table, pressure, temperature, insulation type and thickness and remarks.
- 107.10 Valve Design Tables (VDT) – This document provides the dimensional, material and procurement requirements for the project designated valves.
- 107.11 Valve List – This document contains a numeric listing of all valves designated on the P&IDs and Design Drawings. The list contains the Valve Number, Furnish Specification and Installation Specification, P&ID Number, Pipe Line Number, PDT, VDT, pressure, temperature, and remarks.
- 107.12 Piping Specialty List – This document contains a numeric listing of all piping specialties designated on the P&IDs and Design Drawings. The list contains the Piping Specialty Number, Furnish Specification, and Installation Specification.
- 107.13 Pipeline Identification: The pipeline numbers will be assigned by Owner/Engineer. The format of the pipeline number will be provided after award.
108. DELIVERY, HANDLING AND STORAGE
- 108.1 Contractor shall obtain complete information from the manufacturer regarding the number of pieces and size in which the equipment will be shipped and the date of shipment of each item.
- 108.2 Contractor shall be responsible for the equipment and material to be unloaded and/or erected from the time of their arrival at the site, until the Work is accepted in its entirety by Owner, except during such time as said equipment or material are removed from the control of the Installation Contractor by specific instructions of Owner. If said equipment or material arrives at the site after the award of Contract, but before the arrival of the Installation Contractor on the Project site, the Installation Contractor shall have complete responsibility for the equipment or material while they are being unloaded and handled for them by others.



- 108.3 Upon receipt of equipment shipment, Contractor shall check quantities against invoices for shortages and inspect for visible damage. Before offloading any equipment, Contractor shall immediately notify the Owner when material has been lost or damaged during shipment. Contractor shall make the shipment available for inspection by the carrier before moving or unloading. Owner reserves the right to inspect materials during and after unloading to verify shop workmanship and determine if any corrective work will be necessary.
- 108.4 Upon arrival of the equipment and material at the project site, Contractor shall ensure that each seal on equipment connections and piping ends is intact. If cap, plug, or other type of seal is missing upon arrival of the equipment or material, it shall be cleaned immediately of all foreign material and resealed. Contractor shall maintain seals during the course of the Work, except where otherwise necessary.
- 108.5 During the storage period, all stored material and equipment shall be periodically inspected for tightness of seals.
- 108.6 Equipment and material stored outdoors shall be above grade and protected against dirt, fly ash and inclement weather conditions up to the time of field fabrication or erection; all temporary material for such protection shall be furnished by Contractor.
- 108.7 Contractor shall be responsible for paying any demurrage accumulated on cars due to failure to unload equipment from cars. Any handling of such cars on plant property beyond the point of delivery of the cars by the delivering carrier shall be at Contractor's expense.
- 108.8 Contractor shall maintain records, for the control of receipt, protection, and disbursement of Owner's equipment and material. A record shall be made of all equipment and material that is received and accepted or rejected. The record shall be agreed upon, in writing, with the Owner.
- 108.9 Contractor shall unload and store all spare parts, spare supplies and maintenance tools furnished with the equipment. Maintenance tools shall not be used for the erection work, unless otherwise permitted by the Owner.
- 108.10 Welding rod shall be packaged in appropriate durable containers to limit exposure to elements known to be detrimental to the life and quality of the product.
- 108.11 Buried Pipe:
- a. The coated pipe should at all times be handled with industry-approved methods and equipment such as wide canvas slings, padded cradles, or rubber-covered separators, etc., designed to prevent damage to protective coating.
  - b. Rail shipment should be loaded in accordance with the current rules of the American Railway Association. When shipped by truck, all chains, cables, or other equipment used for fastening down the load should be carefully padded.
  - c. If pipe is to be stored in piles, the same general practice as outlined above should be followed.
  - d. Bare cables, chains, hooks, metal bars, and similar devices should not be allowed to come in contact with the protective coating.

- e. Piping placed in storage shall be stored off the ground using padded bolsters and plain timbers under the uncoated ends. Suitable wedges shall be used to preclude rolling. Pipe shall be stored on flat, well-drained ground whenever possible.
- f. Coated piping subject to deterioration from long exposure to direct sunlight shall be adequately shaded for protection. Buried pipes to be professionally surveyed by Contractor to document as built location, prior to backfilling.
- g. Buried pipe stub outs shall be flanged and with provisions for testing.
- h. All finished underground piping shall be blind flanged at the stub outs and protected after cleaning and testing activities are complete.

109. PROJECT/SITE CONDITIONS

- 109.1 Refer to Section 011900 – Site Design Data.

**PART 2 - PRODUCTS**

201. ACCEPTABLE MANUFACTURERS AND PRODUCTS

- 201.1 Acceptable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed below or listed in other Part 2 Articles.
- 201.2 Contractor shall conform to all requirements of ASME B31.1, Power Piping and ASME Section I, or other designated piping code, where applicable.

202. COMPONENTS

202.1 Piping, Appurtenances, and Accessories:

- a. Provide all necessary miscellaneous piping, vents, drains, and piping accessories and appurtenances indicated on design drawings (except where specifically indicated to the contrary on project drawings or lists), including, but not limited to, fittings, pipe supporting elements, bypasses for piping and specialties, insulation supports, pipe saddles for insulation protection, unions, couplings, pipe flanges, gaskets, bolting, and nozzles.
- b. Provide such other miscellaneous piping, vents and drains, appurtenances, which may not be shown on the design drawings but which may be required to complete the Work and to make the piping system and equipment function properly.

- 202.2 Manufacture: All components shall be of manufacture and type indicated in this Specification or on the design drawings, shall be of material suitable for the pressure-temperature conditions in each case, and shall be acceptable to the Consulting Engineer(s).

203. MATERIAL REQUIREMENTS

203.1 Fusion Bond Epoxy Coated (AWWA C213):

- a. Fusion bond epoxy coating per coating specification CS-232, attached in Section 099113 shall be applied. The coating shall be shop applied per AWWA C213 with the following exceptions and clarifications:

- a1. Surface preparation shall be commercial blast cleaning per SSPC-SP6 or NACE No. 3. Solvent cleaning, where required, shall be per SSPC-SP1. It is intended that coating shall be applied immediately after cleaning. Blasted surfaces that show any rust bloom before the primer can be applied shall be thoroughly cleaned of such rust by blasting.
- a2. Primer shall be Type B (fast drying synthetic) as required by the qualifications set forth in AWWA C213. The primer and enamel shall be from the same manufacturer.
- a3. Trace Wire:
  - b. Trace wire for non-metallic pipe shall be a three (3) inch wide detectable underground warning tape with a brightly colored plastic coating imprinted with the words "Caution Sewer Line Below" in large letters. Empire Level Manufacturing Corp. "Magnetic" or approved equal.

204. FABRICATION REQUIREMENTS

204.1 Shop Fabricated Piping:

- a. It is the responsibility of the Shop Fabricator to coordinate with the Contractor for field specific fit-up requirements.
- b. Contractor shall review the pipe spool drawings. It is the responsibility of Contractor to give a feedback to the engineer regarding field fit-up requirements.
- c. It is Contractor's responsibility to review and evaluate the location of the field welds on the drawings, and to give a feedback to the Consulting Engineer(s) whenever field weld location needs to be relocated.

204.2 Contractor may set up a temporary piping fabrication shop on the Project site for field routed piping.

204.3 Protection of Field Fabricated Materials:

- a. Materials shall be provided with protection against damage, corrosion, and internal contamination in accordance with the following:
  - a1. Materials Stored at or Near the Project Site:
    - a1.1 All materials and equipment shall be packaged, packed, or prepared in a manner which will ensure arrival at destination in satisfactory condition. Procedure and details shall be submitted to Owner for review prior to start of shipment.
    - a1.2 All openings in piping and equipment furnished by Contractor shall be securely plugged, capped, or otherwise blanked off, sealed with tape, and suitably protected against damage and entry of foreign materials and moisture. For shop-fabricated piping, this shall be done as soon as possible after shop cleaning.
    - a1.3 Weld ends on all valves, fittings, pipes, nozzles, etc., shall be capped and sealed with suitable, firmly attached protectors. Butt-weld ends on ferrous materials shall be coated with Special Chemicals Corporation Deoxaluminite, or acceptable equal, prior to capping, back to a ring whose length is the same as the weld preparation plus two (2) inches minimum.



- a1.4 Protectors for beveled ends designed for backing ring or consumable insert shall have a plywood or hardboard liner disc held securely against the beveled end. Protectors for other weld ends may be metal caps without liner discs. Protectors shall not be welded to the weld end.
- a1.5 All flange facings, bolt holes, and other machined surfaces of ferrous materials (except butt joint end preparation) shall be coated with a suitable removable anti-rust compound. No coatings shall be applied to nonferrous materials.
- a1.6 All flanged connections and loose flanges shall be provided with suitable full face flange protectors bolted in place and sealed.
- a1.7 All protectors for openings and all braces, brackets, spacers, ties, bindings, and other shipping, packaging, and packing materials and appurtenances used for protection in shipping, storing, and handling of nonferrous piping and materials shall be of such design, type, and/or arrangement as to prohibit contact between ferrous and nonferrous materials.
- b. Lube oil system piping shall be coated after passivation as specified herein.
- c. Wrapping: Materials of nonferrous metal shall, after cleaning and blanking off and sealing ends, be wrapped in Kraft paper or polyethylene and/or crated for shipment.
- 204.4 General Buried Pipe Fabrication Requirements:
  - a. All pipe sizes of straight pipe, within the size range (diameter and length) capabilities of the automatic coating machinery or process employed in the shop, shall be coated in the shop under controlled conditions. Fittings, connections, and special shapes shall be protective coated as specified for the straight pipe if practicable; however, if fittings and special shapes preclude machine coating, they shall be hand coated equivalent to results on the straight pipe sections.
  - b. All field-welded joints, flanged joints, screwed joints, mechanical joints for field erection shall be left uncoated in the shop for purposes of field erection which shall be cleaned, primed and protective coated in accordance with the same protective coating requirements specified for their respective piping system.
- 204.5 Double Wall Pipe Fabrication Requirements:
  - a. Buried lube oil piping will be double walled pipe with carbon steel carrier pipe and carbon steel containment pipe.
  - b. Containment pipe shall be coated and wrapped with FRP.
  - c. The double wall pipe shall be Perma Pipe Ultra FS piping or equivalent.
  - d. Vents, drains, and test ports shall be double walled tees off of the main line and manufactured by the double wall piping OEM.
- 204.6 Field Joints:
  - a. Where pipe sections are to be joined together by field welding or with mechanical joints, a band of sufficient width to permit joint makeup shall be left free of protective materials on the pipe ends.



- b. Weld end preparation at field weld joints shall be suitably protected during shipping with a coating of Deoxaluminite, or equal to be reviewed by Owner or Owner's engineer.
- c. Mechanical joints using threaded parts such as screws, nuts, and bolts, etc., shall not be coated in the shop but shall receive a suitable rust preventative only, and after final field assembly the joint shall be thoroughly cleaned and coated with the specified system.
- d. Where rubber-gasket joints or mechanical couplings are used, the shop-applied or field-applied coating shall not be in excess of that recommended by the sealing device or coupling manufacturer.

204.7 Buried Ferritic Steel Piping (Not Encased in Concrete):

- a. Piping shall be shop coated with a fusion bond epoxy coating in accordance with AWWA C213.

204.8 Fire Protection Systems:

- a. Piping, joints, fittings, valves, valve boxes, and hydrants shall conform to NFPA requirements.
- b. New fire protection piping tie-ins to the existing main shall use like materials to the main with a transition compatible with the new connecting line. Contractor shall verify the existing main material to determine the material to use for the tie-in and compatible transition.

205. FINISH REQUIREMENTS

205.1 Identification and Marking:

- a. All piping components furnished separately by Contractor shall have a securely attached metal tag marked to identify each item and its particular service. Tag materials shall be stainless steel, unless otherwise specified herein or otherwise accepted by the Consulting Engineers. Identification shall include the individual pipe line number as set forth herein.
- b. Identification on drawings submitted for review, for each pipe shall include the same number used on the tag. Spool, random length of pipe, or single fitting tags shall be attached securely without the use of welding.
- c. All steel pipe shipped in random lengths shall be color-coded with identifying color stripes indicating pipe material (ASTM or ASME number and grade) and schedule running the full length of each pipe to prevent interchanging pipe types during installation.

**PART 3 – EXECUTION**

301. GENERAL

- 301.1 Completeness of Work: It shall be Contractor's responsibility to furnish the services of all trades necessary to complete the Work covered by this Specification. All systems shall be placed in successful service by Contractor to the satisfaction of the Consulting Engineers.

302. PREPARATION

302.1 Removal and Relocation of Present Work: Remove, relocate, and modify any present piping requiring such work, as indicated.

302.2 Connections to Present Work: Remove blind flanges on existing piping to which the work connects, cut, or burn openings and weld to present piping, install and remove such temporary and permanent blind flanges, pipe plugs, shutoff valves, etc., as may be necessary during the progress of the work, and do all other similar work as may be reasonably required to complete the work. All cut-ins or connections made to existing systems shall be done only at such times as Owner may designate. As a safety measure, Contractor shall determine that a system, or portion thereof, is shut down or isolated, and all Hold Card procedures have been implemented, before cutting in or making connection thereto.

303. ERECTION OF PIPING

303.1 Erection of the piping, including valves, pipe-supporting elements, and appurtenances, shall be done in an orderly and workmanlike manner, and shall be scheduled to suit the requirements of the project. In addition to other applicable requirements specified herein, the following specific piping system erection requirements shall apply:

- a. Minimum of Joints: Throughout the entire system there shall be as few joints as possible.
- b. Diagrammatic Connections: Any connections that are indicated only diagrammatically on the design drawings shall be installed in a neat and workmanlike manner, subject to acceptance by Owner.

303.2 Alignment and Drainage:

- a. Piping shall be erected so as to preserve accurate alignment. Contractor shall check field measurements and allowance for makeup lengths or “closures” as may be necessary for accurate alignment and assembly, prior to fabrication and installation.
- b. Pipe runs in which condensate drainage is required shall be properly pitched to points of drainage.
- c. For all steel pipe, the pipe straightness shall be 1/8” per ten (10) feet or 1:1000 for all straight pipe segments or spools made up of several pieces of straight pipes.

303.3 Closure: All piping shall be worked into place and the closing weld made without springing or forcing. It is Contractor’s responsibility to maintain surveillance of the piping system during erection to ensure that no stress from misalignment is imposed, and that dimensional requirements are met. Any discrepancies shall be noted to Owner’s representative. This should include a review of the piping supports in the field to ensure that they are properly located and adjusted to the design position. Neutral points shall be maintained.

303.4 Miscellaneous Small Connections: All openings for vents, drains and other similar connections made after the piping system is erected shall be drilled and the internal area cleaned out. No burning will be permitted.

303.5 Attachments for Pipe Supporting Elements, and Handling: Where attachments to piping furnished by others and erected by Contractor are required, but not furnished and/or installed by others, Contractor shall furnish and/or install such attachments.



- 303.6 Cutting, Drilling, etc.:
- a. Contractor shall do all necessary cutting or patching of concrete or asphalt.
  - b. Contractor shall furnish and/or install anchors and/or anchoring facilities. Where details are not shown on the drawings, Contractor shall submit details to Owner for review and acceptance.
- 303.7 Floor Openings:
- a. Floor pipe openings and sleeves will be provided by Contractor. Piping which is field routed by Contractor shall be run in groups, insofar as is practical, to minimize the number of pipe openings, sleeves and guarding devices required.
  - b. Contractor shall install the guarding devices for the pipe sleeves and pipe openings. After all piping is erected, Contractor shall provide additional guarding devices, if required.
- 303.8 Temporary Support:
- a. Contractor shall furnish and install temporary supports or bracing as required, such as the following times.
    - a1. During hydrostatic testing or leak testing by Contractor, to prevent undue stress on the system's permanent piping supports and to withstand the weight of water without excessive deformation.
  - b. Contractor shall remove any/all temporary supports, anchors, and bracing furnished by Others, as well as that furnished by Contractor, from piping erected by Contractor, at the following times.
- 303.9 Flanged Joints:
- a. Contact Face Finish: Contact faces shall be as set forth in the Piping Design Tables referenced the design drawings for each particular service. All raised face flanges shall have serrated facing. Contact faces for all male and female, and tongue and groove faced flanges shall have smooth tool finish, unless otherwise indicated.
  - b. Gaskets:
    - b1. Gaskets for all joints shall be of such inside dimensions that no portions will project into the ports of valves, pipes, or fittings. Gaskets for male and female joints, and for tongue and groove joints, shall fit into the female or groove facing with approximately 1/32-inch clearance. Gaskets for raised-face joints shall extend to within 1/16 inch of the bolts. Plain-faced flanged joints shall have full-face gaskets with holes for bolts, unless otherwise indicated.
    - b2. Gaskets shall be as set forth in the Piping Design Table for each particular service.
    - b3. Spiral-wound metal gaskets shall be of manufacture and style set forth in the Pipe Design Tables.
      - b3.1 When ordering spiral-wound metal gaskets, the Installation Contractor shall specify complete joint data for each specific application, including:
      - b3.2 Service (fluid to be handled by piping) and operating pressures and temperatures.



- b3.3 Flange material and pressure class.
  - b3.4 Type of flange facings.
  - b3.5 Bolting materials.
  - c. Studs:
    - c1. All alloy steel studs shall have identification marks at one end, covering material, class, etc. Studs for low-temperature and high-temperature Work shall not be interchanged when installing.
    - c2. All steel bolts shall have Class 2A fit threads, and all nuts for steel bolts shall have Class 2B fit threads, per ASME B1.1.
  - d. Thread Compound: Threads of all bolts and studs shall be painted with a suitable thread compound before joint is made up. The compound shall be suitable for the operating temperatures involved. For high-temperature service, special high-temperature thread compound must be used.
  - e. Faces of flanges and gaskets shall be wiped clean when making up all flanged joints.
  - f. Contact faces of all flanged joints shall come squarely together and particular care shall be exercised in pulling up flanged joints to prevent any overstressing of flanges, bolts, or studs.
  - g. No permanent fillers shall be used between flanges, except where specifically indicated on the Design Drawings.
- 303.10 Field Coating Work.
- a. Before piping is lowered into the trench, all areas of the shop-applied coating shall be visually inspected for any damage that may have occurred during shipping and handling. These damaged areas shall be repaired before the pipe is installed.
- 303.11 Protection:
- a. For piping, which is field fabricated by Contractor, all openings of the fabricated piping and remaining cut pipe shall be provided with protectors, as soon as possible after cleaning. Protectors shall remain in place until removal is necessary for connection thereto.
  - b. If connections to piping erected by Contractor are to be made by Others, Contractor shall ensure that the associated terminal connections are provided with protectors. Where such terminals are located in an area where they may be subject to damage from other operations at the project site or constitute a hazard, Contractor shall provide barricades and/or warning signs around the terminals.
  - c. Contractor shall, at the end of each working day, ensure that all remaining opening in piping erected by them and all new openings made by them in existing piping are provided with temporary protectors.
304. FIELD WELDING
- 304.1 Contractor shall meet the requirements outlined below.

- 304.2 It is Contractor's responsibility to review and evaluate the location of the field welds on the drawings, and to give a feedback to the Consulting Engineers whenever field weld location needs to be relocated.
- 304.3 Field welds in piping systems requiring a high degree of cleanliness and a relatively smooth contour at the inside of the welded joint (Lube Oil, fuel gas, ammonia) shall be made using the gas tungsten arc process for the first welding pass. The remaining weld passes shall be made using one of the processes listed previously. All gas tungsten arc welds shall be made with the addition of filler metal.
- 304.4 Welding filler metal chemistry shall match that of the base material, unless otherwise specified. Similar metallurgical properties, i.e., yield strength equal to or greater than base metal, equal or better corrosion-erosion resistance and equal or better thermal properties shall be produced.
- 304.5 The application of heat to correct weld distortion and dimensional deviations in austenitic stainless steels is prohibited.
- 304.6 Preparation of weld ends and fit-up shall be in accordance with the requirements of ANSI/ASME standards. Base metals for butt weld joints shall be prepared by machining or mechanized oxygen cutting. In specific instances where the use of the above equipment is impractical, written permission from the Owner must be secured if hand oxygen cutting is to be substituted. All slag, irregularities and thermally-affected areas shall be removed from oxygen cut ends and hand ends shall be ground smooth.
- 304.7 Backing rings shall not be used in any piping system without prior written approval of the Owner. Backing rings, where allowed by Owner, shall be of the flat split ring type. The material of the backing rings shall be compatible with the composition of the pipe with which it is used.
- 304.8 Welding pre-heat and interpass temperature shall be maintained in accordance with the requirements of the applicable code. Electric or gas heat sources, which provide a uniform application of heat over the weld area, shall be used in accordance with ANSI/ASME B31.1 Section 131.
- 304.9 Stress relieving of all welds shall be performed in accordance with the requirements of the applicable piping code. All welding zones, bends and hot-formed sections shall be fully stress relieved as required by the applicable code.
- 304.10 Wherever possible, stress relieving shall be performed by slowly heating the entire assembly to the specified temperature, holding the temperature for the required length of time, and then allowing the assembly to cool. Where this procedure is impractical, local stress relieving may be employed.
- 304.11 Pipe bending shall be used only when specifically required or where the use of elbows is impractical. All bends shall be smooth, without buckles and truly circular. The allowable flattening, as determined by the difference between the minor and major axes, shall not be greater than 5 percent of the nominal diameter. Allowance shall be made for thinning of the pipe wall in accordance with the requirements of Paragraph 102.4.5 of ASME B31.1 to assure that minimum wall thickness after bending is not less than the minimum wall thickness required.
- a. Fuel gas piping shall utilize 5D bends.
- 304.12 All lugs, ears, and other attachments for support of piping shall be welded to the piping. Attachments for piping systems which must be stress relieved shall be welded to the



pipe prior to final stress relieving. Attachments on shop fabricated piping which must be stress relieved shall be shop welded to the piping.

- 304.13 Field-welding on pressure parts shall be stress relieved as required by applicable codes.
- 304.14 Contractor shall submit welding procedures, stress-relieving procedures, and procedure qualification records to the Owner for review and written approval prior to performing any welding.
- 304.15 Any combustible material or electric cables beneath or adjacent to welding operations shall be protected against sparks, splatter, and molten material. Contractor shall ensure that safe conditions exist prior to and during any welding in areas where coal dust and/or gas may be present. Contractor shall be responsible for supplying any portable ventilation or other equipment necessary to ensure that safe conditions exist and are maintained.
- 304.16 Tools used for cleaning welds shall match weld material (grinders, burr brushes, etc.).
- 304.17 All welds that have been made by Contractor for temporary attachment shall be properly removed and the surfaces of the present work shall be finished clean and smooth. Appropriate NDE shall be implemented to verify there are no resultant defects.
- 304.18 Non-Ferrous Joints:
  - a. HDPE Pipe Joints:
    - a1. Joints in High-Density Polyethylene (HDPE) pipe shall be of butt fusion weld type and shall be made in accordance with the manufacturer's procedures. Copies of certifications shall be made available to the Owner upon request.

305. FIELD QUALITY CONTROL

- 305.1 Inspection and Testing:
  - a. The piping components (including valves), fabricated piping and the installation of the piping shall be tested and/or inspected in accordance with the applicable requirements of the governing code(s).
  - b. Components Furnished by Contractor: Per the requirements of the applicable ASTM or ASME material and ANSI dimensional specifications, and the governing code.
  - c. Leak Testing of Piping Systems: Prior to initial operation, Contractor shall perform a leak test on each part of the system erected by them at the operating pressure and temperature in accordance with the requirements of the following unless otherwise indicated in this Specification:
    - c1. Hydrostatic Test: The following systems are made to ASME B31.1 NBEP piping code and require a hydrostatic leak test excluding vents and drains operating at atmospheric conditions:
      - c1.1 Demineralized Water Piping
      - c1.2 Service water piping
      - c1.3 Wastewater piping (pressurized piping)
      - c1.4 Lube Oil Piping

- c2. Pneumatic Tests: The following systems shall be given a pneumatic test in accordance with the ASME B31.1 Code. The test medium shall be nitrogen or carbon dioxide gas. The pneumatic test shall be preceded by a preliminary test per ASME B31.1.
- c2.1 Anhydrous ammonia piping
- c2.2 Fuel Gas Piping
- c2.3 Instrument Air Piping
- c3. Lube oil piping containment piping shall be leak tested with compressed air or nitrogen.
- c4. All fire protection piping and high-pressure service water piping feeding fire protection shall be hydrostatically tested per NFPA 14.
- c5. Potable water piping shall be pressure tested according to IPC.
- c6. Test Pressures and Temperatures: As set forth in ASME B31.1 or the applicable piping code and as follows:
  - c6.1 Water used for the hydrostatic tests shall in no case be less than 70°F or greater than 125°F for all systems.
  - c6.2 The hydrostatic test pressures shall in no case exceed the adjusted pressure-temperature rating for 100°F as given in the ANSI standard for Steel Pipe Flanges and Flanged fittings (ANSI B16.5) and the ANSI Standard for Steel Valves (ANSI B16.34) for the material and pressure standard involved.
- d. Electrical Inspection of buried metallic pipe: After coating and wrapping operations have been completed, Contractor shall conduct electrical inspections of all coatings of the pipe, special sections, connections, and fittings with an electrical holiday detector. The electrical equipment, procedure, and repair shall be in accordance with the applicable requirements of AWWA C203.
- d1. All buried fuel gas and ammonia piping welds will be 100% holiday tested prior to backfilling.
- 305.2 Temporary Field Testing Facilities and Services:
  - a. Contractor shall furnish, install, and remove blind flanges, pipe plugs, caps, spools, etc., and make all temporary connections necessary for field test by Contractor.
  - b. Contractor shall disconnect and reconnect assemblies where it is necessary for tests by Contractor. Equipment with pressure limitations lower than the test pressure to be used and instruments shall be protected by Contractor against any damaging effects of hydrostatic and pneumatic tests.
  - c. Contractor shall furnish hand or power driven pumps and all other necessary equipment, including heaters and piping connections and valves from the source of test medium, for making field tests by Contractor.
  - d. Contractor shall provide the necessary temporary piping and connections, with valves and blind flanges, and related parts as may be required for filling and draining the piping systems and equipment that will be tested by Contractor.



- e. Contractor shall fill the systems and equipment that they are to hydrotest with water. After testing is completed, Contractor shall drain the water and dispose of it in accordance with all federal, state, and local regulations. The water used for hydrostatic testing shall be demineralized water, condensate, service water, or construction water, as directed by Owner's representative.
  - f. In conjunction with leak testing of the piping, Contractor shall do all gagging of associated safety and relief valves required for the leak testing and shall remove gagging at the completion of the testing.
- 305.3 Supervision: All tests shall be made under the direction and supervision of Owner/Engineer or their authorized representatives, and the Work must in all cases be proven right to their satisfaction.
- 305.4 Documentation and Test Reports: Documentation and test reports shall be in accordance with the governing code and the following:
- a. Contractor shall submit a complete report to Owner/Engineer covering the test results and his inspector's interpretation of test findings and their disposition.
  - b. Each test report shall include data identifying each system (or portion thereof), test method, test number, date of test, Contractor's name, contract number, Owner's name, and project and unit identification.
  - c. Contractor shall furnish Owner/Engineer with three (3) copies of all tests specified and/or required.
306. ADJUSTMENTS AND TIGHTNESS
- 306.1 Contractor shall remedy all leaks in the piping system and appurtenances erected by Contractor that may develop during testing and initial operation and shall retain the necessary field crew on the project after the main erection Work is completed to perform, at no addition to the contract price, the following Work as required to prepare the piping system for continuous operation:
- a. Recheck all bolted assemblies where necessary.
- 306.2 All piping installed by Contractor shall be tight at the maximum working pressures and temperatures.
307. CLEANING AND PAINTING
- a. After materials are finished and tested, they shall be cleaned, painted, and/or protected for shipment in the shop, as follows:
- 307.2 Piping Materials Furnished by Others:
- a. Fabrication by Contractor: Where pipe fittings, flanges, etc., are furnished by others for fabrication by Contractor, Contractor shall after fabrication, clean such pipe in accordance with the requirements herein.

- b. Erection by Contractor: Where valves and other specialties are fabricated by others for erection by Contractor, such materials will be shop cleaned by others: however, Contractor shall inspect the inside of such materials, upon receipt and prior to installation to ensure that they are clean. Contractor shall re-clean such materials if necessary.
- c. Reused Materials: All pipe, fittings, valves, and other appurtenances (if any) that have been removed by Contractor or by others from present systems and which are to be reused by Contractor, shall be thoroughly cleaned both inside and outside and all working parts of valves and other appurtenances shall be checked by Contractor for proper functioning before they are installed. Any malfunctions shall be reported to Owner's Representative.
- d. Flammable Gas Piping Systems: All cleaning and purging of flammable gas piping systems, including cleaning new or existing piping systems, purging piping systems into service, and purging piping systems out of service shall be in accordance with NFPA 56.

307.3 Cleaning During and After Erection:

- a. Contractor shall ensure that all piping erected by them is maintained clean during erection.
- a1. General: The inside of all piping shall be free of loose scale, welding icicles and spatter, oil, grease, rust, paint, welding fluxes, chalk, abrasives, carbon deposits, coatings, moisture, and all other foreign matter before it is placed in service. Cleaning shall be done in accordance with the following:
- a2. Bends after Fabrication: The interior of all bends shall also be thoroughly cleaned by the methods specified above.
- a3. Other Piping: The interior of all other pipe, fittings, valves, specialties, fabricated piping, and appurtenances shall also be thoroughly cleaned by suitable methods acceptable to the Consulting Engineers. As a minimum, the materials shall be rapped and blown out with compressed air.
- a4. Closures: All openings shall be provided with temporary closures, as hereinafter specified, as soon as possible after cleaning.
- a5. Cleaning Materials and Procedures: Prior to start of the Work, Contractor shall submit to the Owner for review, his methods, and procedures for cleaning the piping and type of acid and neutralizing agent to be used for pickling.
- a6. Contractor shall clean out the inside of all cut-ins and openings made by them in existing piping for new connections. The Installation Contractor shall blow out existing piping, prior to making new connections, if required, as directed by Owner's representative. If new connections to cut-ins are not made immediately, the openings shall be sealed with temporary protectors.
- a7. Contractor shall perform blowing out, flushing, chemical cleaning, and other special cleaning operations on principal systems after erection, where required as directed by Owner/Engineer, and/or as indicated on the drawings.
- a8. Lube oil systems shall be drained, pigged, and blown out with compressed air after hydro testing is complete. After piping is verified clean and dry, a nitrogen blanket shall

be applied at 10 psig. Lube oil piping will be flushed with oil prior to being put in service by Others.

b. Cleaning of Piping Materials Furnished by Others:

b1. Fabrication by Contractor: Where pipe, fittings, flanges, etc., are furnished by others for fabrication by Contractor, Contractor shall, after fabrication, clean such piping in accordance with the requirements hereinbefore specified.

b2. Erection by Contractor: Where valves and other specialties and fabricated piping are furnished by others for erection by Contractor, such materials will be shop-cleaned by others; however, Contractor shall inspect the inside of such materials, upon receipt and prior to installation, to ensure that they are clean. Contractor shall re-clean such materials, if necessary.

b3. Reused Materials: All pipe, fittings, valves, and other appurtenances (if any) that have been removed by Contractor or by others from present systems and which are to be reused by Contractor, shall be thoroughly cleaned by them both inside and outside and all working parts of valves and other operating appurtenances shall be checked by Contractor for proper functioning before they are reinstalled. Any malfunctions shall be reported to Owner's representative.

307.4 Temporary Piping and Materials:

a. Compressed air, where required for field blowing out, shall be furnished by the Installation Contractor, unless otherwise set forth in the Contract Documents.

b. Contractor shall furnish and install all other temporary materials, equipment, and facilities required for cleaning, blowing out, flushing, etc., to be done by Contractor, including valves, other piping, pumps, compressors, heaters, instruments, and controls.

307.5 Cleaning Materials and Procedures: Prior to start of the work, the Installation Contractor shall maintain for review by owner or owner's engineer, his methods, and procedures for cleaning the piping and type of acid and neutralizing agent to be used for pickling.

307.6 Closures: All openings shall be provided with temporary closures, as hereinafter specified, as soon as possible after cleaning.

END OF SECTION 400510



**SECTION 400512**

**MISCELLANEOUS SHOP FABRICATED PIPING**

**PART 1 - GENERAL**

101. EXTENT

- 101.1 This Section prescribes the specific requirements for furnishing shop fabricated piping; including all labor, supervision, materials, tools, equipment, and consumable supplies required to complete the work. The work includes the following:
- a. Spooling, shop fabrication, welding, postweld heat treatment (when required), examination, testing, cleaning, and painting or coating the piping specified herein and indicated on the design drawings.
  - b. In addition to all pipe, fittings, and flanges, the following shall be furnished and installed by Contractor:
    - b1. Branch connections for vents, drains, test connections, and all other branch pipes NPS 2 and smaller.
    - b2. Instrument pressure piping connections.
    - b3. Welding bosses for test wells, thermowells, and thermocouples.
    - b4. Radiographic inspection plugs at field welds where required.
- 101.2 Contractor shall prepare each pipe spool for shipping in accordance with this specification and deliver the completed work, f.o.b. carrier, to the Project location.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

- 102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:
- a. Section 013323 – Shop Drawings and Project Data
  - b. Section 013324 – List of Submittals
  - c. Section 400510 – Erection of Piping

103. SYSTEM DESCRIPTION OR DESIGN REQUIREMENTS

- 103.1 System Description:
- 103.2 Design Requirements:
- a. The piping shall be designed for the service conditions specified.
  - b. Piping shall be designed to function to the appropriate ASME, NFPA and AWWA Standards as specified in this section.
  - c. All piping shall be suitable for outdoor installation, based on prevailing ambient conditions at their installed location.
  - d. The pressure-temperature ratings shall be those specified in the applicable ASME standard for the type of end connections used.
  - e. Owner Designed Systems:



- e1. The piping requirements will be specified in one or more of the following attachments to the Specification: Piping Design Tables, Piping Diagrams (also referred to as P&IDs), Piping Line Lists, Project Pipeline Reports, and Design Drawings.
- e2. Owner references the governing code classification and jurisdiction using the following piping code designations:
  - e2.1 ASME B31.1 for Non-boiler External Piping (NBEP)
  - e2.2 National Fire Protection Association (NFPA)
  - e2.3 AWWA
  - e2.4 IPC

104. REFERENCE DOCUMENTS

- 104.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents identified in Section 014219, in addition to federal, state, or local codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the latest additions, addenda, amendments, supplements, thereto, in effect as of the date identified in Section 014219.
- 104.2 ASME – American Society of Mechanical Engineers:
  - a. Boiler and Pressure Vessel Code – Section V – Nondestructive Examination.
  - b. Boiler and Pressure Vessel Code – Section IX - Welding and Brazing Qualifications.
  - c. B16.5 – Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard-Revision of ASME B16.5.
  - d. B16.9 – Factory-Made Wrought Buttwelding Fittings.
  - e. 16.11 – Forged Fittings, Socket-Welding and Threaded.
  - f. B31.1 – Power Piping Code
  - g. B36.10M – Welded and Seamless Wrought Steel Pipe.
  - h. B36.19M – Stainless Steel Pipe.
- 104.3 ASTM – ASTM International:
  - a. A106 – Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
  - b. A182 – Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
  - c. A234 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - d. A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  - e. A335 – Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service.



- 104.4 AWS – American Welding Society:
- 104.5 MSS – Manufacturers Standardization Society of the Valve and Fitting Industry:
  - a. SP-25 – Standard Marking System for Valves, Fittings, Flanges and Unions
- 104.6 NFPA – National Fire Protection Association
- 104.7 PFI – Pipe Fabrication Institute:
  - a. ES-3 – Fabricating Tolerances.
  - b. ES-16 – Access Holes, Bosses, and Plugs for Radiographic Inspection of Pipe Welds.
  - c. ES-24 – Pipe Bending Methods, Tolerances, Process and Material Requirements.
- 104.8 SSPC – Society for Protective Coating
  - a. SP5 – White Metal Blast Cleaning - NACE No. 1-2000; Editorial Revisions November 1, 2004.
  - b. SP6 – Commercial Blast Cleaning.
  - c. VIS-1 – Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs).
- 104.9 Conflict:
  - a. Contractor shall be solely responsible for advising the Owner in writing of any conflicts between the specifications and Contractor's design, including performance and levels of quality. Contractor agrees that its obligations, liabilities, and warranties shall not be diminished or extinguished due to its meeting the requirements of the specifications.
- 105. SUBMITTALS
- 105.1 Submit documents for review in accordance with the submittal requirements of Sections 013323 and 013324.
  - a. Contractor is to confirm with Owner on award that design is to proceed utilizing drawings received during bid stage.
- 105.2 Submittals and Drawings:
  - a. Contractor Requirements: The required drafting work shall begin immediately after notification of award, regardless of the shipping date, and shall proceed in an expeditious and orderly manner until complete. Contractor shall submit to the Consulting Engineer(s) for review and comments, certified drawings and data as hereinafter listed:
    - a1. Isometric fabrication drawings showing the extent of each pipe spool with all shop and field welds clearly indicated. Each pipe spool shall be identified on the drawing with a unique spool number that includes the Consulting Engineer(s)' two-character alphabetic plant system code. The drawing shall show all dimensions, references to the plant's coordinate system, piping line numbers, valve numbers, equipment numbers, drawing continuation numbers, etc. The applicable design drawing number shall be indicated on the Contractor's isometric fabrication drawing.



- a2. Individual orthographic drawings of each pipe spool, showing all dimensions, with a detailed bill of material listing all pipe, fittings, flanges, branch outlet fittings, welding bosses, hanger lugs, insulation support lugs, etc. needed to fabricate the spool. The materials of construction shall be indicated by the appropriate ASTM or ASME specification number. The net weight of the completed pipe spool shall be indicated on the drawing.
- a3. All welding and postweld heat treatment records including the Welding Procedure Specifications (WPS) used, Procedure Qualification Records (PQR), and Welder/Welding Operator Performance Qualification (WPQ) for each welder/welding operator used to perform the Work.
- a4. Contractor's pipe bending procedures.
- a5. Contractor's Quality Control (QC) records including nondestructive examination (RT, UT, PT, MT, and VT) reports.
- 105.3 Record Drawings: Concurrently with the progress of the work, Contractor shall keep a set of record drawings consisting of a marked set of Contractor's shop drawings and Consulting Engineer(s)' design drawings showing all piping as fabricated. They shall note and dimension accurately all changes in elevation, location, and size of material deviating from the contract set of design drawings. Marked prints of the Consulting Engineers' design drawings shall show all changes made and not previously recorded on the design drawings.
- 105.4 Fabrication of all items marked "hold" on any design drawings shall not be started until such "hold" marking has been deleted on a subsequent issue of such drawing. The Consulting Engineers shall be notified immediately in the event that items marked "hold" become a factor that could cause the Contractor delay in meeting the specified schedule.
- 105.5 Performance of any work, fabrication of materials or procurement of fabricated material requiring the review of drawings, data, etc., prior to obtaining final review of drawings and data is at Contractor's risk as Owner and the Consulting Engineer(s) do not accept responsibility for such actions.
- 105.6 Final Record Drawings:
  - a. Contractor shall submit final record drawings within two (2) weeks after shipment of the fabricated piping:
  - b. The drawings format and content shall be in accordance with Section 013300.
- 105.7 Final Document Submittal:
  - a. At the direction of Owner, all documents shall be submitted for record prior to the contract closure.
- 106. GENERAL QUALITY CONTROL AND QUALITY ASSURANCE PROVISIONS
- 106.1 Quality Control:
  - a. The Contractor shall be responsible for assuring that its subsupplier's Quality Control Program meets the specified requirements imposed on the Contractor by Owner.
  - b. Contractor shall develop a recommended Owner Inspection Point Program. This program shall include the manufacturing, inspection, and test operations that the Contractor believes may be of interest to Owner in demonstrating product quality, whether performed in its own or its subsupplier's facilities. The Inspection Point



Program shall be submitted to the Consulting Engineers within one (1) week after award of the Contract.

- c. Owner and/or its designated representative shall have full access to the Contractor's and subcontractor's facilities and work area for reviewing conformance to the approved Quality Control Program, and records, and for witnessing of inspections and test. Owner or Consulting Engineers shall be notified three (3) working days prior to the start of the tests and inspection points as specified by Owner.

106.2 Quality Control Documents to be Submitted:

- a. The following quality control documents shall be submitted:

- a1. Procedures:

- a1.1 Welding procedures and welding procedure qualifications.

- a1.2 A list showing all weld procedures and the specific piping design tables or piping systems that are to be welded by each procedure.

- a1.3 Nondestructive examination procedures (liquid penetrant, magnetic particle, radiography, ultrasonic, etc.), including a list of all shop and/or field welds showing the nondestructive examination requirements of ASME B31.1, and applicable piping codes listed in Article 104, where applicable, for each weld.

- a1.4 Nondestructive examination procedures (liquid penetrant, magnetic particle, and ultrasonic testing) for shear lugs.

- a1.5 Post-weld Heat Treatment (PWHT) procedures.

- a1.6 Cleaning procedures.

- a2. Documentation:

- a2.1 Certification of chemical and physical tests and supplements required for piping, fittings, and valves.

- a2.2 Hydrostatic, pneumatic, and vacuum box test with interpretation of results and disposition.

- a2.3 Radiographic film or electronic images, including Contractor's interpretation of the radiographs, technique report, and shooting sketch (all film negatives or electronic media with one copy of other data).

- a2.4 Nondestructive examination reports.

- a2.5 Records and charts of post-weld heat treatments including identification of weld location (one copy).

- a2.6 Other records and data called for in this standard specification or in other standard specifications referenced in the project specification.

- a2.7 All documentation shall be fully identified. Identification shall include the following:

- a2.7.1 Owner.

- a2.7.2 Project and unit number.

- a2.7.3 Specification number.

- a2.7.4 Spool piece, shear lug number, fitting number, etc.





106.3 Quality Assurance:

- a. Contractor shall have methods in place to assure that items and services, including subcontracted items and services, comply with this specification. Contractor shall describe these methods in its proposal.
- b. All manufacturing, processing, testing, and inspection operations affecting the equipment or material may be subject to surveillance by Owner or Owner's Representative.
- c. Prior to production, Contractor shall submit to Owner a fabrication sequence describing inspection and/or tests to be performed, for use in determining inspection points that Owner may desire to witness. Owner will advise Contractor, prior to production, of those fabrication steps and shop inspection points that Owner desires to witness, and will identify which of these points require work to be stopped pending written authorization to proceed from Owner.
- d. For fabrication steps and tests that Owner desires to witness, Contractor shall give ten (10) working days' notice of witness points, and fifteen (15) working days' notice of hold points. Notification of hold or witness points shall not be considered to have been given until Owner has acknowledged receipt of such notification.
- e. All deviations from this specification must be documented and referred to Owner for written disposition.
- f. Contractor shall furnish the following documents for Owner's records with each shipment:
  - f1. Certificate of Compliance, stating that all materials furnished comply with this specification and accepted deviations.
  - f2. Documents identifying deviations and their acceptance.
- g. No shipment shall be made to Owner without Owner's approval.

107. DEFINITIONS

- 107.1 Design Drawing: When the term Design Drawing is used, it shall mean the Consulting Engineers' drawings (composite drawings, diagrams, schematics, tables, standard drawings, etc., listed in the project specification) indicating the work to be performed. The diagrams (P&IDs) show the piping diagrammatically only and are not to be used for physical layout; however, the detail piping drawings and the piping diagrams shall be considered together and any work called for or indicated on one and not the other shall be considered as part of the work, unless specifically noted to the contrary.
- 107.2 Piping Design Tables: Piping Design Tables form a part of the project specification and designate the materials and pressure standards to be used for components of the piping system.
- 107.3 Piping Supports, Pipe Supports, Pipe Supporting Elements: These terms as used herein and applicable codes shall be understood to mean the entire range of various methods and devices used to support the piping systems referenced herein, including all valves and other piping components, the fluid transported, insulation, appurtenances, etc. The devices shall include all hangers, roll stands, beam clamps, inserts, anchors, snubbers, trapeze arrangements, and other components necessary to properly support the piping systems specified.
- 107.4 Project Pipeline Report: Where a project pipeline report is incorporated as a part of the project specification, each piping line number appears opposite the various correlated



data for each line, including the applicable "piping design table." The piping, in each case, shall be designed for, and shall be suitable for, the applicable data listed in the project pipeline report.

- 107.5 Owner's Shop Inspector: An employee or authorized representative of the Owner assigned to perform various inspections in the shops of the Contractor, or in the shops of the Contractor's Suppliers, to ensure compliance with standards and criteria as required by this specification.
- 107.6 Review Status: is documented using the numbered boxes on the document review stamps.
- 107.7 Shop Drawing: When the term shop drawing is used, it shall mean the Contractors' or Contractor's drawings, including general arrangement drawings, equipment drawings, foundation drawings, fabrication drawings, shop detail drawings, erection drawings, and installation drawings.
- 107.8 Spooling: The term spooling shall be defined as the Contractor's activity of subdividing a pipe line into sections of prefabricated piping by the location of field welds taking into account optimal shipping size and ease of erection. The location of radiographic access holes, where required, is also included in this activity.
- 107.9 Supplementary Steel: This term shall be understood to mean all structural steel, steel plates, stiffeners, etc., which are required to be furnished with the piping supports in order to attach or connect the piping supports to the building structure.
108. DELIVERY, HANDLING AND STORAGE
- 108.1 Packaging and Shipping:
- a. Contractor shall adequately prepare all of the fabricated piping for shipment. Open ends shall be adequately sealed and protected during shipment to prevent corrosion, entrance of foreign matter, and possible damage from rough handling during transit. Any articles or materials that might otherwise be lost in shipping shall be boxed or wired in bundles and plainly identified as described hereinafter.
  - b. Items that are either too heavy or too bulky to be handled by one person shall preferably be fastened to a pallet or be packaged in a manner that is suitable for handling with a forklift truck. Where it is not feasible to handle an item with a forklift truck, parts shall be prepared so that slings for handling may be attached readily while the parts are on the transporting vehicle. Where it is unsafe to attach slings to the box, the boxed parts shall be packed with slings attached directly to the part and the sling shall project through the box or crate so that attachment can be made readily.
  - c. When a shipment is to be made, Contractor shall notify the Owner giving a description of the articles shipped, the packing list, and any other information necessary for identification. Contractor shall also provide instructions for assembly and storage of equipment or instruments that should be stored inside or that require special attention or maintenance procedures prior to installation as well as for the period between completion of installation and the time that the equipment is placed in service. The shipping weight and dimensions of each article shall also be given, as well as any information related to unloading or handling of equipment or materials, such as pickup points and spreader bar requirements. Contractor shall provide notification to the Owner at least fifteen (15) days in advance of the expected shipping date. At that time, the Owner will advise the Contractor of acceptable delivery hours.
  - d. Equipment and separately shipped items shall be clearly identified with a securely fastened, weatherproof tag, labeled with Owner's purchase order number, specification



number, equipment number, or instrument number, if applicable, and service. Shipping containers, packing lists, bills of materials, correspondence, etc., shall be identified with the same above information. Boxes, shipping containers, crates, etc., shall have a packing list firmly attached to the exterior and a duplicate packing slip packed internally.

Example P.O. No.: \_\_\_\_\_  
:  
\_\_\_\_\_ Generating Station –  
Unit  
Specification  
No.: \_\_\_\_\_  
Equipment No.: \_\_\_\_\_  
Service: \_\_\_\_\_  
Date Shipped: \_\_\_\_\_

- 108.2 Unloading, Storage, and Protection:
- a. For items shipped by truck that weigh in excess of 2,000 pounds per item, the truck shall have a removable roof to allow unloading by crane.
  - b. Protective Coatings and Preservatives:
    - b1. Preservative coatings used on components shall be suitable for the conditions normally expected during shipping, storage and throughout the erection period.
    - b2. Each type of preservative used shall be identified as to quality, life expectancy and type. Toxic and hazardous-type preservatives will not be allowed. Complete information shall be submitted to the Consulting Engineers covering step-by-step procedures, including federal, state, and local governing controls for handling and removal of each type of preservative. This information shall be submitted six (6) months prior to delivery.

## **PART 2 - PRODUCTS**

### **201. COMPONENTS**

201.1 General: Piping shall be in accordance with the following:

- a. The applicable requirements of this specification and other standard specifications or documents listed in the SUPPLEMENTS, STANDARDS AND DRAWINGS Section of this specification.
- b. The applicable requirements of governing code(s), as determined by the piping code designation given in the piping line list for each individual line, and as set forth in the REFERENCE DOCUMENTS Section of this specification.
- c. The data, including the specific piping design table, listed in the project pipeline report for each individual line.
- d. The design drawings forming a part of this specification.
- e. Other requirements specified elsewhere in this specification.

Note 1: The complete number for each line, shown on the design drawings and piping line list, indicates the station unit number, the individual piping system, the individual line serial number, the line size, piping code or table change and the actual pipe size .

Note 2: In case of conflict between the various documents forming a part of the specification, the following shall apply:



- e1. The governing code shall take precedence over all other requirements, unless a specifically noted exception is specified thereto.
- e2. The requirements of the design drawings take precedence over the requirements of the standard and reference drawings and the piping design tables.
- e3. The requirements of this project specification and the piping line list, valve list, special piping design tables shall take precedence over the requirements of the Consulting Engineers' standard specifications, standard piping design tables, and other standard documents.
- f. Piping System Design:
  - f1. Piping Line Identification: Unless otherwise indicated, each piping line indicated on the piping diagrams (P&IDs) and/or the piping physical drawings bears an encircled identification figure (line number), except certain small low-pressure/low-temperature lines such as instrument air branch lines identified and specified by notes on the drawings.
  - f2. In each case, change in material, pressure class, size, pipe wall thickness, code jurisdiction, etc., in a line is shown on the detail drawing at the actual point of change. The line numbers shall be used for identification of the lines in all documentation.
  - f3. Instrument and Control Piping: Instrument and control piping (including tubing) shall be in accordance with the applicable requirements specified herein.
- g. Code Standards: All components of the pipeline systems shall conform, where possible, to the standards listed in the governing code(s) (Article 104).
- h. Piping and appurtenances which are indicated on the design drawings and which are included in the work, but are not specifically mentioned in the project specification, shall meet the design pressure, temperature, and other conditions specified for the system and shall be acceptable to the Consulting Engineers.
- i. Where pipe wall thickness or schedule specified in the piping design table is not readily available, substitution of heavier (or lighter) wall pipe will not be permitted unless written permission is obtained from the Consulting Engineers.
- j. Where the type, class, grade, or quality of material specified is not available, Contractor must obtain permission from the Consulting Engineers before a substitute type, class, grade, or quality of material can be used.
- k. Welded and seamless wrought ferritic steel pipe with the wall thickness specified by schedule numbers (40, 80, 160, etc.) or the wall thickness designations Standard (STD), Extra-Strong (XS), and Double Extra-Strong (XXS) shall conform to the dimensions given in ASME B36.10M.
- l. Terminal Connections: Terminal connections of piping furnished by Contractor shall be as indicated on the drawings. Unless otherwise indicated on the drawings, the connections shall be provided with ends to suit the type of joints called for in the applicable piping design table.
- m. Permanent Welded Attachments: Contractor shall furnish and install on the piping all lugs, clips, plates, saddles, etc., to be welded to the piping for connection of pipe supporting elements and snubbers and for attaching insulation, where required, unless otherwise indicated on the design drawings.



n. Branch Connections:

n1. Contractor shall be responsible for the proper design and fabrication of all piping system branch connections that are furnished as part of the work. The rules governing the design of branch connections shall be in accordance with the applicable requirements of the governing code. All additional reinforcement required by the design conditions shall be provided by Contractor in the fabrication of the branch connections.

n2. Welded branch connections and special welded fabricated fittings shall be carefully fitted and properly reinforced as required by the governing code.

n3. Nozzles on headers to which stop valves, safety valves, and relief valves are welded shall have inside and outside diameters that correspond to the inside and outside diameters of the welding ends of the valves to which they connect.

n4. Contractor shall furnish and install, on the piping, all branch outlet connections including welding bosses, Weldolets®, Sockolets®, Thredolets®, Sweepolets®, etc., required for instrumentation, as well as for other branch pipe lines, in all sizes, unless otherwise indicated on the design drawings.

n5. The following branch connections on a line shall be in accordance with the requirements of the piping design table specified for the parent line, in each case, unless indicated otherwise in the piping line list or on the design drawings:

n5.1 Test, tell-tale, local grab sample and permanent cleaning connections.

n5.2 Vent, drain, blow-off, and blow-down connections.

o. Pipe Bends:

o1. The design drawings will indicate the location, bend radius, and angle of turn for all pipe bends.

o2. Contractor shall submit to the Consulting Engineers the specific bending procedure(s) used to perform the Work. Cold bending will not be permitted.

o3. All bends shall conform to the requirements of the governing Code.

o4. Circumferential butt welds shall not be located in the arc of a pipe bend without written approval of the Consulting Engineers.

o5. Minimum tangent lengths and dimensional tolerances shall be in accordance with PFI Standard ES-24.

202. MATERIAL REQUIREMENTS

202.1 All material for pipe, fittings, flanges, etc., shall be as specified in the project specification. All materials not specified in the project specification shall be in accordance with the applicable requirements of the applicable code or codes. All special pipe, fittings, flanges, etc., not covered by the project specification or the governing code, shall be subject to review and acceptance by the Consulting Engineers.

202.2 All items shall be marked with manufacturer's name or trademark and ASTM or ASME material designation. The marking requirements of MSS-SP-25 shall be used.

202.3 Seamless Steel Pipe:

a. ASTM A106 and ASME SA-106 Carbon Steel Pipe:

a1. Ultrasonic tests are not required, unless otherwise noted.



202.4 Welding Fittings:

a. Socket-Weld Fittings:

a1. Class 3000, Class 6000, and Class 9000 Fittings: Fittings shall conform to the requirements set forth in ASME B16.11.

b. Butt-Weld Fittings:

b1. ASTM A182 and A234 and ASME SA-182 and SA-234 ferritic alloy steel fittings should be made from electric furnace steel.

b2. Clam-shell-type fabrication for fittings shall not be used.

b3. For Use with Nominal Wall Pipe: Fittings shall conform to the requirements set forth in ASME B16.9.

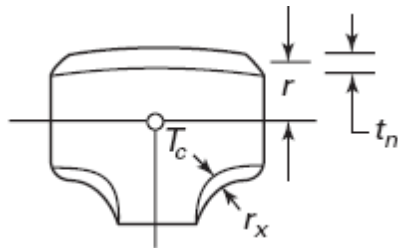
b4. ASME B16.9 welding tees and reducing tees and Sweepolets® or similar welded in contour inert welding branch fittings shall have a minimum crotch radius (dimension  $r_x$  as defined in ASME B31.1, Appendix D, Note 14) of the branch outside diameter divided by 8, or

$$r_x \geq \frac{D_{OB}}{8}$$

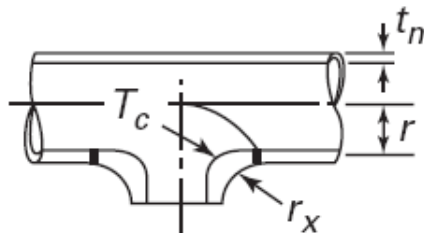
And the minimum crotch thickness (dimension  $T_c$  as defined in ASME B31.1, Appendix D, Note 14) shall be greater than or equal to 1.5 times the nominal pipe wall thickness:

$$T_c \geq 1.5 * t_n$$

For B16.9 welding tees, the dimensions are as defined in the sketch below:



For Sweepolets® and other welded-in contour inserts, the dimensions are defined in the sketch below:



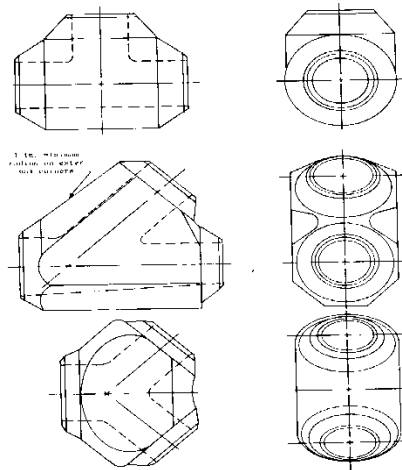
b5. The wall thickness of all fittings shall be equal to or greater than that of the pipe to which it connects.

b6. If the above dimensional requirements cannot be met, the manufacturer shall so state in the bid and proposed dimensions shall be stated.



- b7. All welding shall be performed using welding procedure qualifications in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, and all welders and operators performing this welding shall be qualified in accordance with Section IX.
- b8. Fittings shall be furnished with compatible butt-welding ends to suit the piping to which they connect and shall be machined inside and outside, as required.
- b9. For wye fittings, laterals, special tees, and other irregular shaped fittings, the following shall apply:
  - b9.1 Typical detailed drawings shall be provided with the bid package. Drawings are to be furnished with proper dimensions, estimated weight, and necessary notes for final finishing.
  - b9.2 Fittings shall have additional reinforcement in proper areas to eliminate inherent weakness and stress concentration. The manufacturer shall certify that the fittings are pressure-reinforced according to the requirements of ASME B31.1 or applicable piping code. Calculations for pressure reinforcement shall be provided with the bid package. These calculations will be reviewed to determine that the appropriate calculation method has been used. However, the accuracy, completeness, and strict code compliance is the responsibility of the manufacturer.
  - b9.3 Any center-to-end dimensions of special fittings that are noted on the design drawings are approximate, and Contractor may deviate from these dimensions if required, due to manufacturing limitations. Seller to document these deviations and submit to Owner for confirmation and record.
- c. Fabricated Fittings:
  - c1. All interior and exterior reinforcement of seam and weld joints of fabricated fittings shall be ground smooth and flat within 1/32 of an inch of the base metal material for steam service applications.
  - c2. All evidence of arc strike, crater pits or weld deposits adjacent to the weld preparation on the base metal shall be removed by grinding and repaired; this also includes arc areas caused by magnetic particle inspection pods and weld areas remaining after the removal of temporary attachments. It is recommended that arc strikes be repaired before stress-relieving to minimize residual stresses.
  - d. Wrought steel fittings shall conform to the applicable requirements of ASME B16.9.
  - e. Cast steel fittings shall conform to the applicable requirements of ASME B16.5 and to the requirements of ASME B31.1 applicable to a casting quality factor of 100%. Values for surface finish shall not exceed 500 rms.

f. Finished Shapes of Forged Fittings:



g. Welding Flanges:

- g1. Standard Flanges: Flanges for piping in sizes NPS 24 and smaller for piping systems with design conditions within the allowable ratings set forth in ASME B16.5 shall be as set forth in ASME B16.5. Flanges for piping in sizes NPS 26 through NPS 60 for piping systems with design conditions within the allowable ratings set forth in ASME B16.47 shall be as set forth in ASME B16.47.

h. Identification of Components:

- h1. All piping components furnished separately by Contractor shall have a securely attached metal tag marked to identify each item and its particular service. Tag materials shall be stainless steel, unless otherwise specified in the project specification or otherwise accepted by the Consulting Engineers. Identification shall include the individual pipeline, valve, or component number, as described in MSDE-4.1.1.1 and/or as set forth in the project specification.
- h2. For pipe, tubing, fittings, and shop-fabricated piping sections, the identification tags shall be temporarily attached.
- h3. All steel pipe shipped in random lengths shall be color-coded with identifying color stripes indicating pipe material (ASTM or ASME number and grade) and schedule running the full length of each pipe to prevent interchanging pipe types during installation. In addition, each length, and each piece cut from a length, shall be marked with the applicable ASTM or ASME number, grade, and heat number. Stamping of pipe will be permitted only if blunt-nosed continuous or blunt-nosed interrupted-dot die stamps are used.

i. Attachments Welded to Piping:

- i1. Provide all lugs, clips, plates, rings, eyes, clamps, saddles, etc., welded to piping fabricated by Contractor, as indicated on the drawings, including the following:
- i1.1 Other attachments required for connecting of pipe supports furnished by others, as well as supports furnished by Contractor.
- i1.2 Temporary attachments for handling, alignment, etc.





- i2. Attachment material shall have the same nominal chemical composition as the piping to which it is connected. Ferritic steel attachments shall not be welded directly to stainless steel piping. Carbon steel attachments shall not be welded directly to alloy steel piping.
- i3. Weld metal shall be similar to and compatible with that of the piping and attachment.
- i4. Tools used for cleaning welds shall match weld material (grinders, burr brushes, etc.).
- i5. Attachment welds shall be in accordance with the applicable requirements of the governing code, with procedures and welders qualified in accordance with ASME Section IX, and acceptable to the Consulting Engineers.

203. SOURCE QUALITY CONTROL

- 203.1 The examination and testing of fittings for critical piping systems (see DEFINITIONS Section) in fossil-fueled power plants shall conform to the requirements of this section. This section establishes the examination and testing requirements which are in addition to and supplement the requirements of ASME Section I and/or ASME B31.1 or applicable piping code and the applicable ASTM or ASME material specifications; included herein are examination and testing procedures and acceptance standards, and submittal of documentation and examination and test reports.
- 203.2 Each length of seamless steel pipe shall be hydrostatically tested in accordance with the requirements of the governing ASTM or ASME specification. However, if the test pressure limits set forth therein are less than 1-1/2 times the specified design pressure of the pipe, the pipe shall be tested to 1-1/2 times the specified design pressure unless otherwise specified in the project specification.
- 203.3 Inspection and Testing of Welding Fittings:
  - a. After heat treatment, all surfaces of each special design ferritic steel fitting shall be subjected to 100% visual and magnetic particle inspection.
- 203.4 Examination, Testing, and Inspection:
  - a. Nondestructive Examination (NDE) and Testing:
    - a1. All pipe and fitting materials for critical piping systems shall receive all required testing and examination required by ASME B31.1, the applicable piping code, the applicable ASTM or ASME material specification, and this specification.
    - a2. Nondestructive examinations shall be in accordance with the examination procedures of ASME Section V and as herein specified. The examination shall be performed by personnel who have been qualified in accordance with SNT-TC-1A, supplements and appendices, as applicable, for the technique and methods used.
    - a3. All nondestructive examinations performed shall be executed in accordance with detailed written procedures and shall comply with the appropriate article of ASME Section V.
    - a4. Radiographic Examination of Welds: Examination shall be in accordance with ASME Section V, Article 2 and with the acceptance standards set forth in ASME B31.1 or applicable piping code, whichever governs.
    - a5. Magnetic Particle, Liquid Penetrant, and Visual Examinations of Welds: Magnetic particle, liquid penetrant, and visual testing required by ASME B31.1 or applicable piping code shall be conducted and evaluated in accordance with ASME B31.1 or applicable piping code.



- b. Pressure testing, in accordance with the governing codes, of the completed piping system shall be the responsibility of Contractor. The repair of any Contractor's shop welds due to failure to pass the required pressure tests shall be to Contractor's account.
  - c. All welds shall pass a visual examination. In addition, welds shall receive nondestructive examinations (RT, UT, PT, or MT) in accordance with the governing codes where required. All nondestructive examinations and acceptance standards shall be in accordance with ASME B31.1, Section 136 or applicable piping code.
  - d. Radiography:
    - d1. Welded joints shall be radiographed where required by the governing code.
    - d2. Contractor shall provide special access holes, hole reinforcement (weld metal buildup) or bosses, and plugs for all field welds requiring radiographic examination.
      - d2.1 Access holes, hole reinforcement, bosses, and plugs shall conform to PFI Standard ES-16.
      - d2.2 Access openings shall not deform pipe at weld ends beyond the limits of tolerances specified herein.
    - d3. Test Data, Etc.:
      - d3.1 The supplier of materials covered in this Specification shall submit the following test data, etc., as specified herein and in the applicable ASTM or ASME specifications:
        - d3.1.1 Certified records of the results of the chemical analysis and mechanical tests.
        - d3.1.2 Photomicrographs.
        - d3.1.3 An affidavit certifying that the materials furnished meet the specified requirements.
  - e. Ultrasonic Tests:
    - e1. Ultrasonic tests are not required, unless otherwise noted.
- 203.5 Testing of Welds:
- a. If for any reason it becomes necessary, in the opinion of the Consulting Engineers, to test the quality of welds that have been made by Contractor in either shop-fabricated or field-fabricated assemblies, standard test specimens shall be removed from the designated welds by Contractor and tested in the presence of the Consulting Engineers.
204. FABRICATION REQUIREMENTS
- 204.1 Shop Fabrication:
- a. All piping per this specification shall be shop fabricated in accordance with the requirements of this specification and the standards listed in the REFERENCE DOCUMENTS Section.
  - b. All piping shall be fabricated and welded in the shop as far as possible, to reduce the number of field joints to a minimum.
    - b1. Field welds shall be located so that they are readily accessible for welding and (when required) for stress-relieving.



- b2. The length of shop-welded sections shall be determined by shipping limitations, maneuverability, and erection space available, subject to review and acceptance by the Consulting Engineers.
  - b3. The ends of all weld connections on shop-fabricated sections shall be properly machined in accordance with the welded joint specified in the project specification and the following:
    - b3.1 Machining of butt-weld end preparations shall be done with the piping centered as follows:
      - b3.1.1 Schedule pipe - OD axis
    - b3.2 In those instances where the "C" dimension is less than the "B" dimension, the end of the pipe shall be built up on the inside with weld metal before the butt-weld end preparation is machined.
  - b4. Flanges, where required in high-pressure work, shall be attached in the shop. All flange attachments shall be rechecked after welding to ensure proper alignment.
  - b5. Shop tack-welded flanges shall allow for field adjustments, tolerances shall be in accordance with PFI Standard ES-3, except as otherwise shown on the design drawings. Tack welds that are incorporated into the finished weld shall be visually inspected for defects.
  - b6. Each shop-fabricated section of piping shall have all nozzles, weld end fittings, and all couplings and nipples for drains or for instrument connections welded on in the shop, as far as possible.
  - b7. Piping shall be shop-fabricated to minimize field welds.
- 204.2 General Fabrication:
- a. Change of direction in welded pipelines shall be made by means of welding fittings (in lieu of pipe bends), subject to review by the Consulting Engineers, except as follows:
    - a1. Five-diameter pipe bends shall be used where indicated on the design drawings for fuel gas piping to allow for pigging.
    - a2. Five-diameter pipe bends may be used, where permitted, by the project specification in pipelines two (2) inches nominal size and smaller, where practical, and where clearances are adequate.
    - a3. Pipe bends may be used otherwise only where reviewed and accepted by the Consulting Engineer(s).
  - b. Pipe bends, where used, shall conform to the requirements set forth in the governing code. Unless otherwise indicated in the project specification or on its design drawings, the minimum wall thickness of pipe material for bends and the radius of bends shall be as set forth in the governing Code. The wall thickness given for pipe in the piping design tables includes allowance for bends, unless otherwise noted therein. Pipe bends shall be made true to the specified radii, shall curve uniformly, and shall be made in a manner that will preclude buckling of walls and/or flattening of the pipe cross section.
  - c. Welds shall not be made in pipe bends, unless reviewed and accepted by the Consulting Engineers. If pipe lengths available necessitate a girth weld in a bend, the Consulting Engineers shall be advised so that special weld end dimensions can be calculated.



204.3 Tolerances:

- a. Pipe Tolerance: Unless otherwise indicated on the design drawings, tolerances on pipe shall be in accordance with the applicable ASTM or ASME specifications. Fabricating tolerances shall be in accordance with PFI Standard ES-3, except as otherwise shown on the design drawings.
- a1. Each length of electric-fusion-welded steel plate pipe shall be resized after welding, if necessary, to ensure that the specified minimum wall thickness is maintained and that the pipe is kept within the allowable tolerances set forth in the applicable ASTM or ASME specification. Pipe that is not within the specified tolerances for diameter, out-of-roundness, alignment, wall thickness, or weight will be rejected.
- b. Pipe Straightness: For steel pipe, the pipe straightness shall be 1/8" per 10 ft or 1:1000 for all straight pipe segments or spools made up of several pieces of straight pipes.

204.4 Welding Requirements:

- a. Welding of piping shall be in accordance with the applicable requirements of this specification, the governing piping code, drawings, and supplements.
- b. Welding Procedures and Qualifications:
  - b1. Contractor shall be responsible for the welding performed by their organization and shall establish their own welding procedures for each class and type of weld that will be used in the work.
  - b2. Qualification of welding procedures to be used and qualification of welders and welding operators shall comply with the latest requirements of Section IX of the ASME boiler and pressure vessel code and with other governing codes. Weld procedures and procedure qualifications shall meet all of the requirements of the latest issue of ASME Section IX in effect at the time of the contract award.
  - b3. Contractor shall conduct the tests required to qualify their welding procedures and shall conduct the performance qualifications of welders and welding operators who apply these procedures. All performance qualifications of jobsite Contractors shall be conducted at the site unless otherwise approved by the Owner. Procedures or qualification of procedures or welders by organizations other than the Contractor is not acceptable.
  - b4. The actual testing operations such as bend testing, tensile testing, radiography, or macroetching may be conducted by an independent laboratory on samples fabricated under the direction of the Contractor.
  - b5. The Contractor shall submit to the Consulting Engineers prior to use the Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) for each welding procedure employed in the performance of the work.
  - b6. Each welder/welding operator shall be qualified by the Contractor. Welder/Welding Operator Performance Qualifications (WPQ) certified by others will not be acceptable.
  - b7. Alternate Welding Processes: Alternate welding procedures will be considered if complete Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR) are submitted to the Consulting Engineers and approved in writing by the Consulting Engineers.



- c. Process and Technique:
  - c1. Shielded metal arc welding, gas-shielded flux-cored arc welding, submerged arc welding (shop only), or gas tungsten arc welding (GTAW) processes shall be employed in the work, except where a specific welding process is called for in the project specification and except for shear lugs. The root and second pass of all piping shall be welded using the GTAW process except when the ID is accessible and double welded joints are used. The short circuit transfer mode is not permitted.
  - c2. When open root GTAW welds are made on ASME P-5 material or higher P-numbers, an inert gas purge shall be maintained for the root and second pass. Prior to welding the ID purge area shall be two percent oxygen or less.
  - c3. All socket weld shall have a minimum of two weld passes except 1 NPS or smaller may be welded in a single pass.
  - c4. Each weld pass shall be visually inspected for defects and slag. All defects and slag found shall be removed by chipping and grinding prior to the deposit of additional filler metal.
  - c5. Peening of weld metal is not permitted.
  - c6. Full Penetration Welds: All welds (not including socket and fillet welds) shall be full penetration welds unless indicated otherwise on the design drawings. Where half couplings are used for NPS 2 and smaller branch connections, the end of the half coupling which is to be welded to the main line shall be beveled for a full penetration weld.
  - c7. Piping Components Alignment Tolerances:
    - c7.1 Fitup: Internal misalignment at the weld ends shall in no case exceed the limit specified in ASME B31.1 .
    - c7.2 Open Root GTAW Joints: The internal misalignment tolerance for joints using open root GTAW shall not exceed 1/16 inch.
    - c7.3 Contractor shall notify Consulting Engineers when the average misalignment ( $\delta$  Avg) and Stress Intensification Factor at a joint exceeds the tolerances listed in ASME B31.1, Appendix D.
    - c7.4 For open root GTAW welds, the root gap shall not exceed 3/16 of an inch.
    - c7.5 Minimum Wall Thickness: The minimum wall thickness specified by the Consulting Engineers for pipe, fittings, etc., shall be maintained at weld joints, as well as at other areas.
- d. Butt Weld End Preparation Details:
  - d1. Finished weld end preparations on carbon steel shall be machined to meet the configuration specified on the piping design table or as shown on the project design drawings. Carbon steel may be oxygen or arc cut.
  - d2. Edges shall be cleaned of all grease, oil, paint, rust, scale, oxides, slag, dirt, or other contaminants prior to welding. The discoloration which may remain on flame cut end preparations is not considered a detrimental oxidation.
- e. Tack Welding:
  - e1. Tack welds shall be made by procedures and welders qualified in accordance with ASME Section IX.



- e2. All filler metals used for tack welds shall be the same composition as the filler metal for the joint.
- e3. Tack welds that are incorporated into the finished weld shall be visually inspected for defects. All defects shall be removed before covering tack welds with additional weld metal. Defect removal shall be verified with liquid penetrant or magnetic particle inspection.
- f. Weld Metal: The composition of filler metals and consumable inserts shall be of a chemical composition similar to the base material except as noted in Paragraph 205.4d.
- g. Extent of Welding: All joints in the piping shall be welded unless otherwise indicated and except where piping is of such material that welding is not applicable, where flanges are required at certain equipment, etc., or where special conditions may dictate the use of flanged or other mechanical joints.
- h. Location of Joints: The location of all shop and field welds in all major piping systems shall be shown on Contractor's shop drawings and shall be acceptable to the Consulting Engineers. Field welds shall be located so that they are readily accessible for welding and for stress relieving (where required).
- i. Weld Contour: Weld reinforcement shall be in accordance with the applicable code.
- i1. The contour of the weld reinforcement on the inside and outside of each weld shall conform to the requirements of the governing code and (for welded pipe and fittings) to the material specification. For girth welds the contour shall be maintained as close as possible to the outline shown on the welding end detail drawings referenced in the project specification.
- i2. Welds shall have a gradual increase in thickness from the edges to the center and the surface transition shall be smooth without ridges or depressions, on the inside and outside of weld, except as hereinafter specified otherwise.
- i3. Where radiography is required, the inside and outside of finished surface of the weld in ferritic steel systems shall be ground smooth and flat within 1/32 in. of the base material, unless the Contractor can demonstrate to the satisfaction of the Consulting Engineers that the as-welded surface will not produce radiographic film indications that could mask a defect. The above shall also apply to welds in stainless steel systems, except that the inside surfaces (where accessible) shall be machined; no grinding of internal surfaces of stainless steel systems is permitted.
- i4. Where radiography is not required, grinding of welds shall be as follows:
  - i4.1 For Longitudinal (Seam) Welds in Welding Piping: Grinding of welds is not required where the weld reinforcement is smooth and conforms to the requirements of the governing code and the material specification.
  - i4.2 For Girth Weld Joints in Piping: All joints shall be filled to or above the nominal OD surface of the adjoining pipe, such that the OD of all weld joints shall be equal to or greater than the OD of the adjoining straight pipe (as shown in MSDE-2.1.8.1).
    - i4.2.1 For other piping systems, at pipe-to-pipe joints and pipe-to-casting joints, grinding is not required where the weld reinforcement is smooth and follows the contour shown on MSDE-2.1.8.1.



- j. Arc Strikes: All evidence of arc strikes or weld deposits adjacent to the weld preparation on the base metal shall be removed by grinding and if necessary, weld repaired; this also includes arc areas caused by magnetic particle inspection prods and weld areas remaining after the removal of temporary attachments. Arc strikes shall be repaired before stress relieving.
  - k. Pipe Cutting:
    - k1. Carbon steel pipe may be cut by mechanical or thermal means. The thermal cut end shall be ground to base metal with a minimum metal removal of 1/16 in.
    - k2. The finished cut end of the pipe shall be square to within 1/16 in.
  - l. Stamping: All qualified welders shall be provided with an identification stamp of the low stress type. The welder shall stamp each of their welds with their identification. The stamp shall be located on the base material adjacent to the weld. An acceptable alternate to stamping is to have the welder's identification traceable to the joint by documentation.
  - m. Temporary Welded Attachments for Handling:
    - m1. Contractor may provide temporary lugs or fittings on piping for lifting or handling, but such items must meet the requirements of the governing code, must be designed in a manner so as in no way adversely affect the piping design, and shall be subject to review by the Consulting Engineers.
    - m2. Lugs on piping extending above grade will be removed by Contractor and shall be stress relieved as required by the applicable codes. Lugs on piping to be buried will be left in place and therefore need to be properly stress relieved.
205. FINISH REQUIREMENTS
- 205.1 Cleaning and Painting:
    - a. After materials are finished and tested, they shall be cleaned, painted, and/or protected for shipment in the shop, as follows:
      - b. Cleaning:
        - b1. General: The inside of all piping shall be free of loose scale, welding icicles and spatter, oil, grease, rust, paint, welding fluxes, chalk, abrasives, carbon deposits, coatings, moisture, and all other foreign matter before it is placed in service. Cleaning shall be done in accordance with the following:
          - b2. Fabricated Principal Piping: After fabrication, the interior surfaces of all principal piping systems, except lube oil systems, listed in this specification, shall be thoroughly cleaned by one of the following methods:
            - b2.1 Carbon Steel Piping:
              - b2.1.1 Acid pickling in a suitable solution for a sufficient time to loosen all scale. After pickling and thorough drying, the pipe shall be metal shotblasted, gritblasted, or turbinized to remove all scale, after which it shall be neutralized and rinsed out with hot water at about 180°F. After rinsing, the pipe shall be blown out with compressed air. The air used for final blowing out must be free from all moisture.



- b2.1.2 Blasting to a white finish with angular steel grit of suitable size, after which piping shall be blown out with moisture-free compressed air. In order to avoid the possibility of thinning the pipe wall when blasting, particular care must be taken so that the jet will not be allowed to impinge on any portion of pipe for a longer period of time than is required to thoroughly clean the interior of pipe. The gritblasting and post-cleaning shall be performed in accordance with the applicable procedures for No. 5 White Metal Blast Cleaning as set forth in Steel Structures Painting Council, SSPC-SP5-63. Photographic standards of comparison may be used to define the final surface condition to be supplied under SSPC-SP5-63. For intact mill scale, for partially rusted and pitted surfaces, the appearance of the surface after white metal blast cleaning shall correspond with pictorial standards Asa3, Bsa3, Csa3, Dsa3 of SSPC – Vis 1-63T.
- b2.2 Fabricated Lube Oil Piping:
  - b2.2.1 After fabrication, acid-pickle the inside surfaces with a suitable solution for a sufficient time to loosen all scale, rust, etc. After pickling and thoroughly drying, rinse with clean water at about 180°F until all contamination is removed and treat with a suitable neutralizing and surface conditioning agent. After rinsing, blow out with moisture-free compressed air and then coat the inside surface with an oil-soluble rust-preventive coating (Gulf Oil Coat – VT or equivalent).
- b3. Bends after Fabrication: The interior of all bends shall also be thoroughly cleaned by the methods specified above.
- b4. Other Piping: The interior of all other pipe, fittings, valves, specialties, fabricated piping, and appurtenances shall also be thoroughly cleaned by suitable methods acceptable to the Consulting Engineers. As a minimum, the materials shall be rapped and blown out with compressed air.
- b5. Closures: All openings shall be provided with temporary closures, as hereinafter specified, as soon as possible after cleaning.
- b6. Cleaning Materials and Procedures: Prior to start of the Work, Contractor shall submit to the Owner for review, their methods, and procedures for cleaning the piping and type of acid and neutralizing agent to be used for pickling.
- c. Painting/Coating:
  - c1. Per Section 099113.
- 205.2 Protection:
  - a. Protection: Materials shall be provided with protection against damage, corrosion, and internal contamination in accordance with the following:
    - a1. All materials and equipment shall be packaged, packed, or prepared for shipment in a manner which will ensure arrival at destination in satisfactory condition. Procedure and details shall be submitted to the Owner for review prior to start of shipment.
    - a2. All openings in piping furnished by Contractor shall be securely plugged, capped, or otherwise blanked off, sealed with tape, and suitably protected against damage and entry of foreign materials and moisture. This shall be done as soon as possible after shop cleaning.
    - a3. Weld ends on all fittings, pipes, nozzles, etc., shall be capped and sealed with suitable, firmly attached protectors. Butt-weld ends on ferrous materials shall be coated with Special Chemicals Corporation Deoxaluminite, or acceptable equal, prior to capping, back to a ring whose length is the same as the weld preparation plus a minimum of 2 inches.





- a4. Protectors for beveled ends designed for backing ring or consumable insert shall have a plywood or hardboard liner disc held securely against the beveled end. Protectors for other weld ends may be metal caps without liner discs. Protectors shall not be welded to the weld end. Protection devices coming in contact with fitting metal shall not be of a dissimilar metal.
  - a5. All flange facings, bolt holes, and other machined surfaces of ferrous materials (except butt joint end preparation) shall be coated with a suitable removable antirust compound. No coatings shall be applied to nonferrous materials.
  - a6. All flanged connections and loose flanges shall be provided with suitable full face flange protectors bolted in place and sealed.
  - a7. All protectors for openings and all braces, brackets, spacers, ties, bindings, and other shipping, packaging, and packing materials and appurtenances used for protection in shipping, storing, and handling of nonferrous piping and materials shall be of such design, type, and/or arrangement as to prohibit contact between ferrous and nonferrous materials.
  - a8. Lube oil system piping shall be coated after passivation as specified herein.
  - b. Wrapping: Materials of nonferrous metal shall, after cleaning and blanking off and sealing ends, be wrapped in Kraft paper or polyethylene and/or crated for shipment.
- 205.3 Identification and Marking:
- a. All piping components furnished separately by Contractor shall have a securely attached metal tag marked to identify each item and its particular service. Tag materials shall be stainless steel, unless otherwise specified herein or otherwise accepted by the Consulting Engineers. Identification shall include the individual pipe line number as set forth herein.
  - b. Identification on drawings submitted for review, for each pipe shall include the same number used on the tag. Spool, random length of pipe, or single fitting tags shall be attached securely without the use of welding.
  - c. All steel pipe shipped in random lengths shall be color-coded with identifying color stripes indicating pipe material (ASTM or ASME number and grade) and schedule running the full length of each pipe to prevent interchanging pipe types during installation.

### **PART 3 – EXECUTION**

#### **301. FIELD QUALITY CONTROL**

- 301.1 Inspection and testing by Contractor.
- 301.2 Inspection and testing by the Owner.
- 301.3 Examination for general compliance by the Engineer of Record.
- 301.4 Extent and method of examination and testing.
- 301.5 Acceptance Criteria.
- 301.6 Field Services.

#### **302. INSPECTION AND TESTING**

- 302.1 Contractor shall conduct and be responsible for the shop tests called for in this Specification as well as the applicable codes and standards and shall furnish all facilities necessary for the performance of such tests.



- 302.2 Owner has the right to inspect and witness Seller's manufacturing and testing operations for the piping purchased in this Specification.
- 302.3 Contractor shall submit records and reports for all tests and inspections required by this Specification. These records and reports shall be prepared promptly after each test or inspection and shall be transmitted to the Owner prior to shipment of the piping to the Project site.
- 302.4 Owner shall be given the opportunity to witness the final inspection of all piping assemblies prior to the release for shipment.
- 302.5 Test Control:
- a. A test program shall be submitted to the Owner for review with bid in accordance with the following:
    - a1. The program shall assure that any testing required to demonstrate that the systems and/or components perform satisfactorily in service is performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in this Specification. Test procedures shall include provisions for assuring that all prerequisites for the given tests have been met and that the test is performed under appropriate environmental conditions. Test results shall be documented and evaluated to assure those test requirements and acceptance limits have been satisfied.
    - a2. The test procedures shall provide a complete description of proposed testing sequence and criteria used for determining the acceptance or rejection of the specific assemblies. The procedures shall also include a description of the various levels of responsibility and authority regarding decisions on acceptance or rejection of test results.
    - a3. The test procedures shall provide reference to specific articles and/or sections of applicable industry (AISC, ANSI, ASME, etc.) standards that are incorporated in the test program.
303. SUPPLEMENTS, STANDARDS, AND DRAWINGS
- 303.1 Standard Details:
- a. MSDE-2.1.8.1, Welding End Details: General Notes
  - b. MSDE-2.1.8.2, Welding End Details: Consumable Inserts
  - c. MSDE-2.1.8.5, Welding End Details: Open Root GTAW Welding

END OF SECTION 400512



**SECTION 400523**

**VALVES**

**PART 1 - GENERAL**

101. EXTENT

101.1 This Section establishes the requirements for design, performance, manufacture, inspection, examination, testing, packaging, and shipping for all valve configurations in all piping systems as follows:

- a. Cast iron valves, Pressure Classes 125 and 250, in sizes 2-1/2 inches and larger with flanged or threaded ends.
- b. Steel valves, as follows:
  - b1. Butt-weld end valves, in sizes 2-1/2 inches and larger, cast or forged, Standard and Special Pressure Classes 150, 300, and 600
  - b2. Flanged-end valves, in sizes 2-1/2 inches and larger, cast, or forged Pressure Classes 150, 300, and 600.
  - b3. Socket-weld or threaded end valves in sizes two (2) inches and smaller, forged Pressure Classes 600.

101.2 The quantity, size, rating, material specifications, configuration, and other requirements are listed on the included attachments.

101.3 Manufacturer's valves and valve accessories shall conform to the requirements of the governing code(s) and shall satisfy all conditions and requirements of this Specification and attached Valve Design Tables (VDT) and data sheets.

102. RELATED WORK SPECIFIED IN OTHER SECTIONS

102.1 The work specified in this Section shall be coordinated with work specified in the following related Sections:

- a. Section 013323 – Shop Drawings and Project Data
- b. Section 013324 – List of Submittals
- c. Section 014219 – Reference Documents
- d. Section 016131 – Nameplates and Tags

103. DESIGN REQUIREMENTS

103.1 General Design Requirements:

- a. Valves and accessories shall conform to the requirements of the governing Code(s); in other respects, valves shall conform to the requirements of this Section and shall satisfy all conditions and requirements of the specification.
- b. In the event of variance between the general requirements delineated in this Section and the particular requirements set forth in the VDT or other data sheets, the VDT or data sheets shall take precedence.
- c. The valve requirements will be specified in the VDTs.



- d. Fire protection system:
  - d1. Valves for fire protection piping shall be UL or FM listed.
  - d2. Yard hydrants shall be wet barrel type, capable of being rotated on the valve body.
  - d3. Valve boxes shall have adjustable risers.
- 104. REFERENCE DOCUMENTS
  - 104.1 Standards, specifications, manuals, codes and other publications of nationally recognized organizations and associations are referenced herein. Methods, equipment, and materials specified herein shall comply with the specified and applicable portions of the referenced documents indicated in Section 014219, in addition to federal, state, or local Codes having jurisdiction. References to these documents are to the latest issue date of each document, unless otherwise indicated, together with the applicable additions, addenda, amendments, and supplements thereto in effect as of the date indicated in Section 014219.
  - 104.2 ANSI - American National Standards Institute:
  - 104.3 ASME - American Society of Mechanical Engineers:
    - a. B16.34 – Valves - Flanged, Threaded, and Welding End.
    - b. B31.1 – Power Piping.
  - 104.4 ASTM - ASTM International:
    - a. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
    - b. E94 - Standard Guide for Radiographic Examination.
    - c. E142 - Standard Method for Controlling Quality of Radiographic Testing.
    - d. E165 - Standard Test Method for Liquid Penetrant Examination.
    - e. E446 - Standard Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness.
  - 104.5 AWWA - American Water Works Association.
  - 104.6 MSS - Manufacturers Standardization Society of the Valve and Fitting Industry:
    - a. SP-25 - Standard Marking System for Valves, Fittings, Flanges and Unions.
    - b. SP 55 - Quality Standard for Steel Castings for Valves, Flanges, Fittings and Other Piping Components - Visual Method for Evaluation of Surface Irregularities.
    - c. SP-61 - Pressure Testing of Steel Valves.
    - d. SP-70 - Gray Iron Gate Valves Flanged and Threaded Ends.
    - e. SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service.
    - f. SP-84 - Valves - Socket Welding and Threaded Ends-Superseded by ASME B16.34.
  - 104.7 OSHA – Occupational Safety and Health Administration.



105. SUBMITTALS

105.1 Submit documents for review in accordance with the submittal requirements of Sections 013323 and 013324.

105.2 Shop detail and erection drawings.

106. GENERAL QUALITY CONTROL AND QUALITY ASSURANCE PROVISIONS

107. DEFINITIONS

107.1 Piping Design Tables (PDTs): Specify for pipelines: materials and wall thickness for pipe and fittings, types of piping joints including flanges, flange bolting, and gasketing, and materials, types, pressure classes for valves and Valve Design Tables (VDTs).

107.2 Valve Design Tables (VDTs): Specify the critical characteristics for valves. This includes: materials, configurations, stem types, seat type, packing, manual operator type, and other information for the procurement of valves. A given PDT will specify a series of VDTs which will provide specifications for gate, globe, check, and quarter-turn valves. The VDTs must be supplemented with data sheets for project specific characteristics for automated, control, or supervisory valves.

108. MAINTENANCE

108.1 Special Tools:

- a. A complete set of special tools required for repair, adjustment and complete dismantling and assembling of the valves shall be furnished. Tools shall be new and of first-class quality. Tools shall be shipped to the project in separate containers clearly marked with the name of the equipment for which they are intended.

108.2 Spare Parts:

- a. Provide a complete set of spare parts required for erection.

**PART 2 - PRODUCTS**

201. DESIGN REQUIREMENTS

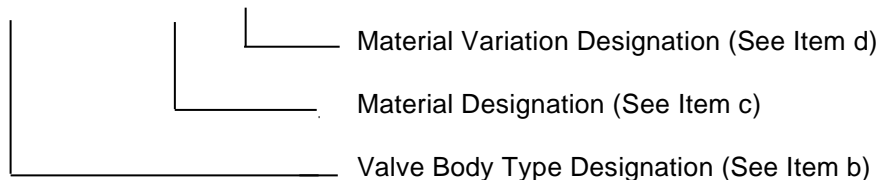
201.1 Refer to attached Valve Design Table (VDT), valve list, and attached data sheets for specific design requirements.

201.2 The following articles describe how to read Valve Design Tables and outline the information specified within the VDT.

201.3 Valve Table Numbering Designation:

- a. All standard VDTs shall be given an alpha-numeric designation as follows:

AAAAA X      X



- b. Valve Body Type: designations are indicated by the first four or five alphabetic characters of the VDT number. There are four (4) types of valve body types described by the VDTs and they are:

400523-3



- b1. CHECK
- b2. GATE
- b3. GLOBE
- b4. QTURN (indicates quarter turn valves, such as butterfly, ball or plug type valves)
- c. Material: Designations are indicated by the first numeric character and are similar to the PDT material designations. Examples of the designations are as follows:
  - c1. 0 - Carbon steel
  - c2. 1 - 1 -1/4% Cr - 1/2% Mo - Si
  - c3. 2 - 2 -1/4% Cr - 1% Mo
  - c4. 3 - Intermediate chrome alloys such as 5% Cr or 9% Cr materials
  - c5. 4 - 304 Stainless steel
  - c6. 5 - 316 Stainless Steel
  - c7. 6 - Copper alloys
  - c8. 7 - Cast iron
  - c9. 8 - Other non-ferrous alloys
  - c10. 9 - Plastics, fiberglass, and other non-metals
- d. Material Variations: are indicated by the second numeric digit. The following are some examples of material variation designations:
  - d1. 30 - 5% Cr - 1/2% Mo
  - d2. 31 - 9% Cr - 1% Mo - V
  - d3. 41 - 304L Stainless
  - d4. 51 - 316L Stainless
  - d5. 71 - Ductile iron
  - d6. 80 - Alloy 20 (UNS N08020)
  - d7. 81 - Aluminum
- 201.4 VDT Attributes:
  - a. Rating: Specifies the valve pressure class rating listed in ASME 16.34.
  - b. Body/Bonnet Type of Attachment: Specifies the type of attachment for the body or bonnet.
  - c. Bonnet Stud Material: Specifies the allowable material for the bonnet stud. This is usually an ASTM or another comparable standard.



- d. Bonnet Nut Material: Specifies the allowable material for the bonnet nut. This is usually an ASTM or another comparable standard.
  - e. Body/Bonnet Material: Specifies the allowable material for the body. This is usually an ASTM or another comparable standard.
  - f. Stem Type: Specifies the stem design to be used.
  - g. Stem Material: Specifies the stem material to be used.
  - h. Disk/Plug Material: This specifies the allowable material for the disk or plug. This is typically carbon steel or another alloy.
  - i. Seat/Backseat: This specifies the seat or backseat configuration of the valve.
  - j. Seat Material: This specifies the type of seat material to be used.
  - k. Packing: This specifies the allowable valve packing material.
  - l. Manual Operator: Specifies the manual operator and allowable material.
  - m. Note Reference: This calls out any notes specific for that specific valve. All applicable notes are attached with the VDT.
- 201.5 Valve List: The following articles discuss the aspects of the valve list included as a supplement to this document:
- a. Valve Number: An attribute defined in accordance with project specific instructions.
  - b. Piping & Instrumentation Diagram: This attribute contains the Piping & Instrumentation Diagram (P&ID) drawing number on which the valve first appears.
  - c. Valve Size: An attribute containing the valve size in inches.
  - d. Design Conditions: The required valve design conditions should be stipulated as follows:
    - d1. Design Pressure: The maximum design pressure of the upstream and downstream piping should be considered for the valve. The design pressure is expressed in psig, or as required by the Project Instructions.
    - d2. Design Temperature: The maximum design temperature of the upstream and downstream piping should be considered for the valve. The design temperature of the valve may not necessarily be coincidental with the design pressure of the corresponding piping system.
  - e. Valve Pressure Class: An attribute defining the valve pressure class as listed in ASME B16.34, and MSS SP-70, -71, -80 and -85.
  - f. Body Configuration: This attribute contains the type of valve body configuration as presented in Table 202.5.h.



**TABLE 202.5.h: VALVE BODIES AND ASSOCIATED CONFIGURATIONS**

Valve Bodies	GATE	GLOBE	CHECK	QTURN
<b>Configurations</b>	Double wedge	Angle	Ball (Lift)	Ball
	Parallel	Diaphragm	Non-Slam Counterweighted	Butterfly
	Slide	Needle	Swing	Lubricated Plug
	Solid Wedge	Stop Check	Non-Slam Tilting Disc	Multiple Ported Plug
	Split/Flexible Wedge	Straight	Non-Slam Wafer Butterfly	
		Y Pattern	Piston (Lift)	

- g. Piping Code: This attribute contains the piping code designator for the system in which the valve is located, per the following:
  - g1. ASME B31.1 for Non-boiler External Piping (NBEP)
  - g2. National Fire Protection Association (NFPA)
  - g3. AWWA
  - g4. IPC
- h. Valve End - Type/Detail: This defines the valve end connection of the valve as flanged, threaded, socket or butt welding by appropriate welding details, mechanical joints, compression joint, solder joint, etc., and the required “C” dimensions.
- i. Operators: This attribute is the abbreviation for the valve-operator type.
- j. Special Accessories: This attribute is the abbreviations corresponding to particular special accessories.
- k. Data Sheet: This attribute is the valve data sheet number if a data sheet is prepared. Valve data sheets contain pertinent design information for the valve.
- 201.6 Code Stamp: All ASME Code valves and other ASME components furnished by the Supplier shall have a nameplate and/or be marked and stamped in accordance with the applicable requirements of the appropriate section of the ASME Code.
- 201.7 Additional Design Requirements:
- 201.8 Valve Operators:
  - a. Manual Operators:
    - a1. All manually-operated valves shall be provided with detent or latch mechanism that will hold the valve at the predetermined location without damage due to fluid induced valve flutter and shall be furnished with a visual position indicator.
- 202. MATERIAL REQUIREMENTS
- 202.1 Refer to VDT's and other attached data sheets for material requirements.





203. SOURCE QUALITY CONTROL

203.1 Testing Equipment and Materials:

- a. Seller is responsible for furnishing all equipment and material required to perform the testing specified herein.
- b. Seller is responsible for maintaining and calibrating all testing equipment.

204. FABRICATION REQUIREMENTS

204.1 Protection:

- a. Valves shall be protected prior to shipment in accordance with manufacturer's standard practice and as follows:
  - a1. All openings in valves and accessory equipment shall be securely plugged, capped, or otherwise blanked off, sealed with tape, and suitably protected against damage and entry of foreign materials and moisture.
  - b. Weld ends shall be capped and sealed with suitable, firmly attached protectors. Protectors for beveled ends shall have a plywood or hardboard liner disc held securely against the beveled end. Protectors for other weld ends may be metal caps without liner discs. Protectors for socket weld-ends may be plugs.
  - c. All flanged connections shall be provided with suitable full-face flange protectors bolted in place and sealed.
  - d. Threaded connections shall be provided with plugs.
  - e. Seller shall furnish Owner with instructions for storage and maintenance of his equipment prior to installation as well as for the period between completion of installation and the time that the equipment is placed in service.

204.2 Valve Identification and Marking:

- a. Marking:
  - a1. For butt-weld and flanged end steel valves: Per ASME B16.34
  - a2. For cast iron valves: Per MSS-SP-70, MSS-SP-71, and MSS-SP-85 as applicable.
  - a3. For valves not covered above: Per MSS-SP-25.
- b. Identification:
  - b1. In addition to the marking specified above, each valve and separate component shall be equipped with a stainless steel metal tag permanently attached in accordance with MSS-SP-25, bearing the corresponding identification number and its particular service indicated herein.
- c. The valves shall be numbered in accordance with the valve list.

205. FINISH REQUIREMENTS

205.1 Valves shall be cleaned and painted in accordance with manufacturer's standard practice, and as follows:

- a. Grit Blasting: Interior of all valve bodies shall be thoroughly blast cleaned using metallic grit. Grit used for stainless steel valves shall be new alumina. All grit blasting materials shall be removed prior to painting.



- 205.2 No paint having an asphaltum base shall be used.
- 205.3 Paint for ferrous metal valves with hot service conditions shall be heat resistant.
- 205.4 Stainless steel valves shall not be painted.
- 205.5 Machined surfaces shall not be painted. Welding end preparations of ferrous metal valves shall be coated with Deoxaluminite, or equal, acceptable to the Consulting Engineers, back to a ring six (6) inches from end. Flange facings, bolt holes, and other external machined surfaces of ferrous metal materials shall be coated with a suitable antirust compound.

**PART 3 – EXECUTION**

- 301. FIELD QUALITY CONTROL
- 301.1 Inspection and Testing by the Seller.
- 301.2 Examination for general compliance by the Engineer of Record.
- 301.3 Extent and method of examination and testing.
- 301.4 Acceptance Criteria.
- 301.5 Field Services:
  - a. Seller shall, at the Owner's option, furnish field representatives to provide technical assistance for erection and installation of the Seller's equipment and/or to provide technical assistance for commissioning and start-up of Seller's equipment. Seller shall, if required by the Owner, furnish training to the Owner's operations personnel.

END OF SECTION 400523

McIntosh Power Plant  
McIntosh Reciprocating Engine Project  
Project No. A14166.002  
Proposal Data Pages



Specification M-8537  
Date: 07-29-2022  
Rev. D – Conformed

**ATTACHMENT 1**  
**PROPOSAL DATA PAGES**

**PROPOSAL DATA FORM**

NAME OF BIDDER: Casey

<b>PROPOSAL DATA</b>		
<b><u>ITEM NO.</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>INCLUDED IN PROPOSAL (YES / NO) OR REQUIRED PROPOSAL DATA</u></b>
<b>1.0</b>	<b>Work Schedule &amp; Performance REQUIRED WITH PROPOSAL</b>	Yes
1.2	Can Bidder perform the Work in accordance with the Project Schedule specified in this Specification? (Answer Yes or No)	Yes
1.3	If the answer is "No", Bidder shall indicate what schedule can be met by submitting a revised schedule with the proposal.	-
1.4	Is the Bidder capable of performing the work required in this specification, as presented in Section 011100 and Attachment 11 DOR of this Specification? (Answer Yes or No)	Yes
1.8	Does Bidder agree to obtain the proper construction permits to complete the Work including the following: 1) Soil Erosion Control Permit and 2) Notice of Intent. (Answer Yes or No)	Yes
1.9	Bidder to submit a project specific construction work (execution) plan with proposal including:	
a	Submit Bidder's construction procedures and sequences, including a narrative explanation of the plan.	Yes
b	Bidder's Proposal Schedule	Yes
c	Bidder shall provide a list of issues, if any exist, that would prevent Bidder from meeting the schedule dates in Section 013216.	Yes
d	Bidder to prepare a site staffing plan by month of major trades and craft supervision. Define the work expected, 5-10s, single shift etc.	Yes
e	Bidder to submit plan to catalog, receive, and store materials for Owner evaluation and eventual turnover to Above Ground GWC Contractor.	Yes
f	Bidder to submit plan to control project cost.	Yes
g	Organization Chart for Key Personnel	Yes
h	Resumes for Key Personnel	Yes
i	Bidder to provide a temporary facilities plan for the project work, considering the available area identified on the Site Plan.	Yes
j	Bidder to verify Owner provided laydown and construction parking is adequate. (Y/N)	Yes
k	Bidder's hot work program.	Yes
l	Bidder's confined space program.	Yes
1.10	Bidder to submit a project specific quality plan with proposal including:	
a	Bidder's ISO 9000 certification	No
b	Bidder's Quality Control program	Yes
1.11	Bidder to submit a site specific safety plan with proposal including:	
a	Bidder's safety program.	Yes
b	Bidder's safety staffing plan (# of safety personnel/craft over duration of project)	Yes
c	Bidder's safety statistics as follows:	
c1	Workers Compensation experience modification rate (EMR);	0.63
c2	OSHA recordable incident rate and associated total man-hours worked for the past three (3) years; (please provide both corporate and power generation/industrial division data separately)	2021: 0.42   1,410,651 2020: 0.57   700,961 2019: 0.51   1,158,361

<b>PROPOSAL DATA</b>		
<b><u>ITEM NO.</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>INCLUDED IN PROPOSAL (YES / NO) OR REQUIRED PROPOSAL DATA</u></b>
c3	OSHA lost time incident rate and associated total man-hours worked for the past three (3) years: please provide both corporate and power generation/industrial division data separately)	2021: 0.00   1,410,651 2020: 0.00   700,961 2019: 0.00   1,158,361
c4	Has your company reported a fatality in the past three (3) years (please provide both corporate and power generation/industrial division data separately)?	No
c5	Has your company been cited by a government agency in the last three (3) years for any occupational health and safety non-compliance or environmental offenses (please provide both corporate and power generation/industrial division data separately)?	No
c6	TRIR and EMR for major subcontractors, including the piling subcontractor. If Bidder has not selected a specific subcontractor for major subcontracting scopes, data should be provided for the top three subcontractors in consideration.	See Proposal Appendix section
1.12	Bidder to provide an experience list of successful projects per the following categories (separate lists, with client references including contact information):	
a	New Power Plant Construction Experience	Yes
b	Reciprocating Engine Plant Construction Experience	Yes
c	Construction Experience on projects performed for Lakeland Electric	Yes
1.13	Bidder shall submit a copy of his Florida State Contractors License	Yes
1.14	Bidder to provide current T&M rates.	Yes
<b>2.0</b>	<b>Independent Testing Agency</b>	
2.1	Bidder acknowledges that they will be responsible for hiring an independent testing/inspection agency to perform code required inspections & tests. (Answer Yes or No)	Yes
<b>3.0</b>	<b>Civil Sitework</b>	
3.1	Bidder acknowledges that it will provide shop drawings for all precast manholes, catch basins, and drainage structures to the Owner for review. Manholes, catch basins, and drainage structures shall not be precast without the Owner's approval of the shop drawings. (Answer Yes or No)	Yes
3.2	Bidder acknowledges that it will provide material gradation and laboratory results for all bedding, backfill, and aggregate materials that are not specified in the project specification or on drawings, prior to installation.	Yes [see clarifications]
3.3	Provide the name of the contractor responsible for the design and installation of the ground improvements system.	No
3.4	Which ground improvement system will be utilized for the project?	No
<b>4.0</b>	<b>Concrete &amp; Foundations</b>	
4.1	Indicate whether the Bidder will have a ready mix batch plant on-site or truck in concrete from an off-site facility.	Off-site
4.2	Provide the name and location of the off-site facility if applicable.	CEMEX Plant, 3770 Maine Ave., Lakeland 33801
4.3	Provide the name of the sub-contractor who will be responsible for the concrete mix design.	CEMEX QC would provide the mix design.
4.4	Does this sub-contractor have experience creating concrete mixes which meet the requirements of ACI for mass concrete placement? This includes controlling the temperature difference between the center and surface. (Answer Yes or No)	Yes

<b>PROPOSAL DATA</b>		
<b><u>ITEM NO.</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>INCLUDED IN PROPOSAL (YES / NO) OR REQUIRED PROPOSAL DATA</u></b>
4.5	Existing undergrounds or embedded utilities may be located within or adjacent to the area in which excavation, demolition, foundation, or modification work is to be performed. Bidder acknowledges that these may be present and that Bidder will work with the Owner to relocate or modify existing undergrounds and utilities as required. (Answer Yes or No)	Yes
4.6	Provide the name of the sub-contractors who will be responsible for the precast prestressed concrete pile installation and testing.	Precast Piling Technology, Inc.
4.7	Bidder to provide the precast pile fabricator and installer names, if subcontracted.	Precast Piling Technology, Inc.
<b>5.0</b>	<b>Mechanical</b>	
<b>5.1</b>	<b>Fire Hydrants</b>	
a	QTY	<b>0 [relocating 1 hydrant]</b>
b	Manufacturer	per spec
c	Model	per spec
d	Hydrants provided with ductile iron pipe spool piece to connect to key operated isolation valve? (yes/no)	No
<b>5.2</b>	<b>Cleanouts</b>	
a	QTY	5
b	Manufacturer	per spec
c	Model Number	per spec
<b>5.3</b>	<b>Floor Drains</b>	2
a	Manufacturer	per spec
b	Model Number	per spec
<b>5.4</b>	<b>HDPE Pipe</b>	
a	Supplier	Secor
b	Product Line	
c	Size / LF / DR Rating	18"/135 LF/CHDPE
d	Size / LF / DR Rating	24"/420 LF/CHDPE
e	Size / LF / DR Rating	15"/471 LF/CHDPE
f	Size / LF / DR Rating	12"/234 LF/CHDPE
g	Size / LF / DR Rating	2"/3331 LF/DR11
h	Size / LF / DR Rating	4"/514 LF/DR 11
i	Size / LF / DR Rating	8"/1055 LF/DR 9
<b>5.5</b>	<b>Carbon Steel Pipe</b>	
a	Supplier	Flow Zone
b	Product Line	ASTM A106 Grade B
c	Size / LF / Schedule	12"/275LF/Sch 40
d	Size / LF / Schedule	6"/890 LF/Sch 40
e	Size / LF / Schedule	2"/857 LF/Sch 80
f	Proposed Coating System	
<b>5.6</b>	<b>Double Wall Carbon Steel Pipe</b>	
a	Supplier	Perma Pipe
b	Product Line	Ultra FS
c	Size / LF / Schedule	2"x6"/900 LF
d	Proposed Coating System/Wrap	FRP
<b>5.7</b>	<b>Ductile Iron Pipe</b>	
a	Supplier	Core & Main
b	Product Line	

<b>PROPOSAL DATA</b>		
<b><u>ITEM NO.</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>INCLUDED IN PROPOSAL (YES / NO) OR REQUIRED PROPOSAL DATA</u></b>
c	Size / LF / Rating	6"/40LF/Sch
d	Size / LF / Rating	
<b>5.8</b>	<b>Manual Operated Valves</b>	
a	QTY	7
b	Manufacturers	Pending Final Design
c	Model Numbers	Pending Final Design
<b>5.9</b>	<b>Key Operated Valves</b>	
a	QTY	0
b	Manufacturer	
c	Model Number	
<b>6.0</b>	<b>Electrical</b>	
<b>6.1</b>	<b>Grounding</b>	
a	Manufacturer	Burndy-Erico
b	Size of Ground Cable	#4/0 & #500 Bare CU
<b>6.2</b>	<b>Cathodic Protection</b>	
a	Type of System	Impressed - AC Powered
b	Manufacturer	Galvotec, Universal, Kris-Tech
c	Subcontractor	Aegion
d	Feet of Piping protected	2900
<b>6.3</b>	<b>Conduit</b>	
a	Manufacturer	CANTEX – Carlon - Allied
b	Type	PVC Sch 80

McIntosh Power Plant  
McIntosh Reciprocating Engine Project  
Project No. A14166.002  
Proposal Pricing Pages



Specification M-8537  
Date: 07-29-2022  
Rev. D – Conformed

**ATTACHMENT 2**  
**PROPOSAL PRICING PAGES**



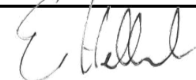
**PROPOSAL PRICING FORM**

NAME OF BIDDER: Casey Industrial

<b>PROPOSAL PRICING</b>		<b>July 6, 2022 Pricing</b>
<b>1.0</b>	<b>FIRM LUMP SUM PRICE</b> for the WORK furnished and installed, complete as covered by Project Specification M-8537, and based on meeting conditions of the Bid Documents, unless exceptions are specifically listed and identified as such in the proposal. The Firm Lump Sum Price shall include all additional costs related to the performance and completion of the WORK, including, but not limited to, Indirect Cost and Field Support Cost.  Without limitation, it is understood that this price is firm, and is not subject to adjustment due to changes in costs of labor or material, or to any other factor, except changes in the scope of work or causes specifically stated in the Contract.  The Firm Lump Sum Price shall equal the combined total of Items 2.1 through 2.5.	<b>\$16,879,295.00</b>
<b>2.0</b>	<b>LUMP SUM PRICE BREAKDOWN: [Notes 2-1 to 2-3]</b>	
2.1	<b>Mobilization and Demobilization:</b>	<b>\$1,214,969.32</b>
2.2	<b>Civil / Structural:</b>	
2.2.1	Sitework (sum of 101 items as listed in detailed section)	\$588,493.24
2.2.2	Civil Piping Systems (sum of 102 items as listed in detailed section)	\$532,965.68
2.2.3	Site Road (sum of 103 items as listed in detailed section)	\$137,966.68
2.2.4	Misc. Roadwork and Surfacing (sum of 104 items as listed in detailed section)	\$395,598.49
2.2.5	Foundations (sum of 105 items as listed in detailed section)	\$6,160,496.34
2.2.6	<b>Civil / Structural TOTAL</b> (Sum of items 2.2.1 thru 2.2.4)	<b>\$7,815,520.43</b>
2.3	<b>Mechanical:</b>	
2.3.1	Fuel Gas (sum of 201 items as listed in detailed section)	\$294,612.07
2.3.2	Potable/Service/Demin Water (sum of 202 items as listed in detailed section)	\$45,919.43
2.3.3	Vaporized Anhydrous Ammonia (sum of 203 items as listed in detailed section)	\$79,426.45
2.3.4	Sanitary Drains (sum of 204 items as listed in detailed section)	\$21,803.00
2.3.5	Equipment Drains (sum of 205 items as listed in detailed section)	\$40,136.44
2.3.6	Fire Protection (sum of 206 items as listed in detailed section)	\$280,414.29
2.3.7	Lube Oil (sum of 207 items as listed in detailed section)	\$545,289.00
2.3.8	Instrument Air (sum of 208 items as listed in detailed section)	\$25,153.09
2.3.9	<b>Mechanical TOTAL</b> (Sum of items 2.3.1 thru 2.3.8)	<b>\$1,332,753.77</b>
2.4	<b>Electrical:</b>	
2.4.1	Grounding (sum of 301 items as listed in detailed section)	\$222,337.18
2.4.2	Cathodic Protection (sum of 302 items as listed in detailed section)	\$295,655.58
2.4.3	Underground Ductbank and Manholes (sum of 303 items as listed in detailed section)	\$946,589.72
2.4.4	Construction Power if furnished by Contractor	\$0.00
2.4.5	<b>Electrical TOTAL</b> (Sum of items 2.4.1 thru 2.4.4)	<b>\$1,464,582.47</b>
2.5	<b>Contract Administration &amp; Execution:</b>	<b>\$4,826,469.01</b>
2.6	<b>Unloading and Storage</b>	<b>\$225,000.00</b>
3.0	<b>Bidder has completed the Unit Pricing tab (yes/no)</b>	<b>Yes</b>
<b>4.0</b>	<b>OTHER CHARGES</b>	
4.1	<b>Builders Risk Insurance</b>	<b>TBD</b>
4.2	<b>Performance Bond (Included in Contract Admin Tab)</b>	<b>\$0.00</b>
4.3	<b>Letter of Credit</b>	<b>\$0.00</b>
4.4	Cancellation Charges	TBD
4.4.1	Cancellation charges – Bidder to furnish a cancellation schedule with the proposal.	Later
4.4.2	Bidder to verify that such a cancellation schedule is included with the bid. (Answer Yes/No)	No
4.5	Work Pause Charge	TBD
4.5.1	Work Pause Charge – Bidder to furnish a work pause schedule with charges for a work stoppage in the event that there is a delay in equipment delivery which delays completion of this contract.	Later

PROPOSAL PRICING		July 6, 2022 Pricing
4.5.2	Bidder to verify that such a pausing charge is included with the bid. (Answer Yes/No)	No
	<b>Optional weekly pricing for three individuals, 90 ton crane, and 14k forklift for delivery receiving and handling. (Base price includes 18 weeks)</b>	\$17,172.00
<b>5.0</b>	<b>BID VALIDITY</b>	
5.1	Bidder hereby agrees that his proposal shall remain valid for acceptance by Owner for a period of ninety days from the Bid due date (Answer Yes/No)	No
5.2	If answer is "No", Bidder shall indicate the date to which his proposal remains valid for acceptance by Owner.	60 Days
<b>6.0</b>	<b>TAXES</b>	
6.1	Bidder shall confirm that no tax has been included in the price column: "No tax included"	No tax included
<b>7.0</b>	<b>BUSINESS INFORMATION</b>	
7.1	Is this business a corporation? (Answer Yes/No)	Yes
7.2	If a corporation, advise state of incorporation.	Oregon
7.3	Full legal name of company.	Casey Industrial, Inc.
7.4	E.I.N.	91-1175747
<b>8.0</b>	<b>COMPLETENESS OF PRICING</b>	
8.1	Bidder hereby certifies that he agrees to all provisions of the Bid Documents unless exceptions are specifically and clearly listed in the proposal and identified as Exceptions. Bidder's printed terms and conditions are not considered specific exceptions. Any exceptions which Bidder has taken are listed on Page(s).	Yes
8.2	Is Bidder's proposal complete with regard to all charges considered part of the Work or services covered by the Bid Documents? (Answer Yes/No).	Yes
8.2.1	If the answer is "No", please detail charges and explain:	
8.3	Does Bidder foresee any Work or services not covered by the Specification but applicable to the intended Work or services? (Answer Yes/No)	No
8.3.1	If the answer is "Yes", please detail charges and explain:	
<b>9.0</b>	<b>PAYMENT SCHEDULE &amp; RETAINAGE</b>	
9.1	Bidder to provide proposed payment schedule for the project, including initial and final payments, retainage held per payment and release of retainage at project conclusion.	Yes
9.2	Owner requires 5% retainage to be withheld from each invoice. Bidder to confirm understanding of this requirement: (Yes / No)	Yes
<b>10.0</b>	<b>SUBCONTRACTED WORK</b>	
	Bidder shall list below all portions of the WORK to be subcontracted; in this connection, attention is specifically directed to the requirements set forth for subcontractor work in the General Conditions:	
	<b>WORK SUBCONTRACTED</b>	<b>NAME OF SUBCONTRACTOR</b>
	Piling	Precast Piling Technology, Inc.
	Cathodic Protection	Aegion

NAME OF BIDDER Eric Helland TITLE: VP of Operations Services

SIGNATURE OF BIDDER  PHONE NUMBER: 1-303-460-1274

ADDRESS 890 W Cherry St, Louisville, CO 80027 FAX NUMBER

EMAIL ADDRESS [eric.helland@mastec.com](mailto:eric.helland@mastec.com) BID DATE: 7/6/2022

- Note 2-1:** The price shall be based on the requirement of this specification and the configuration given in the design drawings.
- Note 2-2:** Price breakdowns shall encompass all cost to successfully complete all Work as defined in the project specification.
- Note 2-3:** The Owner has the right to consider the price quoted for each item to be a take-out price at time of award. If so opted by the Owner, the price of Item 1 will be reduced by the amount quoted for the deleted scope of work.

CIVIL/STRUCTURAL PRICING FORM

Bidder: Casey Industrial

Item No.	Description	Unit	Unit Quantity	Lump Sum		
				Labor \$	Material \$	Total \$
<b>101</b>	<b>Sitework</b>					
101.1	<b>Erosion Protection</b>	ls	1	\$11,947.99	\$4,481.40	\$16,429.39
101.2	<b>Earthwork</b>					
101.2.1	Topsoil Stripping and Stock Piling	c.y.	4,683	\$31,532.38	\$0.00	\$31,532.38
101.2.2	Excavation	c.y.	3,226	\$27,978.51	\$0.00	\$27,978.51
101.2.3	Disposal of unsuitable material	c.y.	7,909	\$78,377.76	\$0.00	\$78,377.76
101.2.4	Imported fill from offsite	c.y.	8,610	\$122,018.95	\$242,156.25	\$364,175.20
101.3	<b>Temp Construction Fencing (Added per Site Permit Requirement Specific Condition #5)</b>	lf.	14,000			\$70,000.00
	<b>101 Sitework Total:</b>					<b>\$588,493.24</b>
<b>102</b>	<b>Civil Yard Piping</b>					
102.1	<b>Sanitary Piping</b> (pricing includes supply and installation of pipe, connections, testing, etc.)					
102.1.1	4" diameter PVC Gravity Pipe / 3" diameter HDPE Force Main (includes excavation, bedding, and backfill)	lf.	784	\$33,741.81	\$5,235.13	\$38,976.94
102.2	<b>Precast Concrete Sanitary Sewer Manhole (with cast iron frame and cover, flexible water tight connections.)</b> (price includes supply and installation of manhole)					
102.2.1	48" inside diameter (including excavation, bedding, and backfill)	ea	5	\$14,497.92	\$12,500.00	\$26,997.92
102.3	<b>Sanitary Lift Station</b> (pricing includes installation of lift station including all required accessories, conc. hold down slab, etc.) <b>(Underground 6ft diameter packaged sanitary wet well lift station with steel sump and valve box)</b>					
102.3.1	Lift Station (including excavation, bedding, and backfill)	ea	1	\$4,432.00	\$0.00	\$4,432.00
102.4	<b>Oily Piping</b> (pricing includes supply and installation of pipe, connections, testing, etc.)					
102.4.1	6" CISP diameter pipe / 4" diameter HDPE force main (includes excavation, bedding, and backfill)	lf	325	\$37,658.48	\$19,486.20	\$57,144.68
102.5	<b>Precast Concrete Oily Sewer Manhole (with cast iron frame and cover and vents)</b> (price includes supply and installation of manhole, etc.)					
102.5.1	48" inside diameter (includes flexible water tight connections, excavation, bedding, and backfill)	ea	1	\$3,341.57	\$3,000.00	\$6,341.57
102.6	<b>Oil Water Separator</b> (pricing includes supply and installation of oil water separator including all required accessories, conc. hold down slab, etc.)					
102.6.2	Oil Water Separator (includes excavation, bedding, and backfill)	ea	1	\$4,416.00	\$0.00	\$4,416.00
102.7	<b>CHDPE Pipe</b> (pricing includes supply and installation of pipe, connections, testing, etc.)					
102.7.1	8", 12", 15", 18", 24" diameter pipe (includes excavation, bedding, and backfill)	lf	1,603	\$126,441.25	\$96,143.83	\$222,585.08
102.8	<b>Precast Concrete Structures (with cast iron frame and cover)</b> (price includes supply and installation of lid, etc.)					
102.8.1	48" inside diameter manhole / 30" x 30" catch basin (includes excavation, bedding, and backfill)	ea	3	\$5,245.77	\$3,000.00	\$8,245.77
102.9	<b>CHDPE Culverts</b> (pricing includes supply and installation of culverts, including excavation, backfill, compaction, flared end sections, riprap protection, etc.)					
102.9.1	5 ft W x 2 ft H culvert (includes excavation, bedding, and backfill)	lf	75	\$32,149.05	\$52,230.36	\$84,379.41
102.10	<b>Mechanical Piping Excavation, Bedding, Backfill</b>					
102.10.1	Excavation (price includes excavation, disposal, protection, sheeting, shoring, dewatering, etc.)	c.y.	575	\$8,275.38	\$0.00	\$8,275.38
102.10.2	Bedding Material (includes compaction)	c.y.	210	\$3,193.19	\$9,366.84	\$12,560.03
102.10.3	Backfill Materials (includes compaction)	c.y.		\$0.00	\$0.00	\$0.00
102.10.4	Additional Items as Required by Contractor (list): <b>Hydro excavation</b>			\$38,478.56	\$0.00	\$38,478.56
	<b>Excavate and dispose of concrete</b>			\$20,132.34	\$0.00	\$20,132.34
	<b>102 Civil Yard Piping Total:</b>					<b>\$532,965.68</b>
<b>103</b>	<b>Site Road</b> (pricing includes supply and installation of road components)					
103.1	Site Road (includes aggregate base, geotextile, and subgrade prep)	sy	5,575	\$80,715.89	\$57,250.79	\$137,966.68
	<b>103 Asphalt Road Total:</b>					<b>\$137,966.68</b>
<b>104</b>	<b>Miscellaneous Roadwork and Surfacing Items</b> (pricing includes supply and installation of the following items)					
104.1	6" Thick Crushed Stone Ground Cover Surfacing (includes geotextile)	sy	24,958	\$172,935.32	\$222,663.17	\$395,598.49
104.2	4" Seeded Topsoil	sy		\$0.00	\$0.00	\$0.00
104.3	Steel Pipe Guard Post (includes painting and filling with concrete)	ea.		\$0.00	\$0.00	\$0.00
	Additional Items as Required by Contractor (list): Temp Surfacing for laydown and parking			\$0.00	\$0.00	\$0.00
	<b>104 Miscellaneous Roadwork and Surfacing Total:</b>					<b>\$395,598.49</b>
<b>105</b>	<b>Foundations</b>					
105.1	<b>Engine Hall Building Foundation</b>					
105.1.1	Excavation	c.y.	600.00			
105.1.2	Backfill & Compaction	c.y.	350.89			
105.1.3	Concrete	c.y.	1,539.00			
105.1.4	Rebar	tons	92.29			
105.1.5	Formwork	s.f.	7,606.00			
105.1.6	Embedments	tons	1.61			
105.1.7	Water Stops	l.f.	883.50			
105.1.8	Piles	ea	152.00			
105.1.9	Grating	s.f.	328.32			
105.1.10	Coating	s.f.	18,956.00			
105.1.11	Vapor Barrier	s.f.	20,852.00			
	<b>Engine Hall Building Foundation Cost</b>			\$489,601.41	\$1,217,674.45	\$1,707,275.86
105.2	<b>Isolated Engine Foundation</b>					

Adjusted in RFC 2

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Item No.	Description	Unit	Unit Quantity	Lump Sum		
				Labor \$	Material \$	Total \$
105.2.1	Excavation	c.y.	0.00			
105.2.2	Backfill & Compaction	c.y.	314.93			
105.2.3	Concrete	c.y.	1,041.13			
105.2.4	Rebar	tons	62.47			
105.2.5	Formwork	s.f.	2,575.00			
105.2.6	Embedments	tons	0.00			
105.2.7	Piles	ea	96.00			
105.2.8	Coating	s.f.	9,956.54			
105.2.9	Vapor Barrier	s.f.	10,952.19			
	<b>Isolated Engine Foundation Cost</b>			\$204,048.89	\$768,129.58	\$972,178.47
105.3	<b>Electrical Equipment Building Foundation</b>					
105.3.1	Excavation	c.y.	0.00			
105.3.2	Backfill & Compaction	c.y.	24.37			
105.3.3	Concrete	c.y.	513.43			
105.3.4	Rebar	tons	30.82			
105.3.5	Formwork	s.f.	1,672.00			
105.3.6	Embedments	tons	0.00			
105.3.7	Vapor Barrier	s.f.	7,679.75			
	<b>Electrical Equipment Building Foundation Cost</b>			\$118,827.48	\$165,526.29	\$284,353.78
105.4	<b>Stack Foundation</b>					
105.4.1	Excavation	c.y.	0.00			
105.4.2	Backfill & Compaction	c.y.	57.59			
105.4.3	Concrete	c.y.	201.60			
105.4.4	Rebar	tons	12.10			
105.4.5	Formwork	s.f.	1,365.00			
105.4.6	Embedments	tons	0.00			
105.4.7	Piles	ea	24.00			
	<b>Stack Foundation Cost</b>			\$48,729.10	\$176,152.57	\$224,881.68
105.5	<b>Selective Catalytic Reducers (SCR's) Foundation</b>					
105.5.1	Excavation	c.y.	0.00			
105.5.2	Backfill & Compaction	c.y.	556.22			
105.5.3	Concrete	c.y.	419.00			
105.5.4	Rebar	tons	25.14			
105.5.5	Formwork	s.f.	1,728.00			
105.5.6	Embedments	tons	0.00			
105.5.7	Piles	ea	36.00			
	<b>SCR Foundation Cost</b>			\$92,879.70	\$298,648.77	\$391,528.47
105.6	<b>Lube Oil Tank and Pump Foundation</b>					
105.6.1	Excavation	c.y.	0.00			
105.6.2	Backfill & Compaction	c.y.	16.41			
105.6.3	Concrete	c.y.	133.20			
105.6.4	Rebar	tons	7.78			
105.6.5	Formwork	s.f.	1,168.00			
105.6.6	Embedments	tons	0.00			
105.6.7	Water Stops	l.f.	138.50			
105.6.8	Concrete Demolition	c.y.	11.29			
	<b>Lube Oil Tank and Pump Foundation Cost</b>			\$41,050.33	\$45,552.45	\$86,602.78
105.7	<b>Cooling Water Collection Tank and Pump Foundation</b>					
105.7.1	Excavation	c.y.	0.00			
105.7.2	Backfill & Compaction	c.y.	8.00			
105.7.3	Concrete	c.y.	18.66			
105.7.4	Rebar	tons	1.87			
105.7.5	Formwork	s.f.	647.00			
105.7.6	Embedments	tons	0.00			
105.7.7	Water Stops	l.f.	60.00			
105.7.8	Grating	s.f.	0.00			
	<b>Cooling Water Collection Tank and Pump Foundation Cost</b>			\$14,337.52	\$9,401.42	\$23,738.94
105.8	<b>Exhaust Duct and Intake Air Filter Support Structure Foundation</b>					
105.8.1	Excavation	c.y.	0.00			
105.8.2	Backfill & Compaction	c.y.	14.81			
105.8.3	Concrete	c.y.	460.33			
105.8.4	Rebar	tons	55,839.56			
105.8.5	Formwork	s.f.	1,130.00			
105.8.6	Embedments	tons	0.00			
105.8.7	Piles	ea	65.00			
	<b>Exhaust Duct and Intake Air Filter Support Structure Foundation Cost</b>			\$80,808.12	\$440,083.08	\$520,891.20
105.9	<b>Radiator Foundation</b>					
105.9.1	Excavation	c.y.	0.00			
105.9.2	Backfill & Compaction	c.y.	408.63			
105.9.3	Concrete	c.y.	866.87			
105.9.4	Rebar	tons	50.60			
105.9.5	Concrete and Helix Micro Rebar (Alternative to deformed bars)	c.y.	0.00			
105.9.6	Formwork	s.f.	2,610.38			
105.9.7	Embedments	tons	0.00			
	<b>Radiator Foundation Cost</b>			\$203,343.22	\$278,515.84	\$481,859.07
105.1	<b>GSU Transformer Foundation</b>					
105.10.1	Excavation	c.y.	222.00			
105.10.2	Backfill & Compaction	c.y.	63.89			
105.10.3	Concrete	c.y.	316.64			

Adjusted in RFC 2

Adjusted in RFC 2

Adjusted in RFC 2

Item No.	Description	Unit	Unit Quantity	Lump Sum		
				Labor \$	Material \$	Total \$
105.10.4	Rebar	tons	20.22			
105.10.5	Formwork	s.f.	5,477.00			
105.10.6	Embedments	tons	0.90			
105.10.7	Piles	ea	19.00			
105.10.8	Water Stops	l.f.	143.75			
105.10.9	Grating	s.f.	920.00			
105.10.10	12" Aggregate Layer	s.f.	920.00			
	<b>GSU Transformer Foundation Cost</b>			\$152,845.03	\$267,784.29	\$420,629.32
105.11	<b>Engine Hall Ventilation Foundation</b>					
105.11.1	Excavation	c.y.	0.00			
105.11.2	Backfill & Compaction	c.y.	34.63			
105.11.3	Concrete	c.y.	86.57			
105.11.4	Rebar	tons	5.19			
105.11.5	Formwork	s.f.	818.00			
105.11.6	Embedments	tons	0.00			
	<b>Engine Hall Ventilation Foundation Cost</b>			\$25,450.19	\$29,796.37	\$55,246.56
105.12	<b>Heat Recovery Buffer Tank Foundation</b>					
105.12.1	Excavation	c.y.	0.00			
105.12.2	Backfill & Compaction	c.y.	27.96			
105.12.3	Concrete	c.y.	26.11			
105.12.4	Rebar	tons	1.78			
105.12.5	Formwork	s.f.	884.00			
105.12.6	Embedments	tons	0.00			
	<b>Heat Recovery Buffer Tank Foundation Cost</b>			\$17,332.25	\$12,001.19	\$29,333.44
105.13	<b>OWS Holddown Foundation</b>					
105.13.1	Excavation	c.y.				
105.13.2	Backfill & Compaction	c.y.				
105.13.3	Concrete	c.y.				
105.13.4	Rebar	tons				
105.13.5	Formwork	s.f.				
105.13.6	Embedments	tons				
	<b>OWS Holddown Foundation Cost</b>			\$6,345.00	\$7,155.00	\$13,500.00
105.14	<b>Natural Gas Pressure Reducing Skid Foundation</b>					
105.14.1	Excavation	c.y.	0.00			
105.14.2	Backfill & Compaction	c.y.	9.63			
105.14.3	Concrete	c.y.	50.92			
105.14.4	Rebar	tons	1.56			
105.14.5	Formwork	s.f.	321.00			
105.14.6	Embedments	tons	0.00			
	<b>Natural Gas Pressure Reducing Skid Foundation Cost</b>			\$15,044.23	\$17,561.16	\$32,605.39
105.15	<b>Misc Foundation</b>					
105.15.1	Excavation	c.y.				
105.15.2	Backfill & Compaction	c.y.				
105.15.3	Concrete	c.y.				
105.15.4	Rebar	tons				
105.15.5	Formwork	s.f.				
105.15.6	Embedments	tons	3.35			
	<b>Miscellaneous Foundation Cost</b>			\$19,404.47	\$13,400.00	\$32,804.47
105.16	<b>Misc Items</b>					
105.16.1	Premolded Joint Filler	s.f.	840.00			
105.16.2	Piling Testing	lsum	1.00			
105.16.3	Additional Items Required By Contractor Not Called Out Above (List Below):					
105.16.3a	(add if required)	ea	1,024.00			
105.16.3b		c.y.	419.60			
105.16.3c		c.f.	88.60			
105.16.3d	Water Stops	l.f.	74.20			
105.16.3e	Minor Structures (<50 Ton) - Erect Steel Light (10-19 lb./LF)	tons	3.00			
105.16.3f	Embedments	tons	3.65			
	<b>Miscellaneous Cost</b>			\$190,346.64	\$158,366.57	\$348,713.21
105.17	<b>Concrete Ductbanks</b>					
105.17.1	Excavation	c.y.	5,000.00			
105.17.2	Backfill & Compaction	c.y.	3,600.00			
105.17.3	Concrete	c.y.	1,045.84			
105.17.4	Rebar	tons	13.75			
105.17.5	Formwork	s.f.	12,002.00			
	<b>Concrete Ductbank Cost</b>			\$309,217.42	\$225,136.29	\$534,353.71
	<b>105 Foundation Total:</b>					<b>\$6,160,496.34</b>
<b>100</b>	<b>CIVIL/STRUCTURAL TOTAL:</b>					<b>\$7,815,520.43</b>

Added in RFC 1

Adjusted in RFC 2

Adjusted in RFC 2

**Notes:**

- Note 100-1: The Bidder shall calculate the material quantity based on the design drawings.
- Note 100-2: Cost of incidental materials required for erections shall be included in the labor cost.
- Note 100-3: Reinforcement pricing shall include the supply and installation of deformed uncoated bars in accordance with ASTM A615, Grade 60 (U.N.) including reinforcement standees/chairs designed by the Contractor.
- Note 100-4: Concrete pricing shall include mud mats (if Contractor prefers), placement, finishing, curing, etc.

**MECHANICAL PRICING FORM**

**Bidder:** Casey Industrial

Item No.	Description	Lump Sum		
		Labor \$	Material \$	Total \$
<b>201</b>	<b>Fuel Gas System</b>			
201	<u>Piping:</u>			
201.1.1	12" sch 40 carbon steel (coated) and appurtenances	\$89,025.87	\$60,966.15	\$149,992.02
201.1.2	6" sch 40 carbon steel (coated) and appurtenances	\$106,527.22	\$38,092.83	\$144,620.05
201.2	<u>Other (Contractor to specify):</u>	\$0.00	\$0.00	\$0.00
	<b>201 Fuel Gas System Total:</b>			<b>\$294,612.07</b>
<b>202</b>	<b>Potable/Service/Demin Water System</b>			
202	<u>Piping:</u>			
202.1.1	2" HDPE SDR 11 and appurtenances	\$41,273.03	\$4,646.40	\$45,919.43
202.3	<u>Other (Contractor to specify):</u>	\$0.00	\$0.00	\$0.00
	<b>202 Potable/Service/Demin Water System Total:</b>			<b>\$45,919.43</b>
<b>203</b>	<b>Vaporized Anhydrous Ammonia</b>			
203	<u>Piping:</u>			
203.1.1	2" sch 80 carbon steel (coated) and appurtenances	\$60,537.10	\$18,889.35	\$79,426.45
203	<u>Other (Contractor to specify):</u>	\$0.00	\$0.00	\$0.00
	<b>203 Vaporized Ammonia Total:</b>			<b>\$79,426.45</b>
<b>204</b>	<b>Sanitary Drain System</b>			
204	<u>Piping:</u>			
204.1.1	4" CPVC and appurtenances	\$0.00	\$0.00	\$0.00
204.1.2	3" CPVC and appurtenances	\$13,891.54	\$1,461.92	\$15,353.46
204.1.3	2" CPVC and appurtenances	\$455.24	\$170.40	\$625.64
204.1.4	1 1/2" CPVC and appurtenances	\$1,775.30	\$516.60	\$2,291.90
204.1.5	3" HDPE SDR 11 and appurtenances	\$0.00	\$0.00	\$0.00
204.2	<u>Equipment / Accessories:</u>			
204.2.1	Floor Drains	\$1,766.00	\$0.00	\$1,766.00
204.2.2	Cleanouts	\$1,766.00	\$0.00	\$1,766.00
204.3	<u>Other (Contractor to specify):</u>	\$0.00	\$0.00	\$0.00
	<b>204 Sanitary Drain System Total:</b>			<b>\$21,803.00</b>
<b>205</b>	<b>Equipment Drains System</b>			
205	<u>Piping:</u>			
205.1.1	6" CISP and appurtenances	\$0.00	\$0.00	\$0.00
205.2	4" CISP and appurtenances	\$0.00	\$0.00	\$0.00
205.2.1	4" HDPE SDR 11 and appurtenances	\$34,880.75	\$5,255.69	\$40,136.44
205.2.2	<u>Other (Contractor to specify):</u>	\$0.00	\$0.00	\$0.00
	<b>205 Equipment Drains System Total:</b>			<b>\$40,136.44</b>
<b>206</b>	<b>Fire Protection System</b>			
206.1	<u>Piping:</u>			
206.1.1	8" HDPE SDR 9 and appurtenances	\$53,637.48	\$21,695.37	\$75,332.85
206.1.2	6" Ductile Iron and appurtenances	\$50,767.69	\$45,080.78	\$95,848.47
206.1.2	Hydrant relocations	\$5,637.71	\$0.00	\$5,637.71
206.1.2	Tie-ins to existing fire water loop	\$8,369.21	\$0.00	\$8,369.21
206.2	<u>Valves &amp; Accessories:</u>			
206.2.1	6" Hydrant isolation valve with roadway box	\$0.00	\$0.00	\$0.00
206.2.2	Hydrants	\$45,453.13	\$49,772.92	\$95,226.05
206.3	<u>Other (Contractor to specify):</u>	\$0.00	\$0.00	\$0.00
	<b>206 Fire Protection System Total:</b>			<b>\$280,414.29</b>
<b>207</b>	<b>Lube Oil</b>			
207.1	<u>Piping:</u>			
207.1.1	2" Double Wall CS Pipe and appurtenances	\$332,313.80	\$212,975.20	\$545,289.00

Item No. 200	Description	Lump Sum		
		Labor \$	Material \$	Total \$
207.2	Other (Contractor to specify):	\$0.00	\$0.00	\$0.00
		\$0.00	\$0.00	\$0.00
	<b>207 Lube Oil System Total:</b>			<b>\$545,289.00</b>
<b>208</b>	<b>Instrument Air</b>			
208.1	Piping:			
208.1.1	2" HDPE SDR 11	\$22,679.18	\$2,473.91	\$25,153.09
208.2	Other (Contractor to specify):	\$0.00	\$0.00	\$0.00
		\$0.00	\$0.00	\$0.00
	<b>208 Instrument Air System Total:</b>			<b>\$25,153.09</b>
<b>200</b>	<b><u>MECHANICAL TOTAL:</u></b>			<b>\$1,332,753.77</b>

**Notes:**

Note 200-1: The Bidder shall calculate the material quantity based on the design drawings.

**ELECTRICAL PRICING FORM**

**Bidder:** Casey Industrial

Item No.	Description	Unit	Unit Quantity	Lump Sum		
				Labor \$	Material \$	Total \$
<b>300</b>						
<b>301</b>	<b>Grounding</b>					
301.1	1/C #4/0 AWG bare Class B stranded copper conductor	l.f.	12000	\$64,342.04	\$54,377.87	\$118,719.91
301.2	1/C #4/0 AWG insulated Class B stranded copper conductor	l.f.	0	\$0.00	\$0.00	\$0.00
301.3	1/C 500 kcmil bare Class B stranded copper conductor	l.f.	2500	\$6,459.04	\$30,000.00	\$36,459.04
301.4	3/4" diameter 10 foot copper clad steel ground rods	each	87	\$8,226.23	\$2,573.36	\$10,799.59
301.5	Embedded ground plates	each	59	\$3,746.24	\$5,276.00	\$9,022.24
301.6	Exothermic welds	each	0	\$0.00	\$0.00	\$0.00
301.7	Compression type connectors	each	711	\$34,227.74	\$11,935.24	\$46,162.98
301.8	Ground test point well	each	1	\$723.41	\$450.00	\$1,173.41
	<b>301 Grounding Total:</b>					<b>\$222,337.18</b>
<b>302</b>	<b>Cathodic Protection</b>					
302.1	Materials including anodes, rectifiers, test stations, etc.	lsum		\$0.00	\$108,059.38	\$108,059.38
302.2	Engineering, field testing, drawings	lsum		\$187,596.20	\$0.00	\$187,596.20
	<b>302 Cathodic Protection Total:</b>					<b>\$295,655.58</b>
<b>303</b>	<b>Underground Raceway</b>					
303.1	2" PVC Conduit	l.f.	2100	\$30,442.81	\$12,873.11	\$43,315.92
303.2	3" PVC Conduit	l.f.	6200	\$85,218.01	\$78,508.14	\$163,726.15
303.3	4" PVC Conduit	l.f.	4100	\$59,066.63	\$68,746.58	\$127,813.21
303.4	5" PVC Conduit	l.f.	1700	\$25,128.25	\$35,611.00	\$60,739.25
304.1	6" PVC Conduit	l.f.	5600	\$92,193.75	\$173,979.80	\$266,173.55
303.5	2" AL Conduit	l.f.	840	\$3,935.36	\$10,416.00	\$14,351.36
303.6	2" AL Elbows	each	168	\$20,487.04	\$51,609.60	\$72,096.64
303.7	3" AL Conduit	l.f.	700	\$1,361.05	\$4,599.77	\$5,960.82
305.1	3" AL Elbows	each	51	\$24,877.12	\$7,232.82	\$32,109.94
303.8	4" AL Conduit	l.f.	120	\$1,457.16	\$2,880.00	\$4,337.16
303.9	4" AL Elbows	each	36	\$24,089.63	\$6,095.52	\$30,185.15
303.10	5" AL Conduit	l.f.	30	\$438.18	\$1,960.00	\$2,398.18
306.1	5" AL Elbows	each	8	\$6,576.85	\$3,394.48	\$9,971.33
303.11	6" AL Conduit	l.f.	80	\$1,885.01	\$4,823.20	\$6,708.21
303.12	6" AL Elbows	each	78	\$77,300.75	\$29,402.10	\$106,702.85
	<b>303 Underground Raceway Total:</b>					<b>\$946,589.72</b>
<b>300</b>	<b>ELECTRICAL TOTAL:</b>					<b>\$1,464,582.47</b>

**Notes:**

**300-1:** The Bidder shall determine the material quantities based on the design drawings.

**300-2:** Pricing shall include all accessories, fittings and hardware required for a complete installation.

**300-3:** The intent of this pricing page is to capture the complete electrical scope of work. Bidder shall add any items not included in the above listing as required.





UNIT PRICE PRICING FORM

Bidder: Casey Industrial

Item No.	Description	Unit	Labor		
			Labor Adds (Cost Less Material) \$	Labor Deducts (Cost Less Material) \$	Material \$
	FIRM UNIT PRICES on which Contractor agrees to make changes in the Work, authorized by the Owner. The following Unit Prices cover work as designated by the Owner and shall apply to the net amount of work that may be added or deducted from that called for in Project Specification M-8537. Without limitation, it is understood that each Unit Price is firm, and includes all activities, preparation of shop drawings, support, overhead, profit, etc., required by Bidder to complete the indicated Work item, and is not subject to adjustment due to changes in costs of labor or materials.				
<b>501</b>	<b>Sitework</b>				
501.1	<b>Erosion Protection</b>	ls			
501.1.1	Silt fence with line posts	lf.	\$5.00	\$3.75	\$4.00
501.1.2	Straw bales with anchorage rods	ea.	\$20.00	\$15.00	\$40.00
501.1.3	Storm water structure inlet protection	ea.	\$1,000.00	\$750.00	\$1,500.00
501.2	<b>Earthwork</b>				
501.2.1	Topsoil Stripping and Stock Piling	c.y.	\$7.60	\$5.70	\$0.00
501.2.2	Excavation	c.y.	\$9.60	\$7.20	\$0.00
501.2.3	Disposal of unsuitable material	c.y.	\$11.20	\$8.40	\$0.00
501.2.4	Imported fill from offsite	c.y.	\$47.50	\$35.63	\$0.00
<b>502</b>	<b>Civil Yard Piping</b>				
502.1	<b>Sanitary Piping</b> (pricing includes supply and installation of pipe, connections, testing, etc.)				
502.1.1	1-1/2" diameter CPVC Gravity Pipe	lf.	\$13.00	\$9.75	\$5.00
502.1.1	2" diameter CPVC Gravity Pipe	lf.	\$13.00	\$9.75	\$5.00
502.1.1	3" diameter CPVC Gravity Pipe	lf.	\$15.05	\$11.29	\$6.65
502.1.1	4" diameter CPVC Gravity Pipe	lf.	\$15.03	\$11.27	\$6.65
502.1.2	3" diameter HDPE Forced Main	lf.	\$0.00	\$0.00	\$0.00
502.2	<b>Precast Concrete Sanitary Sewer Manhole</b> (with cast iron frame and cover, flexible water tight connections.) (price includes supply and installation of manhole)				
502.2.1	48" inside diameter	ea	\$5,000.00	\$3,750.00	\$5,000.00
502.3	<b>Sanitary Lift Station</b> (pricing includes installation of lift station including all required accessories, conc. hold down slab, etc.) ( <b>Underground 6ft diameter packaged sanitary wet well lift station with steel sump and valve box</b> )				
502.4	<b>Oily Piping</b> (pricing includes supply and installation of pipe, connections, testing, etc.)				
502.4.1	4" diameter CISP	lf	\$60.00	\$45.00	\$60.00
502.4.2	6" diameter CISP	lf	\$70.00	\$52.50	\$64.29
502.4.3	4" diameter HDPE forcemain	lf	\$15.03	\$11.27	\$12.00
502.5	<b>Precast Concrete Oily Sewer Manhole</b> (with cast iron frame and cover and vents) (price includes supply and installation of manhole, etc.)				
502.5.1	48" inside diameter (includes flexible water tight connections)	ea	\$5,000.00	\$3,750.00	\$5,000.00
502.6	<b>Oil Water Separator</b> (pricing includes supply and installation of oil water separator including all required accessories, conc. hold down slab, etc.)				
502.7	<b>CHDPE Pipe</b> (pricing includes supply and installation of pipe, connections, testing, etc.)				
502.7.2	8" diameter CHDPE pipe	lf	\$35.19	\$26.39	\$24.06
502.7.3	12" diameter CHDPE pipe	lf	\$49.64	\$37.23	\$42.39
502.7.4	15" diameter CHDPE pipe	lf	\$72.00	\$54.00	\$69.47
502.7.5	18" diameter CHDPE pipe	lf	\$97.70	\$73.28	\$81.43
502.7.6	24" diameter CHDPE pipe	lf	\$116.13	\$87.10	\$122.10
502.8	<b>Precast Concrete Structures</b> (with cast iron frame and cover) (price includes supply and installation of lid, etc.)				
502.8.1	48" inside diameter	ea	\$5,000.00	\$3,750.00	\$5,000.00
502.8.2	30" x 30" inside dimensions	ea	\$5,000.00	\$3,750.00	\$5,000.00
502.9	<b>Culverts</b> (pricing includes supply and installation of culverts, including excavation, backfill, compaction, flared end sections, riprap protection, etc.)				
502.9.1	5'W x 2'H Box Culvert	lf	\$367.90	\$275.93	\$567.60
502.10	<b>Excavation, Bedding, Backfill</b>				
502.10.1	Excavation (price includes excavation, disposal, protection, sheeting, shoring, dewatering, etc.)	c.y.	\$9.50	\$7.13	\$4.00
502.10.2	Bedding Material (includes compaction)	c.y.	\$19.50	\$14.63	\$32.35
502.10.3	Backfill Materials (includes compaction)	c.y.	\$19.50	\$14.63	\$0.00
<b>503</b>	<b>Site Road</b> (pricing includes supply and installation of road components)				
503.1	8" Thick Crushed Stone Base Course	c.y.	\$73.50	\$55.13	\$61.55
503.2	8 OZ / SY Geotextile	s.y.	\$5.40	\$4.05	\$1.60
503.3	Subgrade Preparation (minimum 12" depth)	s.y.	\$19.50	\$14.63	\$32.35
<b>504</b>	<b>Miscellaneous Roadwork and Surfacing Items</b> (pricing includes supply and installation of the following items)				
504.1	6" Thick Crushed Stone Ground Cover Surfacing (includes geotextile)	sy	\$73.50	\$55.13	\$61.55
504.2	4" Seeded Topsoil	sy	\$0.21	\$0.16	\$0.10
<b>505</b>	<b>Foundations</b>				
505.1	Additional precast prestressed pile	ea	\$2,226.92	\$1,808.30	\$2,402.23
505.2	Additional length of pile	l.f.	\$34.26	\$27.82	\$36.96
505.3	Reduction in length of pile	l.f.	\$34.26	\$27.82	\$0.00
505.4	Additional concrete foundation (including deformed rebar, formwork, excavation, and backfilling)	c.y.	\$426.10	\$346.00	\$387.92
505.6	Additional concrete foundation (including Helix micro rebar at 9 lbs/c.y., formwork, excavation, and backfilling)	c.y.	\$426.10	\$346.00	\$326.35

Item No.	Description	Unit	Labor		
			Labor Adds (Cost Less Material) \$	Labor Deducts (Cost Less Material) \$	Material \$
<b>506</b>	<b>Mechanical Piping</b> (pricing includes supply and installation of the following items)				
506.1	<b><u>Carbon Steel - Epoxy Coated</u></b>				
506.1.1	1/2" pipe	l.f.	\$42.00	\$31.50	\$4.65
506.1.2	1/2" - 90° elbows	ea	\$1,500.00	\$1,125.00	\$6.26
506.1.3	1/2" - 45° elbows	ea	\$1,500.00	\$1,125.00	\$6.58
506.1.4	3/4" pipe	l.f.	\$42.00	\$31.50	\$6.18
506.1.5	3/4" - 90° elbows	ea	\$1,500.00	\$1,125.00	\$17.12
506.1.6	3/4" - 45° elbows	ea	\$1,500.00	\$1,125.00	\$6.58
506.1.7	1" pipe	l.f.	\$42.00	\$31.50	\$8.62
506.1.8	1" - 90° elbows	ea	\$1,500.00	\$1,125.00	\$3.62
506.1.9	1" - 45° elbows	ea	\$1,500.00	\$1,125.00	\$6.58
506.1.10	1-1/2" pipe	l.f.	\$1,500.00	\$1,125.00	\$13.96
506.1.11	1-1/2" - 90° elbows	ea	\$1,500.00	\$1,125.00	\$8.11
506.1.12	1-1/2" - 45° elbows	ea	\$750.00	\$562.50	\$6.58
506.1.13	2" pipe	l.f.	\$48.00	\$36.00	\$14.17
506.1.14	2" - 90° elbows	ea	\$1,500.00	\$1,125.00	\$12.80
506.1.15	2" - 45° elbows	ea	\$1,500.00	\$1,125.00	\$8.45
506.1.16	2" - 300# RF Flange	ea	\$750.00	\$562.50	\$29.49
506.1.17	2-1/2" pipe	l.f.	\$48.00	\$36.00	\$24.65
506.1.18	2-1/2" - 90° elbows	ea	\$1,500.00	\$1,125.00	\$8.28
506.1.19	2-1/2" - 45° elbows	ea	\$1,500.00	\$1,125.00	\$7.95
506.1.20	2-1/2" - 300# RF Flange	ea	\$750.00	\$562.50	\$33.66
506.1.21	3" pipe	l.f.	\$53.65	\$40.24	\$30.66
506.1.22	3" - 90° elbows	ea	\$1,500.00	\$1,125.00	\$18.88
506.1.23	3" - 45° elbows	ea	\$1,500.00	\$1,125.00	\$10.70
506.1.24	3" - 300# RF Flange	ea	\$750.00	\$562.50	\$33.66
506.1.25	4" pipe	l.f.	\$55.33	\$41.50	\$42.05
506.1.26	4" - 90° elbows	ea	\$1,780.00	\$1,335.00	\$32.65
506.1.27	4" - 45° elbows	ea	\$1,780.00	\$1,335.00	\$20.70
506.1.28	4" - 600# RF Flange	ea	\$890.00	\$667.50	\$85.11
506.1.29	6" pipe	l.f.	\$61.09	\$45.82	\$72.31
506.1.30	6" - 90° elbows	ea	\$2,020.00	\$1,515.00	\$71.32
506.1.31	6" - 45° elbows	ea	\$2,020.00	\$1,515.00	\$39.12
506.1.32	6" - 600# RF Flange	ea	\$1,010.00	\$757.50	\$166.35
506.1.33	8" pipe	l.f.	\$68.05	\$51.04	\$108.83
506.1.34	8" - 90° elbows	ea	\$2,500.00	\$1,875.00	\$126.74
506.1.35	8" - 45° elbows	ea	\$2,500.00	\$1,875.00	\$63.05
506.1.36	8" - 600# RF Flange	ea	\$1,250.00	\$937.50	\$321.22
506.1.37	10" pipe	l.f.	\$69.01	\$51.76	\$154.30
506.1.38	10" - 90° elbows	ea	\$3,080.00	\$2,310.00	\$256.35
506.1.39	10" - 45° elbows	ea	\$3,080.00	\$2,310.00	\$130.12
506.1.40	10" - 600# RF Flange	ea	\$1,540.00	\$1,155.00	\$449.79
506.1.41	12" pipe	l.f.	\$80.53	\$60.40	\$196.38
506.1.42	12" - 90° elbows	ea	\$3,560.00	\$2,670.00	\$379.68
506.1.43	12" - 45° elbows	ea	\$3,560.00	\$2,670.00	\$178.02
506.1.44	12" - 600# RF Flange	ea	\$1,780.00	\$1,335.00	\$1,012.86
506.2	<b><u>Carbon Steel - Double Wall, FRP Wrapped</u></b>				
506.2.1	2"/6" Pipe	l.f.	\$278.00	\$208.50	\$141.45
506.2.2	2"/6" - 90° elbows	ea	\$4,648.85	\$3,486.64	\$1,777.19
506.2.3	2"/6" - 45° elbows	ea	\$4,648.85	\$3,486.64	\$1,777.19
506.2.4	2"/6" UG U-loop drain assembly	ea	\$2,000.00	\$1,500.00	\$500.00
506.2.5	2"/6" Test Port assembly	ea	\$4,000.00	\$3,000.00	\$2,466.00
506.2.6	2" - 150# RF Flange	ea	\$2,325.00	\$1,743.75	\$500.00
506.3	<b><u>Ductile Iron - Cement Mortar Lined</u></b>				
506.3.1	6" pipe	l.f.	\$158.76	\$119.07	\$62.60
506.3.2	6" - 90° elbows	ea	\$10,280.00	\$7,710.00	\$8,636.50
506.3.3	6" - 45° elbows	ea	\$10,280.00	\$7,710.00	\$8,635.50
506.3.4	8" pipe	l.f.	\$200.00	\$150.00	\$80.00
506.3.5	8" - 90° elbows	ea	\$12,500.00	\$9,375.00	\$10,000.00
506.3.6	8" - 45° elbows	ea	\$12,500.00	\$9,375.00	\$10,000.00
506.3.7	10" pipe	l.f.	\$250.00	\$187.50	\$125.00
506.3.8	10" - 90° elbows	ea	\$15,000.00	\$11,250.00	\$15,000.00
506.3.9	10" - 45° elbows	ea	\$15,000.00	\$11,250.00	\$15,000.00
506.4	<b><u>HDPE SDR 9</u></b>				
506.4.1	6" pipe	l.f.	\$31.52	\$23.64	\$11.99
506.4.2	6" - 90° elbows	ea	\$750.00	\$562.50	\$49.23
506.4.3	6" - 45° elbows	ea	\$750.00	\$562.50	\$49.23
506.4.4	6" Flange adapter with backup ring	ea	\$250.00	\$187.50	\$55.86
506.4.5	8" pipe	l.f.	\$35.36	\$26.52	\$20.34
506.4.6	8" - 90° elbows	ea	\$900.00	\$675.00	\$134.57
506.4.7	8" - 45° elbows	ea	\$900.00	\$675.00	\$134.57
506.4.8	8" Flange adapter with backup ring	ea	\$250.00	\$187.50	\$102.63
506.4.9	10" pipe	l.f.	\$31.42	\$23.57	\$31.60
506.4.10	10" - 90° elbows	ea	\$1,000.00	\$750.00	\$299.00
506.4.11	10" - 45° elbows	ea	\$1,000.00	\$750.00	\$299.00
506.4.12	10" Flange adapter with backup ring	ea	\$400.00	\$300.00	\$170.32
506.5	<b><u>HDPE SDR 11</u></b>				

Item No.	Description	Unit	Labor		
			Labor Adds (Cost Less Material) \$	Labor Deducts (Cost Less Material) \$	Material \$
506.5.1	2" pipe	l.f.	\$25.00	\$18.75	\$1.55
506.5.2	2" - 90° elbows	ea	\$500.00	\$375.00	\$4.82
506.5.3	2" - 45° elbows	ea	\$500.00	\$375.00	\$4.82
506.5.4	2" Flange adapter with backup ring	ea	\$250.00	\$187.50	\$19.29
506.5.5	3" pipe	l.f.	\$27.00	\$20.25	\$2.81
506.5.6	3" - 90° elbows	ea	\$500.00	\$375.00	\$13.23
506.5.7	3" - 45° elbows	ea	\$500.00	\$375.00	\$13.23
506.5.8	3" Flange adapter with backup ring	ea	\$250.00	\$187.50	\$30.97
506.5.9	4" pipe	l.f.	\$29.60	\$22.20	\$5.06
506.5.10	4" - 90° elbows	ea	\$600.00	\$450.00	\$16.32
506.5.11	4" - 45° elbows	ea	\$600.00	\$450.00	\$16.32
506.5.12	4" Flange adapter with backup ring	ea	\$300.00	\$225.00	\$41.12
506.5.13	6" pipe	l.f.	\$31.52	\$23.64	\$10.06
506.5.14	6" - 90° elbows	ea	\$750.00	\$562.50	\$36.51
506.5.15	6" - 45° elbows	ea	\$750.00	\$562.50	\$36.51
506.5.16	6" Flange adapter with backup ring	ea	\$400.00	\$300.00	\$47.58
<b>507</b>	<b>Electrical</b> (pricing includes supply and installation of the following items)				
507.1	<b>Grounding</b>				
507.1.1	1/C #4/0 AWG bare Class B stranded copper conductor	l.f.	\$6.60	\$5.36	\$5.58
507.1.2	1/C #4/0 AWG insulated Class B stranded copper conductor	l.f.	\$0.00	\$0.00	\$0.00
507.1.3	1/C 500 kcmil bare Class B stranded copper conductor	l.f.	\$3.18	\$2.58	\$14.78
507.1.4	3/4" diameter 10 foot copper clad steel ground rods	ea	\$116.44	\$94.55	\$36.43
507.1.5	Embedded ground plates	ea	\$78.19	\$63.50	\$110.13
507.1.6	Exothermic welds	ea	\$0.00	\$0.00	\$0.00
507.1.7	Compression type connectors	ea	\$59.28	\$48.14	\$20.67
507.1.8	Ground test point well	ea	\$890.88	\$723.41	\$554.18
507.2	<b>PVC Conduit</b>				
507.2.1	2"	l.f.	\$17.85	\$14.50	\$7.55
507.2.2	3"	l.f.	\$16.93	\$13.74	\$15.59
507.2.3	4"	l.f.	\$17.74	\$14.41	\$20.65
507.2.4	5"	l.f.	\$18.20	\$14.78	\$25.80
507.2.5	6"	l.f.	\$20.27	\$16.46	\$38.26
507.3	<b>Aluminum Conduit</b>				
507.3.1	2"	l.f.	\$5.77	\$4.68	\$15.27
507.3.2	3"	l.f.	\$2.39	\$1.94	\$8.09
507.3.3	4"	l.f.	\$14.95	\$12.14	\$29.56
507.3.4	5"	l.f.	\$17.99	\$14.61	\$80.46
507.3.5	6"	l.f.	\$29.02	\$23.56	\$74.25
507.4	<b>Aluminum Elbows - 90 degree</b>				
507.4.1	2"	ea	\$150.18	\$121.95	\$378.32
507.4.2	3"	ea	\$600.71	\$487.79	\$174.65
507.4.3	4"	ea	\$824.07	\$669.16	\$208.52
507.4.4	5"	ea	\$1,012.42	\$822.11	\$522.54
507.4.5	6"	ea	\$1,220.46	\$991.04	\$464.21
<b>Notes:</b>					
<b>Unit Pricing:</b> Does not include the cost of construction rental equipment.					
<b>Unit Pricing:</b> Small tools under \$1,000.00					
<b>Unit Pricing:</b> Material Deduct pricing does not include restocking fees					
<b>Unit Pricing:</b> Material deducts apply to volumes greater than 10% of the total amount					



**ATTACHMENT 3**  
**GEOTECHNICAL REPORT**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>REPORT NO.</b>	<b>DATE</b>	<b>TITLE</b>
21693	1.14.2022	Geotechnical Investigation and Document Submittal



**ATTACHMENT 4**  
**CIVIL STRUCTURAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-0500-2001	0	Structural Concrete General Notes
30-0500-2002	1	Standard Prestress Precast Concrete Driven Pile Schedule, Details, and Notes
30-0500-2003	0	Standard Mat Foundation Details - Sheet 1
30-0500-2004	0	Standard Mat Foundation Details - Sheet 2
30-0500-2005	0	Standard Concrete Miscellaneous Details
30-0500-2006	0	Standard Concrete Edge Details
30-0500-2007	0	Standard Equipment Anchor Rod Details
30-0500-2008	0	Standard Electrical Manhole Details - Sheet 1
30-0500-2009	0	Standard Electrical Manhole Details - Sheet 2
30-0500-2010	0	Standard Concrete Ductbank Details
30-0500-2050	A	Engine Hall Building Pile Location Plan
30-0500-2051	A	Engine Hall Building Pile Schedule
30-0500-2052	A	Exhaust Duct Support Structure Pile Location Plan and Schedule
30-0500-2053	A	SCR Pile Location Plan and Schedule
30-0500-2054	A	Exhaust Stack Pile Location Plan and Schedule
30-0500-2055	A	Generator Step-Up Transformer Pile Location Plan and Schedule
30-0500-2100	A	Engine Hall Building Foundation Key Plan
30-0500-2101	1	Engine Generator Foundation Location Plan, Sections & Details
30-0500-2102	A	Engine Hall Building Foundation Plan
30-0500-2103	A	Engine Hall Building Foundation Plan
30-0500-2104	B	Engine Hall Building Foundation Plan
30-0500-2105	A	Engine Hall Building Foundation Plan
30-0500-2106	A	Engine Hall Building Foundation Sections and Details
30-0500-2107	A	Engine Hall Building Foundation Sections and Details
30-0500-2108	A	Engine Hall Building Anchor Rod Schedule and Details
30-0500-2110	B	Electrical/Control Building Foundation Plan, Sections and Details



**ATTACHMENT 4**  
**CIVIL STRUCTURAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-0500-2113	B	Exhaust Duct Support Structure Foundation Plan, Sections & Details
30-0500-2114	A	SCR Foundation Plan, Sections & Details
30-0500-2115	1	Exhaust Stack Foundation Plan, Sections & Details
30-0500-2116	A	Generator Step-Up Transformer Foundation Plan
30-0500-2117	A	Generator Step-Up Transformer Sections and Details
30-0500-2118	B	Radiator Foundation Plan, Sections & Details
30-0500-2119	A	Air Handling Unit Foundation Plan, Sections and Details
30-0500-2120	A	Heat Recovery Tank Foundation Plan, Sections & Details
30-0500-2121	0	Cooling Water Collection Tank Foundation Plan, Sections & Details
30-0500-2122	B	Natural Gas Skid Foundation Plan, Sections & Details
30-0500-2123	A	Lube Oil Tank Foundation Plan, Sections & Details
30-0500-2211	A	Generator Step-Up Transformer Steel Framing Plan, Sections & Details
30-0500-3001	D	Civil Title Sheet, Vicinity Map and Drawing List
30-0500-3002	D	Civil General Notes, Legend, Symbols, and Abbreviations Sheet 1
30-0500-3003	D	Civil General Notes, Legend, Symbols, and Abbreviations Sheet 2
30-0500-3004	D	Site Topography and Benchmark Plan
30-0500-3006	D	Pre-Development Drainage Plan
30-0500-3007	D	Post-Development Drainage Plan
30-0500-3008	D	Temporary Erosion and Sediment Control Plan
30-0500-3009	D	Temporary Erosion and Sediment Control Details
30-0500-3010	D	Initial Grading and Drainage Plan – Sheet 1
30-0500-3011	D	Initial Grading and Drainage Plan – Sheet 2
30-0500-3012	D	Initial Grading and Drainage Details
30-0500-3013	D	Final Grading and Drainage Plan – Sheet 1
30-0500-3016	D	Initial Grading and Drainage Details



**ATTACHMENT 4**  
**CIVIL STRUCTURAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-0500-3017	B	Oily Water and Sanitary Piping Plan
30-0500-3018	B	Oily Water and Sanitary Details
30-0500-3019	B	Oil Water Separator Tank Details
30-0500-3020	B	Sanitary Lift Station Details
30-0500-3021	D	Stormwater Piping Plan
30-0500-3022	D	Stormwater Catch Basin and Manhole Details
30-0500-3025	C	Project Area Definition
30-0500-3027	A	Trench Location Plan
D-20-1900-3002	A	Tank Containment Plan, Sections and Details





**ATTACHMENT 5**  
**MECHANICAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-0000-4001	C	GENERAL ARRANGEMENT OVERALL SITE TIE POINTS
30-0000-4002	C	GENERAL ARRANGEMENT PLOT PLAN
30-0000-4003	C	GENERAL ARRANGEMENT POWER BLOCK
30-0000-4004	B	GENERAL ARRANGMENT ELEVATION VIEW
30-0000-4005	B	GENERAL ARRANGEMENT ELEVATION VIEW
30-0000-4008	A	GENERAL PIPING NOTES AND DETAILS
30-0000-4009	A	GENERAL PIPING NOTES AND DETAILS
30-0000-4010	A	GENERAL PIPING NOTES AND DETAILS
30-0000-4011	A	GENERAL PIPING NOTES AND DETAILS
30-0000-4012	A	GENERAL PIPING NOTES AND DETAILS
30-0000-4013	A	EQUIPMENT LOCATION HEAT RECOVERY THERMAL BUFFER TANK AREA
30-0000-4014	A	EQUIPMENT LOCATION ENGINE HALL AIR EQUIPMENT AREA
30-0000-4015	A	EQUIPMENT LOCATION LUBE OIL EQUIPMENT EXISTING DIESEL FUEL OIL AREA
30-0000-4016	A	EQUIPMENT LOCATION COOLING WATER REPLENISHING PUMP MODULE AND COOLING WATER COLLECTING TANK
30-0000-4017	A	EQUIPMENT LOCATION NATURAL GAS PRESSURE REDUCING AND CONDITIONING EQUIPMENT
30-0000-4018	A	EQUIPMENT LOCATION RADIATOR
30-0000-4019	A	EQUIPMENT LOCATION EMERGENCY DIESEL GENERATOR
30-0000-5001	B	PIPING AND INSTRUMENTATION DIAGRAM LEGENDS AND SYMBOLS
30-0000-5002	B	PIPING AND INSTRUMENTATION DIAGRAM LEGENDS AND SYMBOLS
30-0000-5003	B	PIPING AND INSTRUMENTATION DIAGRAM LEGENDS AND SYMBOLS
30-0001-4004	B	LINE LIST
30-0001-4005	B	VALVE LIST



**ATTACHMENT 5**  
**MECHANICAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-0001-4006	A	EQUIPMENT LIST
30-0903-5001	0	PIPING AND INSTRUMENTATION DIAGRAM SANITARY DRAINS
30-0903-5002	A	GENERAL NOTES AND DETAILS SANITARY SYSTEM
30-0903-5003	A	UNDERGROUND PIPING COMPOSITE SANITARY DRAINS
30-0903-5004	A	ISOMETRIC VIEW SANITARY SYSTEM
30-0906-5001	1	PIPING AND INSTRUMENTATION DIAGRAM OILY WATER DRAINS
30-1001-5001	0	PIPING AND INSTRUMENTATION DIAGRAM DEMINERALIZED WATER SYSTEM
30-1003-5001	0	PIPING AND INSTRUMENTATION DIAGRAM POTABLE WATER
30-1004-5001	0	PIPING AND INSTRUMENTATION DIAGRAM SERVICE WATER
30-1012-5001	0	PIPING AND INSTRUMENTATION DIAGRAM FIRE PROTECTION SYSTEM
30-1407-5001	0	PIPING AND INSTRUMENTATION DIAGRAM ANHYDROUS AMMONIA
30-1503-5002	D	PIPING AND INSTRUMENTATION DIAGRAM INSTRUMENT AIR SYSTEM
30-2002-5001	0	PIPING AND INSTRUMENTATION DIAGRAM FUEL GAS SUPPLY
30-2400-5001	0	UNDERGROUND PIPING COMPOSITE SITE KEY PLAN
30-2400-5002	0	UNDERGROUND PIPING COMPOSITE SITE KEY PLAN
30-2400-5003	0	UNDERGROUND PIPING COMPOSITE PLAN 01
30-2400-5004	0	UNDERGROUND PIPING COMPOSITE PLAN 02
30-2400-5005	0	UNDERGROUND PIPING COMPOSITE PLAN 03
30-2400-5006	0	UNDERGROUND PIPING COMPOSITE PLAN 04
30-2400-5007	0	UNDERGROUND PIPING COMPOSITE PLAN 05
30-2400-5008	0	UNDERGROUND PIPING COMPOSITE PLAN 06
30-2400-5009	0	UNDERGROUND PIPING COMPOSITE PLAN 07
30-2400-5010	0	UNDERGROUND PIPING COMPOSITE PLAN 08
30-2400-5011	0	UNDERGROUND PIPING COMPOSITE PLAN 09



**ATTACHMENT 5**  
**MECHANICAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-2400-5012	0	UNDERGROUND PIPING COMPOSITE PLAN 10
30-2400-5013	0	UNDERGROUND PIPING COMPOSITE PLAN 11
30-2400-5014	0	UNDERGROUND PIPING COMPOSITE PLAN 12
30-2400-5015	0	UNDERGROUND PIPING COMPOSITE PLAN 13
30-2400-5016	0	UNDERGROUND PIPING COMPOSITE PLAN 14
30-2400-5017	0	UNDERGROUND PIPING COMPOSITE PLAN 15
30-2400-5018	0	UNDERGROUND PIPING COMPOSITE PLAN 16
30-2400-5019	0	UNDERGROUND PIPING COMPOSITE PLAN 17
30-2400-5021	0	UNDERGROUND PIPING COMPOSITE PLAN 18
30-2400-5021	0	UNDERGROUND PIPING COMPOSITE PLAN 19
30-2401-5002	0	PIPING AND INSTRUMENTATION DIAGRAM LUBE OIL STORAGE
30-2401-5003	0	PIPING AND INSTRUMENTATION DIAGRAM LUBE OIL MAINTENANCE
GATE71	H	VALVE DESIGN TABLE – GATE71
MREP-0076	A	PIPING DESIGN TABLE – MREP-0076
MREP-0092	A	PIPING DESIGN TABLE – MREP-0092
MREP-0095	A	PIPING DESIGN TABLE – MREP-0095
MREP-0097	A	PIPING DESIGN TABLE – MREP-0097
MREP-0099	A	PIPING DESIGN TABLE – MREP-0099
MREP-0305	A	PIPING DESIGN TABLE – MREP-0305
MREP-0607	A	PIPING DESIGN TABLE – MREP-0607
MREP-C098	A	PIPING DESIGN TABLE – MREP-C098



**ATTACHMENT 6**  
**ELECTRICAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-0300-7010	0	ELECTRICAL NOTES AND DETAILS INDEX
30-0300-7011	0	ELECTRICAL NOTES AND DETAILS INDEX
30-0300-7012	0	ELECTRICAL NOTES AND DETAILS INDEX
30-0300-7013	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7014	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7015	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7016	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7017	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7018	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7019	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7020	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7021	0	ELECTRICAL NOTES AND DETAILS GROUNDING
30-0300-7033	0	ELECTRICAL NOTES AND DETAILS MANHOLES
30-0300-7034	0	ELECTRICAL NOTES AND DETAILS CONDUIT
30-0300-7035	0	ELECTRICAL NOTES AND DETAILS CONDUIT
30-0300-7036	0	ELECTRICAL NOTES AND DETAILS CONDUIT
30-0300-7037	0	ELECTRICAL NOTES AND DETAILS CONDUIT
30-0311-7001	A	GROUNDING DRAWING KEY PLAN
30-0311-7002	A	GROUNDING PLAN LAYOUT
30-0311-7003	A	GROUNDING PLAN LAYOUT
30-0311-7004	A	GROUNDING PLAN LAYOUT
30-0311-7005	A	GROUNDING PLAN LAYOUT
30-0311-7006	A	GROUNDING PLAN LAYOUT
30-0311-7007	A	GROUNDING PLAN LAYOUT
30-0311-7008	A	GROUNDING PLAN LAYOUT
30-0311-7009	A	GROUNDING PLAN LAYOUT



**ATTACHMENT 6**  
**ELECTRICAL DESIGN DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
30-0311-7010	A	GROUNDING PLAN LAYOUT
30-0311-7011	A	GROUNDING PLAN LAYOUT
30-0311-7012	A	GROUNDING PLAN LAYOUT
30-0311-7013	A	GROUNDING PLAN LAYOUT
30-0311-7014	A	GROUNDING PLAN LAYOUT
30-0311-7015	A	GROUNDING PLAN LAYOUT
30-0311-7016	A	GROUNDING PLAN LAYOUT
30-0311-7017	A	GROUNDING PLAN LAYOUT
30-0311-7018	A	GROUNDING PLAN LAYOUT
30-0311-7019	A	GROUNDING PLAN LAYOUT
30-0311-7020	A	GROUNDING PLAN LAYOUT
30-0313-7001	A	DUCT BANKS / BURIED CONDUITS ENGINE HALL SOUTH AREA PLAN LAYOUT
30-0313-7002	B	DUCT BANK / BURIED CONDUIT DRAWING KEY PLAN
30-0313-7003	B	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7004	B	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7005	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7006	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7007	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7008	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7009	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7010	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7011	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7012	A	DUCT BANKS / BURIED CONDUITS PLAN LAYOUT
30-0313-7015	B	DUCT BANKS / BURIED CONDUITS SECTIONS
30-0313-7016	B	DUCT BANKS / BURIED CONDUITS MANHOLE DETAILS



**ATTACHMENT 7**  
**REFERENCE DRAWINGS**  
**(SEE ZIPPED ATTACHMENT FILE)**

<b>DRAWING NO.</b>	<b>REV.</b>	<b>TITLE</b>
20-1900-2001	0	Tank Containment, Platforms, Stairs, Plan, Sections & Details
20-1900-3002	1	Tank Containment Plan, Sections and Details
C0-350	2	Circulating Water System Cooling Tower Basin Plan & Section
C0-351	2	Circulating Water System Cooling Tower Basin Sections & Details

McIntosh Power Plant  
McIntosh Reciprocating Engine Project  
Project No. A14166.002  
Submittal Process



Specification M-8537  
Date: 07-29-2022  
Rev. D – Conformed

**ATTACHMENT 8**  
**SUBMITTAL PROCESS**



101. DRAWING SUBMITTAL PROCESS

101.1 The project will be utilizing a collaborative project web site (program is TBD). In lieu of submitting hardcopy transmittals, Contractor shall post all official transmittals of correspondence, data, drawings, documents, etc., to the project web site. Unless specifically requested, Contractor shall not submit hardcopy documents. Owner and Engineer will post comments on Contractor's transmittals via the collaborative project web site. Specific details are under coordination now.

101.2 Contractor Document Transmittal Requirements

- a. All transmittals shall include a unique transmittal number and clearly indicate the Owner's name, Engineer's project number, Owner's project number, how they are being sent, and the reason for the transmittal.
- b. The transmittal should include a clear, concise description of all documents enclosed. A list by document/drawing number, revision number, and revision date is to be indicated.
- c. Separate transmittals shall be provided for each discipline (General, Structural, Mechanical, Electrical, I&C and HVAC) as much as possible.
- d. A drawing being transmitted for review for the first time shall so state on the transmittal sheet or letter accompanying the drawing.
- e. Identification of changes on all documents from previous issue must be clearly shown on each document by "scoping/clouding" all revisions from the previous issue.
- f. Transmittals without revisions annotated will be rejected and returned to Contractor unprocessed. Submittals without revisions annotated will be rejected and returned to Contractor unprocessed.
- g. Distributions to other companies are to be shown on the face of the transmittal.

101.3 Document Requirements

- a. All documents shall be in English and shall bear the project name and a full title block containing a unique identification number, revision number, source and type of document and descriptive title. Each document shall clearly indicate the applicable status, e.g., Preliminary, For Information, For Review, For Acceptance, For Bid, For Construction, Record.
- b. All PDFs of documentation (drawings and documents) shall be printed electronically and shall be searchable. Printed on paper and then scanning prevents the document from being searched. If Contractor's vendors have no other option, Contractor must OCR the document prior to submitting.
- c. The measurement system shall be U.S. Customary System, and all drawings and dimensions shall be to scale. Non-scale dimensions (NTS) on drawings will not be permitted on "To Scale" drawings. A scale bar shall be included to permit use following photo-reduction.
- d. Standard Architectural sizes shall be used for drawings. Drawings shall be prepared in such a way that photo-reduction to B size shall result in a legible and useable drawing. Particular attention shall be paid in this respect to selection of fonts. When drawings larger than B size are submitted, a B size print shall also be submitted.





- 101.4 Contractor's drawings shall apply specifically to this contract. Drawings or documentation labeled for another project will not be considered and will be returned to the Contractor immediately.
- 101.5 If general-type drawings are submitted for review which include devices which Contractor does not intend to supply on this contract, Contractor shall certify on the drawings which devices are not to be supplied.
- 101.6 When general-type drawings are submitted from subcontractors to Contractor, such as standard datasheets or cutsheets for off the shelf components, project identifying information shall be included on the document/drawing. Similarly, project unique markings must be supplied to indicate which information applies to this project.
- 101.7 Document Numbering:
- a. Contractor: Vendors shall use Vendor Document/Drawing Numbering
  - b. Engineer: S&L shall use Lakeland Electric Document/Drawing Numbering
  - c. All drawings, manuals, datasheets, and other documents must be assigned a document number, title, and revision. Purchaser's name, station name, contract number, specification number and equipment number (if applicable) shall be stated on the document or drawing.
- 101.8 Electronic File Naming:
- a. All electronic copies of files submitted shall be named using the document number as the filename. Document/drawing titles shall not be included in the filename. There is a 25-character limit on file naming.
  - b. 3D model file naming requirements will be provided via the 3D modeling plan, called the PLADES plan.
  - c. Each time a drawing is submitted electronically, the file submitted shall include the drawing file merged with all the attached reference files. This merging of the reference files is essential. If the electronic copy of the drawing does not include the reference data, it will be impossible to recreate an exact duplicate of the drawing once a reference file has been updated for any reason.
- 101.9 Contractor Document Transmittal Return Process
- 101.10 Drawings that are reviewed by the Engineer will be returned to Contractor with a transmittal letter and any comments marked on the drawings or in the letter.
- 101.11 All comments and questions must be resolved before a resubmittal of the drawings will be processed, which may require meetings between Contractor, Owner and Engineer to resolve.
- 101.12 If the design has not developed enough to resolve some of the comments or questions, Contractor shall place a "hold" on those items or areas of design. The Engineer reserves the right to return drawings unprocessed to Contractor if any evidence exists that Contractor has not acknowledged all comments and questions from previous submittal.
- 101.13 The Engineer's status stamp is provided below. The Owner/Engineer will stamp each drawing with one of the following status codes:



**REVIEWED FOR DESIGN INPUT/CONSTRUCTION**  
**UTILITY XXXXXXXX**  
**STATION XXXXX – UNIT XXXXX**  
**SARGENT & LUNDY<sup>LLC</sup>**

1.  No exception taken. Proceed with Fabrication or Construction in accordance with specification.
2.  Revise as noted and resubmit. Proceed in accordance with specifications after incorporating noted revisions.
3.  Does not meet specification requirements. Revise and resubmit. Hold Fabrication and/or construction.
4.  For information only.

**ANY ACTION SHOWN ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT WITHOUT WAIVING ANY CONTRACTUAL OBLIGATIONS INCLUDING DESIGN OR DETAILING.**

FOR: <u>EQUIPMENT NAME</u>	DATE: _____
EQUIPMENT NO.: _____	PROJECT NO.: _____
SPECIFICATION NO.: _____	RE: _____

101.14 Drawings and data, or portions thereof, submitted for review will be distributed to project team members to meet the project requirements. This includes drawings and data with proprietary statements.

101.15 Approval of documents does not relieve the Contractor of the responsibility to satisfy the requirements of the specification.

McIntosh Power Plant  
McIntosh Reciprocating Engine Project  
Project No. A14166.002  
Division of Responsibility



Specification M-8537  
Date: 07-29-2022  
Rev. D – Conformed

**ATTACHMENT 9**  
**DIVISION OF RESPONSIBILITY**

<b>Spec No. / DOR Indicator</b>	<b>Abbreviation</b>	<b>Description</b>
N/A	LE	Lakeland Electric
N/A	S&L	Sargent & Lundy
M-8520	RICE	RICE supply and delivery
M-8521	TOPO	Topographic Survey
M-8522	WETL	Wetlands Delineation, if required
M-8523	GEOT	Geotechnical Survey
M-8524	HVAC	Engine Hall Ventilation
M-8525	SHOPTANK	Shop Fabricated Tanks
M-8526	FIELDTANK	Field Fabricated Tanks
M-8527	MVS	MV Switchgear
M-8528	LVS	LV Switchgear
M-8529	DC&UPS	DC and UPS System
M-8530	GSU	GSU
M-8531	NSB	Non- seg Bus
M-8532	SST	Station Service Transformers
M-8533	RELAY	Relay Panels
M-8534	FP	Fire Protection
M-8535	EDG	EDG
M-8536	PEMB	Pre Engineered Buildings with bridge crane
M-8537	GWC-BG	GWC- Below Grade, fnd, piping, elect
M-8538	GWC-AG	GWC- Above Grade includes RICE installation
M-8539	HVEQ	High Voltage Equipment
M-8540	PERF	Performance Testing
M-8541	OWS	Oily Water Separator
M-8542	SAN LIFT	Sanitary lift
M-8543	DEMO	Tank Farm Mech Demo
M-8544	SECURITY	Security Access Equipment & Cameras
M-8545	IA	Instrument Compressors, Dryers & Receivers
M-8546	MCC	MCC Specification
M-8547		

### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
<b>MAN 6 x 18V51/60G Equipment Package</b>						
6 x 18V51/60G Engines		RICE	RICE	RICE	RICE	
Generator		RICE	RICE	RICE	RICE	
Steel foundation frame		RICE	RICE	RICE	RICE	
<b>Auxiliary Systems</b>						
<b>Mechanical Auxiliary Systems</b>						
<b>Fuel Gas System</b>						
Plant Isolation Valve		S&L	S&L	M-8538	M-8538	
Natural Gas Train (regulator, filter, shutoff valves)		RICE	RICE	RICE	M-8538	
Natural Gas Flow meter (for each engine)		RICE	RICE	RICE	M-8538	
Natural Gas Pressure Reducing Station		RICE	RICE	RICE	M-8538	
Blind Flanged Connection for Future LNG System		S&L	S&L	M-8537	M-8537	
<b>Lubricating Oil System</b>						
Lube Oil Tank - Service (Engine)	Steel foundation frame is used as lube oil service tank, tank is part of engine	RICE	RICE	RICE	RICE	
Lube Oil Tank - Supply with heater	One (1) tank - 10,000 gallons	S&L	S&L	M-8525	M-8538	
Lube Oil Tank - Maintenance with heater	One (1) tank - 6,000 gallons	S&L	S&L	M-8525	M-8538	
Lube Oil Tank - Waste Oil	One (1) tank - 6,000 gallons	S&L	S&L	Existing T-116	N/A	Existing, in place tank to be reused.
Lube Oil Tank Insulation (Supply and Maintenance)		S&L	S&L	M-8538	M-8538	
Transfer Pumps		RICE	RICE	RICE	M-8538	
Feed Pumps						
Filters		RICE	RICE	RICE	M-8538	
Preheater		RICE	RICE	RICE	M-8538	
Lube Oil Module		RICE	RICE	RICE	M-8538	
Oil Mist Eliminator		RICE	RICE	RICE	M-8538	
Onboard Lube Oil Systems		RICE	RICE	RICE	M-8538	
<b>Compressed Air Systems</b>						
Starting air compressor modules and receivers	Two (2) compressor modules, Five (5) receivers	RICE	RICE	RICE	M-8538	
Starting air system distribution header on media hub module		RICE	RICE	RICE	M-8538	
Instrument air system, compressors, dryers, and receivers	2x100% Compressors and Dryers, 1x100% Receiver	S&L	S&L	M-8545	M-8538	
Instrument air system distribution header on media hub module		RICE	RICE	RICE	M-8538	
<b>Cooling System</b>						
LT cooling system pumps		RICE	RICE	RICE	M-8538	
LT cooling system heat exchangers		RICE	RICE	RICE	M-8538	
LT cooling system control valves		RICE	RICE	RICE	M-8538	
HT cooling system pumps		RICE	RICE	RICE	M-8538	
HT cooling system heat exchangers		RICE	RICE	RICE	M-8538	
HT cooling system control valves		RICE	RICE	RICE	M-8538	
Heat recovery system pumps		RICE	RICE	RICE	M-8538	
Heat Recovery System Circulation Pump - Standby Heating	2x100%	S&L	S&L	M-8538	M-8538	
Heat Recovery System Buffer Tank	1x100% (200,000 gallons)	S&L	S&L	M-8526	M-8538	
Heat Recovery System Buffer Tank heater	External heater	S&L	S&L	M-8538	M-8538	
Heat Recovery Tank Insulation		S&L	S&L	M-8526	M-8526	
Heat recovery system heat exchangers		RICE	RICE	RICE	M-8538	
Heat recovery system control valves inside Engine Hall		RICE	RICE	RICE	M-8538	

### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
Heat recovery system control valves outside Engine Hall	Heat recovery buffer tank, heater, heater recirc pump area	S&L	S&L	M-8538	M-8538	
<b>Charge Air System</b>						
Charge Air Filter		RICE	RICE	RICE	M-8538	
Charge Air Rubber Expansion Joint		RICE	RICE	RICE	M-8538	
Charge Air Duct		RICE	S&L	M-8538	M-8538	Duct just coated, no insulation & lagging required.
<b>Exhaust System</b>						
Rupture Disc		RICE	RICE	RICE	M-8538	
Exhaust Duct Turbo Charger Expansion Joint		RICE	RICE	RICE	M-8538	
Exhaust Duct		RICE	S&L	M-8538	M-8538	
Exhaust Gas Duct Insulation and Lagging		RICE	S&L	M-8538	M-8538	
SCR Inlet and Outlet Expansion Joint		S&L	S&L	M-8547	M-8538	
Stack Inlet Expansion Joint		S&L	S&L	M-8547	M-8538	
<b>Fire Protection System</b>						
Underground Fire Protection Water Main System and Hydrants		S&L	S&L	M-8537	M-8537	
Hand-Held Portable Fire Extinguishers		S&L	S&L	M-8534	M-8534	
Fire Detection, Alarm and Notification Panel		S&L	S&L	M-8534	M-8534	
Fire Detection Devices		S&L	S&L	M-8534	M-8534	
<b>Gas Detection System</b>						
Gas Detection Alarm and Notification Panel		RICE	RICE	RICE	M-8538	
Gas Detection Devices		RICE	RICE	RICE	M-8538	
<b>Oily Water System</b>						
Oil Water Separator	1 x 100% with 2 x 50% pumps	S&L	S&L	M-8541	M-8537	
<b>NOx and CO Control Systems</b>						
Reagent storage tank, reagent forwarding equipment, vaporizers	Existing tanks and vaporizers used	S&L	S&L	N/A	N/A	
Reagent pressure regulating station at SCR		RICE	RICE	RICE	M-8538	
Equipment, analyzers for NOx control, monitoring ports		RICE	RICE	RICE	M-8538	
Reagent interconnecting piping and valves		S&L	S&L	M-8538	M-8538	
<b>Electrical Systems</b>						
<b>Instrumentation and Control System</b>						
Local and Remote-engine control panels/cabinets (GCPs, SIPs)		RICE	RICE	RICE	M-8538	
Central Common control panel (CCP)		RICE	RICE	RICE	M-8538	
Engine Auxiliary Interface Panels (EAP-IPs)	Six (6) units	RICE	RICE	RICE	M-8538	
Common Auxiliary Interface Panels (CAP-IP)	One (1) unit	RICE	RICE	RICE	M-8538	
RICE SCADA, RAU, RAC, CoCoS		RICE	RICE	RICE	M-8538	
Operator Workstations (HMI), Printers		RICE	RICE	RICE	M-8538	
Historian (part of SCADA)		RICE	RICE	RICE	RICE	Included in MAN SCADA, shop installed.
Datalink to LE's SCADA RTU for Automatic Generation Control		RICE/LE/S&L	RICE/S&L	M-8538	M-8538	LE/S&L will provide design input.
Instrumentation, instrument racks, tubing, valves, and fittings (internal to skids)		RICE	RICE	RICE	M-8538	
Instrument tubing (external to skids)		S&L	S&L	M-8538	M-8538	
Remote Terminal Unit (RTU)		LE	LE	LE	M-8538	RTU is by LE. RTU is in LE supplied cabinet located in RICE EEB.
MAN SCADA Interface with LE Historian Server		RICE/LE/S&L	RICE/S&L	M-8538	M-8538	Coordination between RICE and LE/ S&L.
IT Network		S&L	S&L	M-8538	M-8538	
Plant IT and Communications		LE	LE	LE	LE	
BOP Instruments & Instrument Racks		S&L	S&L	M-8538	M-8538	

### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
BOP Controls		S&L	RICE	RICE	N/A	S&L provides design input to RICE (BOP I/O, control descriptions, marked up P&IDs for graphic sketches).
EDG datalink to MAN CCP		RICE/S&L	RICE/S&L	M-8538	M-8538	
Gas Alarm Panel Datalink		RICE	RICE	M-8538	M-8538	
Weather Station		S&L	S&L	M-8538	M-8538	
<b>Shipment Receipt and Storage</b>						
<b>MAN Engine Equipment deliveries</b>						
Receipt, Unloading and On Site Storage of MAN deliveries in 2022		N/A	N/A	N/A	M-8537	
Receipt, Unloading and On Site Storage of MAN deliveries in 2023		N/A	N/A	N/A	M-8538	
<b>Receipt, Unloading and On Site Storage of Owner deliveries in 2022</b>		N/A	N/A	N/A	M-8537	
<b>Receipt, Unloading and On Site Storage of Owner deliveries in 2023</b>		N/A	N/A	N/A	M-8538	
<b>Receipt, Unloading and On Site Storage of Contractor deliveries</b>		N/A	N/A	N/A	M-8537/M-8538	Contractors to receive, unload and store their respective equipment deliveries.
<b>High Voltage System - 69kV</b>						
High Voltage Tenoroc Switchyard Modifications		LE	LE	LE	LE	
High Voltage Transmission Line	One (1) run - Dead-end to Switchyard	LE	LE	LE	LE	
High Voltage Rigid Bus and Supports		LE	S&L	M-8539	M-8538	
High Voltage Disconnect Switch	One (1) unit	LE	S&L	M-8539	M-8538	
High Voltage Current Transformers		LE	S&L	M-8539	M-8538	
High Voltage Voltage Transformers		LE	S&L	M-8539	M-8538	
High Voltage Dead-end Structure	One (1) unit	LE	S&L	M-8539	M-8538	
High Voltage Overhead Cable	GSU to rigid bus Disconnect Switch to Dead-end	LE	S&L	M-8539	M-8538	
Generator Step-Up Transformer	One (1) three winding unit	S&L	S&L	M-8530	M-8530	rough set by GSU vendor, oil fill and dress out.
GSU protective relay panel	One (1) panel	S&L	S&L	M-8533	M-8538	
<b>Medium Voltage System - 15kV</b>						
Generator neutral grounding cubicles	Six (6) units	RICE	RICE	RICE	M-8538	
Generator surge capacitor and lightning arrester cubicles	Six (6) units	RICE	RICE	RICE	M-8538	
15 kV Non-seg Bus Duct	Two (2) runs	S&L	S&L	M-8531	M-8538	
15 kV Metal Enclosed Switchgear	Two (2) lineups	S&L	S&L	M-8527	M-8538	
<b>Low Voltage System - 480V</b>						
13.8 kV-480 V Transformers	Two (2) units	S&L	S&L	M-8532	M-8538	
4.16 kV-480 V Transformer	One (1) unit	S&L	S&L	M-8532	M-8538	
600 V Non-seg Bus Duct	Two (2) units	S&L	S&L	M-8531	M-8538	
480 V Metal Enclosed Switchgear	One (1) double ended lineup	S&L	S&L	M-8528	M-8538	
480 V Motor Control Centers	Eight (8) lineups	S&L	S&L	M-8546	M-8538	
Miscellaneous power distribution panels		S&L	S&L	M-8533	M-8538	
Miscellaneous power distribution transformers		S&L	S&L	M-8532	M-8538	
Emergency Diesel Generator	One (1) unit	S&L	S&L	M-8535	M-8538	
<b>125VDC System</b>						
Battery	One (1) rack - 60 cells	S&L	S&L	M-8529	M-8538	
Battery Disconnect Switch	One (1) unit	S&L	S&L	M-8529	M-8538	
Battery Chargers	Two (2) units	S&L	S&L	M-8529	M-8538	
DC Distribution Panel	One (1) unit	S&L	S&L	M-8529	M-8538	
<b>125VAC UPS System</b>						
Inverter	One (1) unit	S&L	S&L	M-8529	M-8538	

### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
Constant Voltage Transformer	One (1) unit	S&L	S&L	M-8529	M-8538	
Static Transfer Switch	One (1) unit	S&L	S&L	M-8529	M-8538	
Manual Bypass Switch	One (1) unit	S&L	S&L	M-8529	M-8538	
AC Distribution Panel	One (1) unit	S&L	S&L	M-8529	M-8538	
<b>Cables</b>						
MV Power Cable		S&L	S&L	M-8538	M-8538	
LV Power Cable		S&L	S&L	M-8538	M-8538	
Control Cable		RICE/S&L	S&L	M-8538	M-8538	
Instrumentation Cable		RICE/S&L	S&L	M-8538	M-8538	
Copper Communication Cable		RICE/S&L	S&L	M-8538	M-8538	
Fiber Optic Cables		RICE/S&L	S&L	M-8538	M-8538	
Non-ANSI-standard cable and connectors		RICE	RICE	RICE	M-8538	
<b>Raceway</b>						
Cable tray		S&L	S&L	M-8538	M-8538	
Cable Tray Supports		S&L	M-8538	M-8538	M-8538	
Conduit - Above Grade		S&L	M-8538	M-8538	M-8538	
Conduit Supports		S&L	M-8538	M-8538	M-8538	
Electrical Underground Raceway		S&L	S&L	M-8537	M-8537	
<b>Grounding System</b>						
Grounding - Below Grade		S&L	S&L	M-8537	M-8537	
Grounding - Above Grade		S&L	M-8538	M-8538	M-8538	
<b>Lighting &amp; Receptacle System</b>						
Lighting - Engine Hall and Electrical and Control Building	LED-type station lighting	S&L	S&L	M-8538	M-8538	
Lighting - Outdoor	LED-type station lighting	S&L	S&L	M-8538	M-8538	
120V convenience receptacles		S&L	S&L	M-8538	M-8538	
480V Welding receptacles		S&L	S&L	M-8538	M-8538	
<b>Lightning Protection</b>						
		S&L	M-8538	M-8538	M-8538	M-8538 to subcontract a specialty UL certified installer for Florida.
<b>Cathodic Protection</b>						
		S&L	M-8537	M-8537	M-8537	
<b>Security System</b>						
Hardware		LE	LE	M-8544	LE	
Raceway and Cable		LE	M-8538	M-8538	M-8538	
<b>Construction Power</b>						
		LE	LE	LE	LE	LE intends to use the 480V transformer by the U3 cooling tower at 200 amps.
<b>Miscellaneous Scope</b>						
<b>Tools - Specialty and Maintenance</b>						
		RICE	RICE	RICE	N/A	
<b>Transportation and offloading of RICE onto Foundations</b>						
		RICE	RICE	RICE	RICE	
<b>Commissioning/Startup</b>						
Commissioning engineers		RICE/S&L	RICE/S&L	N/A	N/A	
RICE representatives		RICE	RICE	RICE	N/A	
Vendor representatives for BOP Equipment		N/A	N/A	each BOP spec	N/A	
Plant Operators		N/A	N/A	LE	N/A	
<b>Training at Site - MAN</b>						
Training Off Site - MAN		RICE	RICE	RICE	N/A	
Training at Site - BOP Equipment		N/A	N/A	each BOP spec	N/A	Training is required for all supplied equipment, specifications M-8524 and higher



### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
<b>Factory Test</b>						
Engine Test		RICE	RICE	RICE	N/A	
Generator Test		RICE	RICE	RICE	N/A	
Controls FAT		RICE	RICE	RICE	N/A	Witnessed by LE/ S&L
BOP equipment FAT		N/A	N/A	each BOP spec	N/A	
<b>Owner Witness Test - Owner's Representation</b>						
Travel and Local Transportation		N/A	N/A	LE/S&L	N/A	
Board and Lodging		N/A	N/A	LE/S&L	N/A	
<b>Performance Testing</b>						
3rd Party Performance testing services		RICE	N/A	M-8540	N/A	
Witness of Site Performance Test		N/A	N/A	RICE	N/A	
<b>Condition Assessment of Existing Equipment to be re-used</b>						
		LE	N/A	N/A	N/A	
<b>Pre-Engineered Buildings</b>						
3D Model		N/A	M-8536	M-8536	N/A	
Shop prime coating for steel members		M-8536	M-8536	M-8536	M-8536	
Prime coating touch-up		M-8536	M-8536	M-8536	M-8538	
Field finish coating for steel members		M-8538	M-8538	M-8538	M-8538	
<b>Building Enclosure</b>						
Siding system and thermal insulation, including trim and accessories		M-8536	M-8536	M-8536	M-8538	
Roofing system and thermal insulation, including trim, accessories, gutters, and downspouts		M-8536	M-8536	M-8536	M-8538	
Engine Hall acoustical insulation and interior liner panels, including trim and accessories		M-8536	M-8536	M-8536	M-8538	
Major openings indicated on the drawings		S&L	S&L	M-8536	M-8538	
Small openings		S&L	S&L	N/A	M-8538	
Flashing around pipes and cable tray to properly seal openings		S&L	S&L	N/A	M-8538	
<b>Building Accessories</b>						
Rolling steel doors		M-8536	M-8536	M-8536	M-8538	
Exterior Personnel doors including door hardware		S&L	M-8536	M-8536	M-8538	
Interior Personnel doors including door hardware		S&L	M-8538	M-8538	M-8538	
Canopies at personnel doors		M-8536	M-8536	M-8536	M-8538	
Engine Hall bridge crane	Includes rails, wiring, motor, and all other miscellaneous items required for the bridge crane operation.	S&L	M-8536	M-8536	M-8538	
Bridge crane motor and load testing		N/A	N/A	M-8538	M-8538	
Rooftop exhaust ventilators at Engine Hall		M-8536	M-8536	M-8536	M-8538	
Roof curbs for ventilating equipment		M-8536	M-8536	M-8536	M-8538	
All other building Ventilation systems- Engine Hall		S&L	S&L	M-8524	M-8538	Engine Hall
All other building HVAC systems- Electrical Building		S&L	S&L	M-8538	M-8538	wall type BARD units
Exterior lighting systems		S&L	S&L	M-8538	M-8538	
Ladders including gates, life safety devices and associated horizontal lifelines and anchorage		M-8536	M-8536	M-8536	M-8538	with PEMB
<b>Building Interiors</b>						
Engine Hall Platforms		RICE	RICE	RICE	M-8538	
Electrical and Control Building partitions, suspended ceilings, casework and interior doors		S&L	S&L	M-8538	M-8538	
Engine Hall Concrete Sealer and Hardener Coating		S&L	S&L	M-8537	M-8537	
Electrical and Control Building interior finishes		S&L	S&L	M-8538	M-8538	
Interior lighting, power and communication systems		S&L	S&L	M-8538	M-8538	
Fire detection and fire protection systems		S&L	M-8534	M-8534	M-8534	
<b>Engine Hall Wall Mounted Ventilation</b>						
Equipment (Air Handling Units, VFDs, ridge vent, roof curb, fan evase and interconnecting ductwork)		M-8524	M-8524	M-8524	M-8538	

### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
Equipment interface connections, details, grout, modifications to existing steel for equipment mounting		M-8524	M-8524	N/A	M-8538	
Anchor bolts (if required)		M-8524	M-8524	M-8538	M-8538	
Fastening hardware including expansion anchors at interface with others, fan support steel		M-8524	M-8524	M-8524	M-8538	
Insulation (if required)		M-8524	M-8524	M-8524	M-8538	
Instrumentation & Control to the extent possible for shop assembly		M-8524	M-8524	M-8524	M-8524	
Electrical power supply to disconnect switch		S&L	S&L	M-8538	M-8538	
Cables between disconnect switch and starter/control panel		M-8524	M-8524	M-8524	M-8524	
Operating controls		M-8524	M-8524	M-8524	M-8524	
Fan dampers, fan weather hoods with bird screens		M-8524	M-8524	M-8524	M-8538	
Grounding		S&L	S&L	M-8538	M-8538	
Roof, floor and wall penetrations, all flashing and seal material		M-8524	M-8524	M-8536	M-8538	
Painting (not including field touchup)		M-8524	M-8524	M-8524	M-8524	
Shop Testing, adjusting, and balancing		N/A	N/A	M-8524	M-8524	
Field testing, adjusting, and balancing		N/A	N/A	M-8524	M-8524	
<b>Building Plumbing</b>						
Electrical and Control Building Plumbing including fixtures	Above grade plumbing components	S&L	S&L	M-8538	M-8538	
<b>Piping</b>						
<b>Above Ground</b>						
Pipe testing in accordance with applicable codes		S&L	S&L	M-8538	M-8538	
Tie In to existing system pipelines		S&L/LE	S&L	M-8538	M-8538	
<b>Large Bore BOP Pipe &amp; Supports (2-1/2" &amp; Larger)</b>						
Fuel Gas System	excluding pressure reducing station	S&L	S&L	M-8538	M-8538	
Demineralized Water		S&L	S&L	M-8538	M-8538	
Service Water		S&L	S&L	M-8538	M-8538	
Potable Water		S&L	S&L	M-8538	M-8538	
Firewater		S&L	M-8534	M-8538	M-8538	
LT cooling system piping inside Engine Hall		RICE	RICE	M-8538	M-8538	
LT cooling system piping inside Engine Hall on engine integration module and media hub skid		RICE	RICE	M-8538	M-8538	
HT cooling system piping inside Engine Hall		RICE	RICE	M-8538	M-8538	
HT cooling system piping inside Engine Hall on engine integration module and media hub skid		RICE	RICE	M-8538	M-8538	
Cooling Water outside of Engine Hall	HT and LT	S&L	S&L	M-8538	M-8538	
Heat recovery system piping inside Engine Hall		RICE	RICE	M-8538	M-8538	
Heat recovery system piping inside Engine Hall on engine integration module and media hub skid		RICE	RICE	M-8538	M-8538	
Heat Recovery outside of Engine Hall		S&L	S&L	M-8538	M-8538	
Instrument Air piping inside Engine Hall		S&L	S&L	M-8538	M-8538	
Instrument Air piping inside Engine Hall on engine integration module and media hub skid		RICE	RICE	M-8538	M-8538	
Instrument Air outside of Engine Hall		S&L	S&L	M-8538	M-8538	
Starting Air piping inside Engine Hall		RICE	RICE	M-8538	M-8538	
Starting Air piping inside Engine Hall on engine integration module and media hub skid		RICE	RICE	M-8538	M-8538	
Oily Water Drains		S&L	S&L	M-8538	M-8538	
Vaporized Ammonia		S&L	S&L	M-8538	M-8538	
Lube oil piping inside Engine Hall		RICE	RICE	M-8538	M-8538	
Lube oil piping inside Engine Hall on engine integration module and media hub skid		RICE	RICE	M-8538	M-8538	
Lube oil piping outside of Engine Hall		S&L	S&L	M-8538	M-8538	
<b>Small Bore Piping &amp; Supports (2" &amp; Smaller)</b>						
Fuel Gas System	Not including pressure reducing station; model only, no isometrics	S&L	S&L	M-8538	M-8538	

**Division of Responsibility**

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
Demineralized Water	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Service Water	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Potable Water	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Firewater	Model only, no isometrics	S&L	M-8534	M-8538	M-8538	
LT cooling system piping inside Engine Hall	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
LT cooling system piping inside Engine Hall on engine integration module and media hub skid	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
HT cooling system piping inside Engine Hall	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
HT cooling system piping inside Engine Hall on engine integration module and media hub skid	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
Cooling Water outside of Engine Hall	HT and LT , Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Heat recovery system piping inside Engine Hall	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
Heat recovery system piping inside Engine Hall on engine integration module and media hub skid	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
Heat Recovery outside of Engine Hall	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Instrument Air piping inside Engine Hall	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
Instrument Air piping inside Engine Hall on engine integration module and media hub skid	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
Instrument Air outside of Engine Hall	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Starting Air piping inside Engine Hall	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
Starting Air piping inside Engine Hall on engine integration module and media hub skid	Model only, no isometrics	RICE	RICE	M-8538	M-8538	
Oily Water Drains	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Vaporized Ammonia	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
Lube Oil	Model only, no isometrics	S&L	S&L	M-8538	M-8538	
<b>Below Ground</b>	Composites only					See Civil section for Storm water piping, Sanitary, etc
Pipe testing in accordance with applicable codes		S&L	S&L	M-8537	M-8537	
Tie In to existing system pipelines		S&L/LE	S&L	M-8537	M-8537	
<b>Large Bore BOP Pipe &amp; Supports (2-1/2" &amp; Larger)</b>						
Fuel Gas System	Not including pressure reducing station	S&L	S&L	M-8537	M-8537	
Demineralized Water		S&L	S&L	M-8537	M-8537	
Service Water		S&L	S&L	M-8537	M-8537	
Potable Water		S&L	S&L	M-8537	M-8537	
Firewater		S&L	S&L	M-8537	M-8537	
Cooling Water		S&L	S&L	M-8537	M-8537	
Vaporized Ammonia		S&L	S&L	M-8537	M-8537	
OWS Discharge Piping		S&L	S&L	M-8537	M-8537	
<b>Small Bore Piping &amp; Supports (2" &amp; Smaller)</b>						
Fuel Gas - upstream of gas control skid		S&L	M-8537	M-8537	M-8537	
Fuel Gas - downstream of gas control skid		S&L	M-8537	M-8537	M-8537	
Demineralized Water		S&L	M-8537	M-8537	M-8537	
Service Water		S&L	M-8537	M-8537	M-8537	
Potable Water		S&L	M-8537	M-8537	M-8537	
Firewater		S&L	M-8537	M-8537	M-8537	
Cooling Water		S&L	M-8537	M-8537	M-8537	
Vaporized Ammonia		S&L	M-8537	M-8537	M-8537	
<b>Trenched Piping</b>						
Cooling Water		S&L	S&L	M-8538	M-8538	
Heat Recovery		S&L	S&L	M-8538	M-8538	
<b>Piping Thermal Insulation/Lagging</b>						
Large Bore Piping		S&L	S&L	M-8538	M-8538	
Small Bore Piping		S&L	S&L	M-8538	M-8538	
Heat Tracing		S&L	S&L	M-8538	M-8538	

### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
<b>Valves &amp; Specialties (not supplied by RICE)</b>						
<b>Above Ground</b>						
Fuel Gas - upstream of gas control skid		S&L	S&L	M-8538	M-8538	
Fuel Gas - downstream of gas control skid		S&L	S&L	M-8538	M-8538	
Demineralized Water		S&L	S&L	M-8538	M-8538	
Service Water		S&L	S&L	M-8538	M-8538	
Potable Water		S&L	S&L	M-8538	M-8538	
Firewater		S&L	S&L	M-8538	M-8538	
Cooling Water		S&L	S&L	M-8538	M-8538	
Heat Recovery		S&L	S&L	M-8538	M-8538	
Instrument Air		S&L	S&L	M-8538	M-8538	
Starting Air		S&L	S&L	M-8538	M-8538	
Sanitary Drains		S&L	S&L	M-8538	M-8538	
Oily Water Drains		S&L	S&L	M-8538	M-8538	
Vaporized Ammonia		S&L	S&L	M-8538	M-8538	
Lube Oil		S&L	S&L	M-8538	M-8538	
<b>Below Ground</b>						
Demineralized Water		S&L	S&L	M-8537	M-8537	
Service Water		S&L	S&L	M-8537	M-8537	
Potable Water		S&L	S&L	M-8537	M-8537	
Firewater		S&L	S&L	M-8537	M-8537	
Cooling Water		S&L	S&L	M-8537	M-8537	
Vaporized Ammonia		S&L	S&L	M-8537	M-8537	
<b>BOP Miscellaneous</b>						
Emergency Combination Eyewash/Shower Stations		S&L	S&L	M-8538	M-8538	
Hose Stations - Service Water		S&L	S&L	M-8538	M-8538	
Hose Stations - Station Air		S&L	S&L	M-8538	M-8538	
<b>Structural Steel</b>						
Engine Hall Building Structure		S&L	M-8536	M-8536	M-8538	
Engine Hall Building Auxiliary Steel		M-8536	M-8536	M-8536	M-8538	
Engine Hall Building Crane		M-8536	M-8536	M-8536	M-8538	
Electrical Building Structure		S&L	M-8536	M-8536	M-8538	
Engine Access Platform Structure		RICE	RICE	RICE	M-8538	
Engine Hall Exhaust Duct and Charge Air Duct Support Platforms Structure		RICE	RICE	RICE	M-8538	
Pipe Support Modules Structure		RICE	RICE	RICE	M-8538	
Exhaust Duct and Charge Air Filter Support Structure		S&L	S&L	M-8539	M-8538	
SCR Outlet Exhaust Duct Support Structure		S&L	S&L	M-8539	M-8538	
Radiator Support Structure		RICE	RICE	RICE	M-8538	
Generator/Alternator Anchor Bolts		RICE	S&L/RICE	RICE	M-8538	
Stack Anchor Bolts		RICE	S&L/RICE	RICE	M-8537	
Cast-in Anchor Bolts including Nuts and Washers (Engine Hall, Electrical Building, Engine Hall Exhaust Duct and Charge Air Duct Support Platforms Structure, Exhaust Duct and Charge Air Filter Support Structure, etc.)		S&L/RICE/OTHERS	S&L	M-8537	M-8537	
Post Installed Anchor Bolts		-	S&L/RICE	M-8538	M-8538	
Misc Pipe and Cable Tray Support Steel		S&L	S&L	M-8538	M-8538	
<b>Civil</b>						
<b>Site Preparation</b>						
Wetland Mapping		M-8522	M-8522	M-8522	N/A	
Topographic Mapping		M-8521	M-8521	M-8521	N/A	
Site Permit/Storm Water Pollution Prevention Plan	per Site Permit	S&L	OTHERS	N/A	N/A	Includes Erosion and Sediment Control Permitting. S&L provides input to Trinity for site permit.
Temporary Use Areas, including Engine Assembly Area	Topsoil disposal area, soil management area	S&L	M-8537	M-8537	M-8537	

### Division of Responsibility

Description	Scope Definition	DOR				Remarks
		Basic Design	Detailed Design	Furnish / Supply By	Installation By	
Storm Water Underground Piping		S&L	S&L	M-8537	M-8537	
Catch Basins, Manholes		S&L	S&L	M-8537	M-8537	
Culverts		S&L	S&L	M-8537	M-8537	
Retention Basin		S&L	S&L	M-8537	M-8537	
Initial Grading and Drainage		S&L	S&L	M-8537	M-8537	
Oily Water Sewer Gravity Influent Piping to OWS		S&L	S&L	M-8537	M-8537	
Sanitary Lift Station	2x100% lift station pumps	S&L	S&L	M-8542	M-8537	
Sanitary Sewer Underground Piping (Gravity Sewer to Lift Station and Forced Main)		S&L	S&L	M-8537	M-8537	
Plant Roads		S&L	S&L	M-8537	M-8537	
Heavy Haul Roads		S&L	S&L	M-8537	M-8537	
Fencing & Gates- during construction between U1-3 Demolition and RICE project		S&L	S&L	LE	LE	
Fencing & Gates- during construction between U5 and RICE Project		S&L	S&L	LE	LE	
Fencing - during Underground General Work Construction		S&L	M-8537	M-8537	M-8537	
Bollards		S&L	S&L	M-8538	M-8538	
Finish Grading & Surfacing		S&L	S&L	M-8538	M-8538	Initial grading to raise site elevation to rough finish grade
Final Roadways		S&L	S&L	LE	LE	
Plant Signage from Public Roadway		S&L	S&L	LATER	LATER	TBD
Site Landscaping		S&L	S&L	LE	LE	
Road Signage		S&L	S&L	LE	LE	
Excavation and Backfilling		S&L	M-8537	M-8537	M-8537	
Compaction/Soil Betterment for Piping Trenches and Cable Trenches		S&L	M-8537	M-8537	M-8537	
Removal of Temporary Storm Sewer for Heavy Haul		S&L	M-8538	M-8538	M-8538	
Removal of Temporary Storm Sewer and Extension of Stormwater Basin North		S&L	S&L	M-8538	M-8538	
<b>Foundations</b>						
Engine Hall and Concrete Curbs		S&L	S&L	M-8537	M-8537	
Engine Hall Trench Grating		S&L	S&L	M-8537	M-8537	
Isolated Engine Generator		RICE	S&L	M-8537	M-8537	
Electrical Building and Concrete Curbs		S&L	S&L	M-8537	M-8537	
Stack		S&L	S&L	M-8537	M-8537	
SCR		S&L	S&L	M-8537	M-8537	
Lube Oil Tank Pump and Tank Foundation and Containment		S&L	S&L	M-8537	M-8537	
Cooling Water Collection Tank and Pump Foundation and Containment		S&L	S&L	M-8537	M-8537	
Exhaust Duct and Intake Air Filter		S&L	S&L	M-8537	M-8537	
Radiator		S&L	S&L	M-8537	M-8537	
GSU Transformer		S&L	S&L	M-8537	M-8537	
GSU Transformer Containment Grating and 12" Stone Layer		S&L	S&L	M-8537	M-8537	
Misc Foundation Containment Grating		S&L	S&L	M-8537	M-8537	
Engine Hall Ventilation Equipment		S&L	S&L	M-8537	M-8537	
Heat Recovery Thermal Buffer Tank		S&L	S&L	M-8537	M-8537	
OWS Hold-down Pad		S&L	S&L	M-8537	M-8537	
Fuel Gas Conditioning		S&L	S&L	M-8537	M-8537	
BOP Miscellaneous		S&L	S&L	M-8537	M-8537	
Piles		S&L	S&L	M-8537	M-8537	
Misc Foundation items such as waterstops, vapor barriers, and premolded joint filler.		S&L	S&L	M-8537	M-8537	
Grout under Equipment and Column Base Plates		S&L	S&L	M-8538	M-8538	
Prefabricated Piping Trenches		S&L	S&L	M-8538	M-8538	
Prefabricated Cable Trenches		S&L	S&L	M-8538	M-8538	

McIntosh Power Plant  
McIntosh Reciprocating Engine Project  
Project No. A14166.002  
Preliminary List of Shipments



Specification M-8537  
Date: 07-29-2022  
Rev. D – Conformed

**ATTACHMENT 10**  
**PRELIMINARY LIST OF SHIPMENTS**

## **EXHIBIT B**

### **CONTRACTOR'S PROPOSAL**

Proposal submitted by CASEY INDUSTRIAL, INC., dated May 31, 2022, with addendum RFC updates which are on file in the office of the City Treasurer-City Clerk, and is by reference incorporated herein.

## **EXHIBIT C**

### **PAYMENT DETAILS**

Account Name:	Casey Industrial, Inc.
Bank:	BMO Harris Bank NA
Address:	PO Box 755, Chicago, IL 60690
ABA Routing #:	071000288
For ACH Files ABA Routing #:	2091189
For Wire Transfers Account Number:	2091189
Mail Checks To:	890 West Cherry Street, Louisville, CO 80027

Please send all ACH Notices and Wire Transfer Notices to: [ar@caseyind.com](mailto:ar@caseyind.com)



## **EXHIBIT D**

### **PAYMENT SCHEDULE**

8% due at Contract signing

10% due at 15% Project completion

33% due at 30% Project completion

22% due at 50% Project completion

12% due at 75% Project completion

10% due at Substantial Completion

5% at Project completion, demobilization/documentation supplied.

**EXHIBIT E**

**INSURANCE**



**RISK MANAGEMENT & PURCHASING**  
1140 EAST PARKER STREET  
LAKELAND, FL 33801

**UNDERGROUND GENERAL CONTRACTOR  
FOR THE MCINTOSH RECIPROCATING ENGINE PROJECT**

**BID 2136**

**INSURANCE AND SAFETY REQUIREMENTS  
MREP Underground General Contractor**

**STATEMENT OF PURPOSE**

The City of Lakeland (the "City") from time to time enters into agreements, leases and other contracts with Other Parties (as hereinafter defined).

Such Agreements shall contain at a risk management/insurance terms to protect the City's interests and to minimize its potential liabilities. Accordingly, the following requirements shall apply:

**CITY DEFINED**

The term City (wherever it may appear) is defined to mean the City of Lakeland itself, its Commission, employees, volunteers, representatives and agents.

**OTHER PARTY DEFINED**

The term Other Party (wherever it may appear) is defined to mean the other person or entity which is the counter-party to the Agreement with the City and any of such Other Party's subsidiaries, affiliates, officers, employees, volunteers, representatives, agents, contractors and subcontractors.

**LOSS CONTROL/SAFETY**

Precaution shall be exercised at all times by the Other Party for the protection of all persons, including employees, and property. The Other Party shall comply with all laws, rules, regulations or ordinances related to safety and health, and shall make special effort to anticipate and detect hazardous conditions and shall take such precautionary and prompt action where loss control/safety measures should reasonably be expected.

The City may order work to be stopped at any time, without liability, if conditions exist that present immediate danger to persons or property. The Other Party acknowledges that such stoppage, or failure to stop, will not shift responsibility for any damages from the Other Party to the City.

**INSURANCE - BASIC COVERAGES REQUIRED**

The Other Party shall procure and maintain the following described insurance, except for coverage specifically waived by the City of Lakeland, on policies and with insurers acceptable to the City, and

insurers with AM Best ratings of no less than A.

These insurance requirements shall in no way limit the liability of the Other Party. The City does not represent these insurance requirements to be sufficient or adequate to protect the Other Party's interests or liabilities, but are merely minimums.

"Except for workers' compensation and professional liability, the Other Party's insurance policies shall be endorsed to name the City of Lakeland as **additional insured**. It is agreed that the Other Party's insurance shall be deemed primary and non-contributory with respect to any insurance or self-insurance carried by The City of Lakeland for liability arising out of the operations of this agreement."

### **Insurance Requirements (cont'd)**

#### **INSURANCE – BASIC COVERAGES REQUIRED (cont'd)**

Except for worker's compensation, the Other Party waives its right of recovery against the City, to the extent permitted by its insurance policies.

The Other Party's deductibles/self-insured retentions shall be disclosed to the The Other Party is responsible for the amount of any deductible or self-insured retention.

Insurance required of the Other Party or any other insurance of the Other Party shall be considered primary, and insurance of the City shall be considered excess, as may be applicable to claims which arise out of the Hold Harmless, Payment on Behalf of the City of Lakeland, Insurance, Certificates of Insurance and any Additional Insurance provisions of this agreement, contract, or lease.

**Commercial General Liability:** This insurance shall be an "occurrence" type policy written in comprehensive form and shall protect the Other Party and the additional insured against all claims arising from bodily injury, sickness, disease, or death of any person other than the Other Party's employees or damage to property of the City or others arising out of any act or omission of the Other Party or its agents, employees, or Subcontractors and to be inclusive of property damage resulting from explosion, collapse or underground (xcu) exposures. This policy shall also include protection against claims insured by usual personal injury liability coverage, and to insure the contractual liability assumed by the Other Party under the article entitled **INDEMNIFICATION**, and **"Products and Completed Operations" coverage.**

The Other Party is required to continue to purchase products and completed operations coverage for three years beyond the City's acceptance of renovation or construction properties.

**The liability limits shall be:**

<b>Bodily Injury and Property Damage</b>	<b>\$5,000,000 Single limit each occurrence</b>
--	---

**Business Automobile Liability:** Business Auto Liability coverage is to include bodily injury and property damage arising out of ownership, maintenance or use of any auto, including owned, non-owned and hired automobiles and employee non-ownership use.

**The liability limits shall be:**

<b>Bodily Injury and Property Damage</b>	<b>\$1,000,000</b>
--	--------------------

**Workers' Compensation:** Workers' Compensation coverage to apply for all employees for statutory limits and shall include employer's liability with a limit of \$100,000 each accident, \$500,000 disease policy limits, \$100,000 disease limit each employee. ("All States" endorsement is required where applicable). If

exempt from Worker's Compensation coverage, as defined in Florida Statue 440, the Other Party will provide a copy of State Workers' Compensation exemption.

All subcontractors shall be required to maintain Worker's Compensation.

The Other Party shall also purchase any other coverage required by law for the benefit of employees.

**Excess Liability:** This insurance shall protect the Other Party and the additional insured against all claims in excess of the limits provided under the employer's liability, commercial automobile liability, and commercial general liability policies. The policy shall be an "occurrence" type policy, and shall follow the form of the General and Automobile Liability.

**The liability limits shall be: \$10,000,000**

## **ADDITIONAL INSURANCE**

**Additional Insurance:** The City requires the following types of insurance.

**Contractors Pollution Liability:** which is a contractor base policy, which should be provided on an occurrence basis, Contractor Pollution Liability provides third-party coverage for bodily injury, property damage, defense, and cleanup as a result of pollution conditions (sudden/accidental and gradual) arising from contracting operations performed by or on behalf of the contractor.

**The liability limits shall be: \$1,000,000 OR**

**Environmental Impairment Liability:** The Other Party shall be responsible for purchasing and maintaining environmental impairment liability insurance. This insurance should cover the following types of environmental impairment: Sudden and Accidental, and Gradual.

**The liability limits shall be: \$1,000,000**

**Crane or Riggers Liability:** This insurance covers legal liability protection for the individual or business entity when acting as a rigger for the property of others in their care, custody and control.

**The liability limits shall be: \$1,000,000**

**Professional Liability/Malpractice/Errors or Omissions Insurance:** The Other Party shall carry professional malpractice insurance throughout the term of this Contract and shall maintain such coverage for an extended period of three (3) years after completion and acceptance of any work performed hereunder. At all times throughout the period of required coverage, said coverage shall insure all claims accruing from the first date of the Contract through the expiration date of the last policy period. In the event that Other Party shall fail to secure and maintain such coverage, Other Party shall be deemed the insurer of such professional malpractice and shall be responsible for all damages suffered by the City as a result thereof, including attorney's fees and costs.

**The liability limits shall be: \$5,000,000**

## **EVIDENCE/CERTIFICATES OF INSURANCE**

Required insurance shall be documented in Certificates of Insurance which provide that the City shall be notified at least 30 days in advance of cancellation, nonrenewable,

New Certificates of Insurance are to be provided to the City prior to coverage renewals.

Receipt of certificates or other documentation of insurance or policies or copies of policies by the City, or by any of its representatives, which indicate less coverage than required does not constitute a waiver of the Other Party's obligation to fulfill the insurance requirements herein.

**EXHIBIT F**  
**INDEMNIFICATION**



# Indemnification Contractor

To the fullest extent permitted by laws and regulations, and in consideration of the amount stated on any Purchase Order, the Contractor shall indemnify and hold harmless the City, its officers, directors, and employees from and against all third-party liabilities, damages, losses, and costs, (including but not limited to reasonable attorneys fees and court costs) to the extent caused by any acts of negligence, recklessness or intentional wrongful misconduct in the performance of the work by the Contractor, any Subcontractor, or any person or organization directly or indirectly employed by any of them to perform or furnish any of the work or anyone for whose acts any of them may be liable.

In any and all claims against the City, or any of its officers, directors, or employees by any employee of the Contractor, any Subcontractor, any person or organization directly or indirectly employed by any of them to perform or furnish any of the work or anyone for whose acts any of them may be liable, this indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any such Subcontractor or other person or organization under workers' or workmen's compensation acts, disability benefit acts, or other employee benefit acts, nor shall this indemnification obligation be limited in any way by any limitation on the amount or type of insurance coverage provided by the City, the Contractor, or any of his Subcontractors. To the extent this Indemnification conflicts with any provision of Florida Law or Statute, this indemnification shall be deemed to be amended in such a manner as to be consistent with such Law or Statute.

**Applicability:** It is the express intent of the Contractor that this agreement shall apply for the project(s) or time period indicated below. (Check and complete one):

\_\_\_\_\_ **Agreement is applicable to all contracts, purchase orders and other work performed for the City of Lakeland for the time period of not more than five (5) years.**

\_\_\_\_\_ to \_\_\_\_\_.  
(Date) (Date)

(OR)

\_\_\_\_\_ **Agreement is limited to Bid #, Purchase Order #, Requisition # \_\_\_\_\_, or Contract dated \_\_\_\_\_.**

**Subrogation:** The Contractor and his Subcontractors agree by entering into this contract to a Waiver of Subrogation for each required policy herein. When required by the insurer or should a policy condition not permit Contractor or Subcontractor to enter into a pre-loss agreement to waive subrogation without an endorsement, then Contractor or Subcontractor agrees to notify the insurer and request the policy be endorsed with a Waiver of Transfer of Rights of Recovery Against Others, or its equivalent. This Waiver of Subrogation requirement shall not apply to any policy, which includes a condition specifically prohibiting such an endorsement, or voids coverage should Contractor or Subcontractor enter into such an agreement on a pre-loss basis.

**Release of Liability:** Acceptance by the Contractor of the last payment shall be a release to the City and every officer and agent thereof, from all payment-related claims hereunder for anything done or furnished for, or relating to the work. City and Contractor waive all claims against each other (and against each other's parent company and affiliates) for any consequential, incidental, indirect, special, exemplary or punitive damages (including, but not limited to, loss of actual or anticipated profits (other than Contractor's profit on completed work), revenues or product; loss of business or reputation; loss by reason of shutdown or non-operation; increased expense of operation, borrowing or financing; loss of tax credits or other like incentives; loss of use or productivity; or increased cost of capital), and regardless of whether any such claim arises out of breach of contract or warranty, tort, product liability, indemnity, strict liability or any other legal theory.

**Savings Clause:** The parties agree that to the extent the written terms of this Indemnification conflict with any provisions of Florida laws or statutes, in particular Sections 725.06 and 725.08 of the Florida Statutes, the written terms of this indemnification shall be deemed by any court of competent jurisdiction to be modified in such a manner as to be in full and complete compliance with all such laws or statutes and to contain such limiting conditions, or limitations of liability, or to not contain any unenforceable, or prohibited term or terms, such that this Indemnification shall be enforceable in accordance with and to the greatest extent permitted by Florida Law.

\_\_\_\_\_  
Name of Organization

**BY:**

\_\_\_\_\_  
Signature of Owner or Officer

\_\_\_\_\_  
E-mail Address

**STATE OF :** \_\_\_\_\_

\_\_\_\_\_  
Organization Phone Number

**COUNTY OF:** \_\_\_\_\_

The foregoing instrument was acknowledged before me, by means of physical presence, this \_\_\_\_ day of \_\_\_\_\_, 2022.

by \_\_\_\_\_, of \_\_\_\_\_.  
Printed Name of Owner / Officer Corporate or Company Name

He/She is personally known to me or has produced \_\_\_\_\_ as  
State Drivers License Number

identification, and did \_\_\_\_\_ / did not \_\_\_\_\_ take an oath.

\_\_\_\_\_  
Signature of Person Taking Acknowledgment

\_\_\_\_\_  
Printed Name of Person Taking Acknowledgment

\_\_\_\_\_  
Notary Seal

**CITY OF LAKELAND**

Revised: January 11, 2021

**BY:** \_\_\_\_\_  
Joyce Dias, Risk Management & Purchasing Director

**DATE** \_\_\_\_\_

**EXHIBIT G**

**PROJECT SCHEDULE**



**SECTION 013216**

**PROJECT SCHEDULE**

**PART 1 – GENERAL**

101. **EXTENT**

101.1 This Section 013216 outlines the requirements for Project Controls which are to be set in place for the Owner to accurately and transparently evaluate the status of the Work with regard to the Contractor's schedule, cost and performance of the Work. Contained in this Section are Contractor's requirements for the Proposal Project Schedule, the Detailed Project Schedule, Resource Loading, Schedule Updates, Progress Reporting and Owner required and controlled schedule dates.

102. **GENERAL SCHEDULE REQUIREMENTS**

102.1 The Contractor shall employ and retain experienced personnel and, provide appropriate support to plan, develop, provide, and properly maintain schedules, progress reports, earned value information, estimate and budget development, plans, cost reporting, cost forecasting functions, and invoicing in accordance with requirements of the Contract, including the Project Controls requirements. These practices relate, among other things, to Planning and Scheduling, Progress Measurement and Earned Value, Cost Control, and Change Management of the Work. The Contractor is responsible for ensuring that Owner is informed at all times of the status of the Work, changes in personnel, changes in the Work scope, changes in the planned Work sequences, changes to the remaining Work schedule, unplanned interferences to performing the Work, and any actual or potential delays to the Work regardless of the source or reason.

102.2 The Contractor shall provide the name, email address, qualifications, experience, general contact information and title of its representative who is responsible for developing, accessing and maintaining the Contractor's schedule. Once submitted and approved by Owner, such designated person shall not be replaced without written approval by Owner.

102.3 Contractor must meet or exceed the Project Controls requirements and provisions detailed in the Contract, including those identified by this Section 013216.

102.4 The Contractor must have a formal policy that endorses the use of configuration management and defines key roles and responsibilities. The Contractor must also ensure that sufficient resources are provided to adequately implement the configuration management process. The Contractor should establish and document the configuration management requirements at the earliest practical time prior to initiation of the schedule development activities.

- a. Configuration Management is used to enforce four primary goals: (1) ensure that a disciplined approach is used in changing approved/issued documentation, (2) changes must be applied consistently through all impacted documents, (3) source documents are identified, and (4) the Baseline is maintained as current throughout the Project.

102.5 The Detailed Project Schedule shall be a CPM (Critical Path Method) schedule composed of respective detailed activities ("Detailed Activity(ies)") logically tied together to form a comprehensive single project schedule network.



- 102.6 The Contractor must work collaboratively within the Owner's Project Schedule System and with Owner's Project Controls Representative(s) (or Owner's Engineer Project Controls Representative) to ensure the requirements and provisions as identified by this Section 013216 are met.
- 102.7 Schedule Hosting Environment requirements are as follows:
- a. The Owner will provide the hosting environment where Contractor's Detailed Project Schedule will reside along with other Contractor and Supplier schedules which the Owner will incorporate to create a Master Project Schedule.
  - b. The Contractor will have access to and maintain and update its portion of the Detailed Project Schedule. Access to the Owner Engineer's Primavera Project Enterprise System P6 database will be provided via a Web based service such as LoadSpring Solutions, LLC ("LoadSpring") or a Virtual Private Network (VPN) connectivity to the Owner's scheduling software.
  - c. Identified Project team member will be provided with limited "write" access to the Master Project Schedule for their company only. At no time will the Contractor be allowed to alter any P6 activity relationships to or from other parties' Project Schedules maintained in the Owner's hosting environment.
  - d. Contractor may begin development of their respective Detailed Project Schedule within its own Primavera P6 databases with the understanding that the Contractor's Detailed Project Schedule will be transferred to the Owner using an XER backup and be incorporated into Owner's Master Project Schedule after the Contractor's Detailed Project Schedule has been approved and accepted by the Owner as the initial Baseline. Once the Contractor's Detailed Project Schedule has been transferred, the Contractor shall access and maintain Contractor's Detailed Project Schedule within the Owner's Project Enterprise System.

102.8 New Schedules are to be created in a planning/developmental node. Titles for the new schedules should be structured using the following naming conventions:

Project ID	Project Name
01.29.01.01-XX-Y	Proposed Project Schedule (example)

The Project ID consists of the first 4 levels of the WBS, followed by a revision letter "XX" while under development. Once the schedule is approved by the Owner, the revision becomes a numeric value. The suffix "Y" is determined by the schedule type, where a "C" designates the current schedule, "BL" designates a baseline schedule, and an "A" designates an archived schedule.

102.9 Owner Activity Code Structure. Owner will provide, and Contractor shall utilize, an activity coding structure for the Project Schedule. In addition to Owner's codes, Contractor may utilize additional coding as may be required for Contractor's internal use and reporting. Owner's initial activity coding structure is identified upon award. Owner reserves the right to change and enhance Owner's schedule coding structure as Owner deems appropriate throughout the Project. Contractor will incorporate Owner's changes and enhancements to the Owner activity coding structure in the Detailed Project Schedule at no additional cost to the Owner.



102.10 The Contractor’s schedule shall be carried out in accordance with Table 013216-1 and the Submittal Schedule given in Section 013324 of this Specification. It shall be the Contractor’s responsibility to maintain the progress of its Work in accordance with the schedule.

Table 013216-1  
Owner-Required and Milestone Schedule Dates

No.	Item	Date	Liquidated Damages?*
1	Contractor Mobilization	08/03/2022	No
2	Stormwater Ponds Complete	08/26/2022	No
3	Site Preparation & Heavy Haul Modifications Complete	08/30/2022	No
4	Engine, Engine Hall, and Exhaust Gas Duct Structure Piling Complete	10/14/2022	No
5	SCR, Stack and GSU Piling Complete	10/19/2022	No
6	Engine Foundations Complete	12/06/2022	No
7	Engine Hall Foundations Complete	12/1/2022	No
8	Electrical Equipment Building Foundation Complete	01/04/2023	No
9	Balance of Plant Foundations Complete	12/06/2022	No
10	Underground Piping Complete	11/28/2022	No
11	Electrical Duct Banks Complete	12/22/2022	No
12	Complete All Punch List Work	01/11/2023	Yes
13	Complete Demobilization	01/8/2023	No

\*Contractor shall refer to the terms and conditions governing Liquidated Damages set forth in the Contract.

The term “Foundations Complete” is defined as the day after the seven (7) day curing period has been completed, for all items other than the Engine Foundations. In the case of the Engine Foundations, “Foundations Complete” corresponds to the date on which the concrete has achieved at least 75% of the specified compressive strength as determined by ASTM C1074 via the Maturity Method, or by testing field cured cylinder specimens.

Table 013216-2  
Owner-Controlled Schedule Dates

No.	Item	Date
1	Pre-Bid Walkdown (Non-mandatory)	04/26/2022
2	Proposals Due	05/16/2022
3	Estimated Contract Award	07/21/2022
4	Plant Available to Contractor to Begin Work	07/22/2022
5	Engine Hall Foundation Issued for Construction	07/25/2022

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No.	Item	Date
6	Heat Recovery Buffer Tank Foundation Issued for Construction	08/02/2022
7	Electrical Building Foundation Issued for Construction	08/08/2022
8	Radiator Foundation Issued for Construction	08/11/2022
9	Hall Ventilation Equipment Foundations Issued for Construction	09/06/2022
10	Oily Water Separator Delivery	09/28/2022
11	Sanitary Lift Station Delivery	11/09/2022
12	Complete Installation	12/31/2022

103. PROPOSAL PROJECT SCHEDULE REQUIREMENTS

103.1 The Contractor shall submit with its proposal a comprehensive Proposed Project Schedule. The Proposed Project Schedule shall be of sufficient detail to identify, at a minimum:

- a. The general approach and sequence of the Work, as outlined in the Installation Plan to be developed by the Contractor in accordance with the Scope of Work given in Section 011100 and Attachment 9 of this Technical Specification.
- b. Anticipated award date
- c. The Owner-Required Schedule dates as set forth in 013216-1.
- d. The Owner-Controlled Schedule Dates presented in 013216-2.
- e. The material delivery dates as identified in 013216-1.
- f. Construction-related engineering.
- g. Material procurement by Contractor.
- h. Submittal of shop detail and erection drawings for components supplied by Contractor.
- i. Significant interface points between the Owner and Contractor, including material and/or components that will be provided by the Owner or Contractor.
- j. Planned delivery dates for material and components furnished by Contractor.
- k. Start and completion of fabrication periods for material furnished by Contractor.
- l. Start and completion for each key component's fabrication, assembly and/or subassembly on site.
- m. A Proposal Project Schedule that provides sufficient detail to describe the Detailed Activities for all planned tie-in Outages
- n. Submittal of all other information as defined in Section 013324 List of Submittals

103.2 The Proposal Project Schedule shall be in the form of a bar chart or Gantt chart, and must show the logical flow and progression of the Work and the anticipated critical





path(s). As a minimum, the work associated with engineering, material procurement, construction, outage, and completion shall be segregated.

104. DETAILED PROJECT SCHEDULE DEVELOPMENT

104.1 Contractor's schedule shall be executed in accordance with Table 013216-1, the schedule provided in the Contract and the Submittal Schedule in Section 013324. It shall be the Contractor's responsibility to maintain the progress of its Work in accordance with the schedule.

104.2 Schedules provided by Contractor are subject to Owner review, comments, and approval as outlined in Section 105 below. The Owner's review or approval of any schedule is solely for the purpose of assuring the Owner that the applicable Contractor's schedule submission meets the intent of this Section. The Owner's review or approval does not constitute a guarantee or agreement by the Owner that the submitted schedule is complete or is otherwise executable by the Contractor.

104.3 Project Controls Kickoff Meeting. Within seven (7) days of contract award, Contractor and Owner shall conduct a Project Controls Kickoff Meeting including their respective Project Controls, designated Project Management personnel, information technology and finance personnel, to discuss the Project Controls, schedule, hosting access, schedule links, EVMS, invoicing, cost reporting, change management, risk management and asset management requirements and Project procedures discussed in this Section. Owner will provide initial review and training of Owner-provided systems, such as LoadSpring, at this time. As necessary, additional meetings will be scheduled between Owner and Contractor to assure that both parties have a complete understanding of the requirements, systems, and procedures. Contractor shall submit to Owner for review, Contractor's proposed long-term Schedule Maintenance Procedures ("SMP"). To the extent that there are inconsistencies between the SMP and the Contract, the Contract shall govern.

a. The goal of the Project Controls Kickoff Meeting shall be to establish a simple, bullet format desk outline that addresses:

a1. P6 WBS Structure and Titles.

a2. Global Activity Codes and dictionary definitions.

a3. EPS and/or Project Activity Codes and definitions (if used).

a4. Resource dictionary and titles.

a5. Resource Codes and dictionary definitions.

a6. Cost Account Codes and dictionary definitions.

a7. User Defined Fields (Activity / Resource) defined for generic use and purpose.

a8. Calendar Definitions.

a9. P6 Activity Step Templates (if used).

a10. Time Impact Analysis procedures.

a11. Special formatting issues such as Activity Numbering.



- a12. Owner's Schedule Hosting Environment access and use.
  - a13. Plan for supporting Update Process and Cycles.
  - a14. Plan for Schedule/Cost Change Control.
  - a15. List of key contacts (name, email address, phone).
- 104.4 Bar Chart Schedule. Within fourteen (14) Days after contract award, Contractor shall submit to Owner for review, a comprehensive bar chart schedule that identifies all major phases, work areas, structures, and Detailed Activities associated with the entire scope of Contractor's Work. This schedule shall include any anticipated work not yet awarded to the Contractor and shall include all Owner Milestone Dates identified in Table 013216-1.
- 104.5 The term days is defined as calendar days.
- 104.6 Detailed Project Schedule
- a. Within fourteen (14) Days after contract award, Contractor shall submit its Detailed Project Schedule along with a detailed Project Execution Plan, addressing all aspects of the design process, material procurement, document submittals (refer to Section 013324 for the list of submittals), fabrication, inspections, material receipt and storage, assemblies, subassemblies, construction and erection, and turn-over sequences to the Owner that will satisfy the dates per Table 013216-1 and Section 013324 for Owner's review and approval.
  - b. Owner Review and Comment.
    - b1. Following submission by Contractor, the Owner will have fourteen (14) Days to review and comment on the submitted Detailed Project Schedule. Unless otherwise agreed by the Parties, on or before ten (10) Days following Contractor's receipt of Owner's comments on the proposed Detailed Project Schedule, Owner and Contractor will meet to discuss Owner's findings. No later than fourteen (14) Days following owner and Contractor's meeting, Contractor shall incorporate all agreed upon changes, including changes required by the Contract, and resubmit the proposed Detailed Project Schedule to Owner for consideration. The above process of resubmission, review, meeting, and incorporating corrections shall continue until Owner approves the Detailed Project Schedule at which time that Detailed project Schedule will be designated as an approved Detailed Baseline Schedule and shall be used as the initial Baseline Detailed Project Schedule.
    - b2. In the event Owner rejects the proposed Detailed Project Schedule, and while the draft Detailed Project Schedule is being revised and approved, Owner may elect to have Contractor start updates on one of the rejected draft Detailed Project Schedules, as a parallel schedule file. Upon Owner's written approval of the Detailed Project Schedule, Contractor will transfer Owner-approved status information from the parallel updated schedule file to the approved Detailed Baseline Schedule to assist in expediting the development and reporting of the status updates.
    - c. In the case of start milestone dates identified in Table 013216-1 or anticipated delivery dates identified in Table 013216-1, work shall not be scheduled to start any sooner than shown, unless approved by the Owner. In the case of completion milestones, the Work shall be scheduled to complete on or before the dates identified in Table 013216-1.



- d. The Detailed Project Schedule shall be completed using the Primavera Enterprise P6 v7.0 scheduling software unless a different scheduling software or version is approved by the Owner.
- e. The Detailed Project Schedule and all Detailed Project Schedule updates shall, at a minimum, include the following characteristics:
  - e1. The Detailed Project Schedule shall be of sufficient detail to assure adequate planning and execution of the Work, such that, in the judgment of Owner, it provides an adequate basis for monitoring and evaluating the progress of the Work.
  - e2. Contractor's Detailed Project Schedule shall be in the form of a single schedule network depicting the entire scope of the Contractor's efforts to complete the Work. The schedule network shall be complete with no open ends, other than one activity indicating the Project award milestone. All Detailed Activities shall be tied to both start and completion milestones. All Detailed Activities and milestones shall be sequenced together in a logical order to form float paths. All float paths shall ultimately lead to and be logically tied to a related intermediary start and completion milestone as defined by Table 013216-1. Intermediate start and completion milestones and completion interface milestones shall be tied to the Project completion milestone.
- f. Submittal Detailed Activity requirements are as follows:
  - f1. As required to meet the dates set forth in Table 013216-1, Contractor shall include Detailed Activities that fully identify and delineate the time and logical sequences for the development, submittal, review, and return of each drawing or drawing package, data, calculations, or other documents as set forth in the Contract, including this Technical Specification.
  - f2. As appropriate, the submittal Detailed Activities shall be properly sequenced and logically related to the appropriate engineering, manufacturing, inspection, and delivery tasks so that the status of individual submittal Detailed Activities reflect on the projected schedule dates of the related and logically tied Detailed Activities.
  - f3. The submittal Detailed Activities shall include a period of not less than twenty (20) Days, or as otherwise set forth in the Technical Specifications, for the Owner's Engineer to review each initial submittal. The Owner's Engineer's review period will commence when the electronic submittal is received by the Owner's Engineer and will end when the submittal is returned or is otherwise discharged by the Owner's Engineer.
  - f4. The submittal Detailed Activities shall allow for a minimum of one Contractor re-submittal and one Owner re-submittal review period or additional re-submittal periods based on the Contractor's experience, for each required submittal. Owner and Contractor shall mutually determine how this allowance will be incorporated into to the Detailed Project Schedule allowing for full transparency and identification.
- g. Contractor and Owner-Supplied Material requirements are as follows:
  - g1. The Detailed Project Schedule shall account for both the Contractor's procurement of key materials and those items being supplied by the Owner. All significant or key material deliveries will be tracked separately and identified with "Delivery Received" milestones in the Detailed Project Schedule that will be logically tied to all related on-site schedule installation activities that are dependent upon the associated delivery to proceed.



Deliveries controlled or managed by the Owner shall be identified separately from those controlled by or managed by the Contractor.

- g2. The Contractor-supplied materials shall be shown in the Detailed Project schedule with an appropriate level of detail that facilitates detailed in-progress status reporting of key elements for each item of procurement. Key elements shall include, but not be limited to: award; release to fabricate; fabrication; shop drawing and product submittals; QA/QC hold points; and individual deliveries of key components matching the level of detail contained in the Contractor's construction schedule. Any planned material deliveries which include multiple deliveries spanning a time greater than seven (7) Days shall each be scheduled and tracked separately. Each key or significant delivery shall be logically tied to a corresponding Contractor "Delivery Received" milestone, which in turn will be logically tied to the on-site schedule installation Detailed Activities which are contingent on the delivery. Following Owner's reasonable approval, bulk or common materials require only Start and Complete Delivery milestones and need only be logically tied to the first and last installation Detailed Activity that would be contingent upon the associated deliveries.
- g3. In the case of material deliveries by the Owner and Owner-Controlled Dates, the dates for the Owner "Delivery Received" milestones in the schedule will be established by the application of "Finish On or After" date constraints in the P6 software for each milestone. These dates will conform to the dates listed in Table 013216-1. The Contractor will coordinate with the Owner, as necessary, to identify changes in Owner delivery dates due to awarded contracts, known status updates, or approved changes.
- h. Fabrication, Inspection and Delivery Detailed Activity requirements are as follows:
  - h1. The Contractor's Detailed Project Schedule shall include a detailed fabrication, inspection, and delivery Detailed Activities for items furnished and/or installed by the Contractor. The fabrication, inspection, and delivery Detailed Activities shall address all major or significant procurement and fabricating steps or processes, including the creation of shop detail and erection drawings for all materials, assemblies and subassemblies and products being provided. In addition, any required or anticipated key hold points and key inspections required by this Technical Specification or by the Contractor's own procedures shall be identified and accounted for in the fabricating, inspection and delivery Detailed Activities. Any Owner-required releases, inspections, or reviews shall be clearly identified in the Detailed Project Schedule.
  - h2. As required to meet the dates set forth in this Technical Specification, the fabricating, inspection, and delivery Detailed Activities shall identify all deliveries including bulk materials, subassemblies, assemblies, structural steel, process piping, and products to be installed. The Detailed Project Schedule installation sequences and dates shall be subject to further coordination with the Owner, Owner's Engineer, and Owner's Other Contractors.
  - h3. Partial deliveries with distinct separate delivery times (i.e., greater than seven (7) days apart) shall include multiple delivery activities (e.g., 0-50%, 51 to 100%) to be coordinated with the receipt of the component on site.
  - h4. Contractor may release Subcontractors' engineering as needed to meet the engineering deliverables schedule.
- i. The Detailed Activities in the Detailed Project Schedule shall meet the following criteria:



- i1. Conform to and include the Owner's requirements for common schedule coding structures, WBS codes, calendars, etc., in accordance with the Owner's guidelines to be provided at award.
- i2. As reasonably feasible, the Detailed Activities shall be divided by separate or distinct areas and features of the Work as identified by the Owner's WBS and schedule codes provided by the Owner, further divided into the lowest practical level of detail representing single operations, identifiable deliverables, or identifiable actions that are performed by specific groups, individuals, or entities. Separate Detailed Activities shall not be combined if they can be easily tracked individually or require the passing of a deliverable from one distinct group to another.
  - i2.1 Field operations involving pre-erection fabrication will be divided from erection work. Installation shall be further divided by the distinct operations carried out by individual crews or labor trades in a single continuous operation.
  - i2.2 Non-continuous work will be divided into separate Detailed Activities.
  - i2.3 Subcontracted work tasks will be separated from the Contractor's self-performed work tasks.
  - i2.4 Significant QA/QC Detailed Activities or hold points will be included in the schedule.
  - i2.5 Any rehab, replacement, or temporary work shall be broken out separately for each work phase and area.
  - i2.6 Testing and turnovers will be shown separate from installation work.
- i3. Planned Detailed Activity durations shall be no greater than the following, unless the Contractor can show good reason why it would be impractical to meet these requirements:
  - i3.1 Thirty (30) Days for engineering related work,
  - i3.2 Sixty (60) Days for procurement related work, and
  - i3.3 Fourteen (14) Days for site construction related work.
- i4. Original and subsequent remaining durations shall take into account weather conditions that the Contractor or their Subcontractors can reasonably anticipate for the planned operation and seasonal conditions.
  - i4.1 Failure to include a reasonable anticipation of weather shall not be grounds for a request for a Project time extension under Section 18.
- j. Individual Detailed Activities must clearly delineate the representative work and work area to be performed in the Detailed Activities descriptions. No two Detailed Activities shall have the same description. When common or repetitive Detailed Activity work task descriptions are used in multiple Detailed Activities, each will include unique descriptive words to distinguish one Detailed Activity from other without the use of coding or WBS
- j1. Non-milestone Detailed Activities shall begin with an action verb, where appropriate. (e.g., install, adjust, erect, test, etc.) Milestone descriptions shall include a form of the word Begin or Complete and Milestone where appropriate.



- k. The Project shall be scheduled in units of days accounting for various shift work, as applicable. Each Detailed Activity in the Detailed Project Schedule shall be assigned a Project scheduling calendar per the Owner's Master Project Schedule lists of calendars, available at award. As needed, the Contractor may request that additional Project scheduling calendars be created by the Owner. Once Baseline, work calendars shall not be changed without written notification to the Owner, including the reasons for this change.
- l. For purposes of interfacing the Contractor's Detailed Project Schedule with the Owner's Master Project Schedule, the Contractor will provide "Installation Interface" milestones representing work areas or items of work to be turned over to the Contractor from the Owner or those work areas or items to be turned over by the Contractor to the Owner. Interface Milestones shall be clearly identified and be logically tied to all associated work or float paths. In cases where the interface is provided by the Owner, the Contractor will include a "Finish On or After" date constraint representing the date contained in Table 013216-1. The Contractor will coordinate with the Owner as necessary to identify changes in the Owner interface dates due to awarded contracts, known status updates, or approved changes.
- m. Constraints and Schedule Tie requirements are as follows:
  - m1. The Contractor's Detailed Project Schedule shall minimize the use of artificial date constraints for purposes of calculating either early or late dates, other than to indicate contractual start or completion dates. When artificial date constraints are used, the purpose of each date constraint will be recorded in the schedule activity "Notes" log (e.g., Date Constraint xx/xx/xx used to indicate Contract Completion Milestone Date). Contractor shall not use Mandatory Start or Finish constraints in developing or maintaining the Detailed Project Schedule.
  - m2. The Contractor's use of "start to start" or "finish to finish" schedule logic shall be kept to a minimum. When start to start logic types are used, the finish of the affected predecessor activity shall have a finish successor defined in order to avoid possible open ended Detailed Activity finishes. When finish to finish logic types are used, the affected successor create and manage the EVS Activity shall have a defined predecessor start.
  - m3. The Contractor's use of "finish to start" schedule logic shall be maximized as a direct outcome of the level of detail Owner desires in the Detailed Project Schedule. The Contractor's use of "finish to start" schedule logic with time lags shall be kept to a minimum. In no case shall a finish to start logic with a time lag represent work effort that otherwise could be represented by a Detailed Activity (i.e., coating cure time, inspection hold, Owner review, hoisting equipment movement). When the Contractor deploys the use of time lags on finish to start logic, the purpose and objective for the time lag shall be recorded on the predecessor's create and manage the EVMS Activity "Notes" log. The Contractor will be responsible to monitor and maintain all deployed time lags to assure that they accurately reflect the Contractor's current work plan.
- n. Resource Loading requirements are as follows:
  - n1. Once approved by the Owner as a Baseline, each engineering and field installation Detailed activity in the Detailed Project Schedule that requires physical effort to perform to include anticipated Subcontractor's work, but other than the Owner's reviews, milestones, time related holds, shall be assigned an estimated amount of direct man-hours broken down by discipline and craft by the Contractor. The purpose of the work



hour assignments will be to provide an estimated work effort weight or weighted value of each task relative to each other and relative to the overall work effort of the Contractor. This information will be used to establish time based planned progress and to generate planned performance indices in the form of an Earned Value Management System (“EVMS”). Such EVMS shall include the following:

- n1.1 Direct man-hour resources will include the assigned hours for each resource type applied.
- n2. The Contractor will predetermine for each Detailed Activity resource loaded in the schedule, the method to quantify the physical progress made as the work is executed, expressed as a percentage of completion. This predetermination will be referred to as the “Rules of Credit” (ROC). This information will be used by the Contractor and verified by the Owner to establish the percentage of completion for each Detailed Activity resource loaded in the schedule.
  - n2.1 This percentage of completion will be multiplied by the pre-established resource loading man-hours to determine the “Earned” man hours and current progress.
  - n2.2 This information will be used to establish a basis to compare current progress against the planned progress and to generate periodical performance indices.
- n3. ROC are a form of progress measurement and will be predetermined by the Contractor and approved by the Owner. The ROC will be tailored to specific tasks and be used to establish the physical percentage of completion as work progresses on the applicable Detailed Activity. ROC do not have to perfectly represent the actual quantities but must be reasonably evident and measurable. Proposed ROC are to be submitted with the Detailed Project Schedule. Acceptable ROC methods may include but are not limited to:
  - n3.1 Establish percentages to multiple actions or multiple deliverables contained in a single Detailed Activity whose total does not exceed 100% (e.g., develop preliminary drawing = 50%, internal review and comment on preliminary drawing = 20%, edit and issue final drawing for approval = 30%).
  - n3.2 Establish key material quantities to be installed that will be measured against actual quantities installed. (e.g., 50 tons of steel installed / 100 tons planned = 50%).
  - n3.3 Establish operational planned quantities that will be measured against actual quantities performed (e.g., 400 lf of pipe weld performed / 4000 lf planned = 10%).
  - n3.4 Establish “Steps” in the applicable Detailed Activity which identifies specific operations (e.g., forms = 30%, rebar and embeds = 50%, pour = 10%).
  - n3.5 Contractor will keep on record and provide to Owner if asked their ROC calculations that established the claimed percentages of completion.
- o. All payment milestones in the schedule of values shall be included in the Detailed Project Schedule with at least one predecessor and one successor. This information will be used to establish an activity driven contract value spend report and confirm the achievement of individual payment milestones.



105. OWNER'S REVIEW AND APPROVAL OF CONTRACTOR'S DETAILED PROJECT SCHEDULE:
- 105.1 Detailed Project Schedule Approval
- a. The Contractor's submittal of the full Detailed Project Schedule will be subject to the Owner's review, comment, and approval, in accordance with the Contract. The submission shall be in the form of a Primavera P6 XER file along with printouts depicting the following:
    - a1. Early and late dates for the Detailed Project Schedule Detailed Activities.
    - a2. Planned durations and total float for the Detailed Project Schedule Detailed Activities.
    - a3. The Detailed Project Schedule critical path and all near critical paths that are within thirty (30) days of the critical path.
    - a4. Executive Summary Level (a.k.a. Level 1) Bar Chart representing the summary totality of time used for the primary engineering, procurement, deliveries, and construction, along with Owner Required Milestones identified in Table 013216-1 for each Facility as taken from the P6 schedule data file.
    - a5. A Management Summary Level (a.k.a. Level 2) Bar Chart representing in summary fashion individual Engineering Discipline efforts, Key Material Procurements, Construction by Areas, and Key Systems Testing along with Owner Required Milestones identified in Table 013216-1 for each individual unit as taken from the Detailed Project Schedule P6 schedule data file.
- 105.2 Owner shall provide written comments and approval status within fourteen (14) Days of submission. As deemed appropriate by Contractor, Owner and Contractor shall meet as soon as practical, but no later than ten (10) Days, after Owner's comments are received to review and discuss necessary changes or corrections that Owner will require. As necessary, resubmission of the Detailed Project Schedule addressing any required changes will occur within twenty-eight (28) days after receipt. This process will repeat until the Detailed Project Schedule is accepted by the Owner as being in compliance with Article 104.
- a. In the event the Contractor fails to secure Owner approval of the Detailed Project Schedule, Contractor shall maintain and update a version of the Detailed Project Schedule as a separate P6 schedule file at least once every fourteen (14) Days. Such updates and maintenance shall include work progress, changes in percentages of completion, actual dates, changes in remaining durations, changes in planned work sequences, and changes in work scope. Any and all updates shall be provided to the Owner shall be in the form of a P6 XER file and a printable file. Once the Detailed Project Schedule has been approved, all prior maintenance and status updates shall be transferred onto the approved Detailed Project Schedule, forming the first update.
  - b. The Owner's review or approval of the Detailed Project Schedule is solely for the purpose of assuring the Owner that the Contractor's Detailed Project Schedule meets the intent of this Section. The Owner's review or approval does not constitute a guarantee or agreement by the Owner that the submitted Detailed Project schedule is complete or is otherwise executable by the Contractor.





105.3 Failure by the Contractor to submit either the Detailed Project Schedule by the times specified or in the manner prescribed shall give the Owner the right withhold any and all payments due Contractor until such time Contractor has fully complied the requirements listed in Section 013216, Article 104.

106. BASELINE DETAILED PROJECT SCHEDULE

- a. Once submitted and approved by the Owner, the approved Detailed Project Schedule file shall be presented and designated as the “Baseline Detailed Project Schedule.” The Baseline Detailed Project Schedule, or subsequently approved Baseline Detailed Project Schedule revisions, shall be used to measure and evaluate all schedule progress.
- b. Owner’s goal and preference is to avoid and minimize the need to Re-baseline if possible. Any changes to the Baseline Detailed Project Schedule, including Re-baselining or resourcing changes or change order maintenance, will be subject to the Owner’s review and approval. All subsequently approved Baseline Detailed Project Schedule Re-baselining or Baseline Maintenance revisions shall be assigned a sequential number; shall have the schedule files preserved for future reference; and shall replace the prior Baseline Detailed Project Schedule revision as the baseline from which to measure and evaluate the Contractor’s Project progress.
- c. After submittal of the Detailed Project Schedule, the Contractor is required to use the Owner’s scheduling database for their computerized scheduling. The original baseline will be duplicated in a working file that Contractor will maintain and update on a periodic basis as described in Article 108 of this Specification to accurately reflect completed work, in progress work, and the planned sequence and timing of the remaining work.
- c1. Until such time that the Detailed Project Schedule is approved by the Owner as the Baseline Detailed Project Schedule, the Owner may request Contractor to update a Detailed Project Schedule as a parallel schedule file. Upon approval of a Baseline Detailed Project Schedule, Contractor will transfer status information from the parallel updated schedule file to the Baseline Detailed Project Schedule Baseline Detailed Project Schedule to form the first approved schedule update in order to assist in expediting the development and reporting.
- d. Within fourteen (14) Days after approval of the Baseline Detailed Project Schedule, the Contractor shall provide the Owner for review, comment and approval a fully resource loaded Baseline Detailed Project Schedule as described in Article 108 of this Technical Specification of all engineering, procurement, construction and start-up Detailed Activities, including those performed by Subcontractors. The resources in the schedule shall equal the direct work hours as bid by Contractor and posted in the proposal pricing pages under the heading of “Man-Hours” for each task. With this submission, Contractor will also submit its proposed Rules of Credit (ROC).The Resource loading and ROC shall be subject to Owner’s review and approval.
- d1. Submission shall include as a minimum:
  - d1.1 Resource Loaded P6 XER file,
  - d1.2 Manpower tabulations: by Detailed Activities, by WBS, by Responsibility codes and by Construction Areas,
  - d1.3 Manpower histograms and S-curves; by Responsibility codes, by WBS and by Summary Total,



- d2. Manpower histograms by Responsibility codes, by WBS and by Summary Total.
- d3. Owner will provide the Contractor with Owner's review comments and approval status for both the Resource Loading and ROC within fourteen Days after submission. Contractor will work cooperatively to resolve any issues brought forth by Owner review and as necessary correct and or resubmit the Resource Loaded Schedule.
- d4. In cases where engineering or installation Work will be performed by a yet to be awarded Subcontractor as of the Resource Loading submission, Contractor will reasonably estimate the man hours to be included in the schedule resource loading for such work. Once awarded, the Subcontractor shall provide the Contractor with a corrected resource loading. Contractor shall give written notice to the Owner when such situation does occur and shall secure the Owner's written approval and procedure use the updated resource loadings.
- e. Once the Baseline Detailed Project Schedule has been approved, the Contractor shall not, without the Owner's prior written approval and consent, make the following changes to any Baseline or subsequent schedule updates:
  - e1. Delete or modify a schedule activity ID number.
  - e2. Substantively change a Detailed Activity description so as to modify the general scope of work that each Detailed Activity in Detailed Project Schedule was intended to cover.
  - e3. Modify the work hours loaded into the schedule.
  - e4. Change or modify a calendar or change or modify the assigned calendar to individual Detailed Activities.
  - e5. Change or modify the Owner's WBS or Project coding.
- 106.2 Following the establishment of the Baseline Detailed Project Schedule, the Contractor will assist the Owner, as necessary, to merge the approved Baseline Detailed Project Schedule into the Owner's Master Project Schedule. Assistance will generally be to verify the logical ties from the Contractor's Delivery Completion Milestones to the related Detailed Activities in the field erection schedule. Additional assistance may be requested to modify the Contractor's erection sequence to better match and optimize the other field erection schedules either at the time of merging the Baseline Detailed Project Schedule with the Master Project Schedule or later when the other field erection schedules baseline has been established. Any changes resulting from merging the approved Baseline Detailed Project Schedule into the Owner's Master Schedule shall not be subject of a change order unless the Owner's Required Schedule Dates in Table 013216-1 are modified. Any modification to the Owner's Required Schedule Dates in Table 013216-1 must be approved through the change order process.
- 107. MASTER SCHEDULE
- 107.1 The Contractor's Detailed Project Schedule shall be compatible with the Owner's overall Project schedule ("Master Project Schedule") that will contain the detailed schedules of other suppliers and field erectors. As a minimum, the following shall apply to this requirement:
  - a. Each Detailed Activity in the Detailed Project Schedule shall meet the needs of the Owner's Master Project Schedule; should these needs change, the Contractor shall



adjust the installation sequences, add Detailed Activities or milestones, adjust delivery or interface milestone dates, or adjust the level of detail in their Detailed Project Schedule as determined by the Owner.

- b. The Owner will determine and maintain the schedule interface points between all Owner, Contractor, and Owner's Other Contractors in the Master Project Schedule, which will include any schedule logic ties, with the assistance of the Contractor. Any Contractor-suggested adjustments to the schedule interface points will be brought to the Owner's attention for the Owner's consideration. Contractor shall highlight all non-Contractor interface points with the Owner, vendors or other external entities that could impact the schedule and execution plan. Contractor will assume overall schedule integration to assure linkage of those interfaces within the schedule.
- c. The Detailed Activity ID characters shall include a reservation for the Owner's assignment. The number of reserved characters shall be determined by the Owner at a later date.
- d. The sequencing of these Detailed Activities will be used by the Owner in the Master Schedule as the primary interface points and schedule logic ties to the other field erection activities.
- e. The Master Project Schedule will be contained and maintained in the Owner's Schedule Hosting Environment.

108. DETAILED PROJECT SCHEDULE UPDATES

- 108.1 Once the Detailed Project Schedule has been submitted and approved as the Baseline Detailed Project Schedule, the Contractor shall continuously show evidence of the orderly progress, consistent with the Table 013216-1 and the schedule in the Contract by updating the Detailed Project Schedule and providing written progress reports.
- 108.2 Schedule updates shall occur periodically during the performance of the Work, except as required for recovery plans as noted in the Contract. The exact timing and method of each schedule update and report submission will be confirmed with Owner.
- 108.3 Frequency of Schedule Updates.
  - a. Schedule status updates shall occur every thirty (30) Days for the first 180 Days after contract award or more frequently if the Owner determines this would be advisable to assure schedule compliance. The schedule status date will be the last business day of the month at 11:59 pm.
  - b. After the first 180 Days after contract award, schedule status updates shall occur every fourteen (14) Days until Contractor Mobilization, or more frequently if the Owner determines this would be advisable to assure schedule compliance. The schedule status date will be every 14th Day at 11:59 p.m.
  - c. Following Contractor Mobilization, schedule status updates shall occur every seven (7) Days or more frequently if the Owner determines this would be advisable to assure schedule compliance. The schedule status date will be every seven (7) Days at 11:59 p.m.
  - d. The Contractor's schedule updates of the Detailed Project Schedule shall continue until the Work has been completed.



- 108.4 All updates shall comply with the following requirements:
- a. Reflect Contractor's then-current means and methods, planned or anticipated sequences, planned or anticipated dates, and any known or anticipated delays.
  - b. Determine the current percentage completion status of all Detailed Activities by calculating actual progress by the approved ROC Guidelines, or other approved Earned Value Management practices.
  - b1. When requested by Owner, Contractor will provide information and back-up support to validate methods used to develop physical percent complete.
  - b2. Physical percent complete will not be based solely on remaining durations compared to original durations or actual milestone payments earned compared to milestone payments budgeted.
  - b3. All activities shall use P6's "Physical Percent Complete" status method unless based on Level of Effort. Contractor shall not use P6's "Duration Percent Complete" method for the purpose of determining percentage of completion or changes in remaining durations.
  - b4. All significant reductions to previously reported percent complete (greater than a 5% reduction) will be reported in Contractor's status report along with a detailed explanation.
  - c. Remaining durations shall represent the Contractor's current best estimate for each Detailed Activity based upon then-current or known factors which might affect the remaining duration.
  - c1. Contractor shall not base the remaining duration of any Detailed Activity on the percent completed or an automated countdown process such as expected finish constraints. Expected Finish Dates should be regarded as commitments by the responsible individual and should not be taken lightly. Expected Finish Dates should preferably be used to calculate remaining duration of in progress Detailed Activities and be removed once applied.
  - c2. Significant changes in the remaining durations greater than the span of time between updates will be reported in Contractor's status report.
  - d. Any and all revisions to the WBS, approved activity codes, activity calendars, assigned calendars, activity descriptions or activity resource loading shall require prior written approval of Owner.
  - e. Any revisions to any logic affecting the critical path or near critical paths, shall be reported and described in detail in Contractor's update status report.
  - f. Use retained logic for all schedule update calculations. Any Detailed Activities that are reported by P6 to be "out-of-sequence" shall have their logic ties appropriately revised to correct the out-of-sequence condition.
  - g. Identify the actual start and completion dates for each Detailed Activity in the schedule as supported by Project records.
  - g1. Any changes in previously reported actual dates shall be reported and described in detail in Contractor's update status report.



- h. For Owner submittal reviews and other Owner related Detailed Activities in progress but not yet completed, or for Owner interface milestones contained in the Contractor's Detailed Project Schedule, Contractor shall request status from the Owner.
  - i. Report Actual Direct Man Hours and Earned Direct Man Hours by resource code or agreed upon summary level
  - j. Approved scope changes affecting in-progress Work shall be incorporated into the Contractor's Detailed Project Schedule by the Contractor within fourteen (14) Days of approval. Approved scope changes which do not affect in-progress Work shall be incorporated into the Contractor's Detailed Project Schedule by the Contractor within thirty (30) Days of approval or before the start of scope change Work, whichever is shorter. Schedule impacts of the Work scope changes shall be identified prior to work commencing.
- 108.5 The Contractor will be required to discuss the status of the Detailed Project Schedule during the plan of the day meetings.
- 108.6 The Contractor is required to notify the Owner of any substantial change in the Detailed Project Schedule that will affect material deliveries or installation within forty-eight (48) hours of identifying the issue. An updated schedule detailing the substantial change shall also be submitted concurrently.
- 108.7 Progress Measurement:
- a. Progress measurement shall be performed and reported by the Contractor using an Earned Value Measurement System (EVMS) based on Rules of Credit and Man-Hour Resource Loading. Proposed progress milestones shall be reviewed with the Owner and agreed upon at the onset of the Work. Contractor will submit their EVMS calculations via updates to Contractor's schedule in the Owner's system for the Owner's representative to review at the commencement of the Project and on the same periodic basis as the schedule updates during the execution of the Project, or as requested by the Owner.
  - b. Contractor will provide planned and actual quantity installed of bulk materials such as:
    - b1. CY of concrete,
    - b2. Tons of Concrete Reinforcement Steel,
    - b3. Tons of Structural Steel,
    - b4. SF of Sheet metal Siding
    - b5. SF of Sheet metal Roofing
    - b6. SF of Hopper Plate work
    - b7. Tons of Conveyor Gallery
    - b8. Tons of Conveyor Gallery Supports
    - b9. LF of large bore pipe,
    - b10. LF of pipe welding,



- b11. SF of thermal insulation
  - b12. LF of buried piping > 4"
  - b13. SY of Suspended grading,
  - b14. LF of AG Conduit > 3"
  - b15. LF of AG Conduit < 2.5"
  - b16. LF of cable tray
  - b17. LF of Power wire pulled
  - b18. # of Power Panels
  - b19. # of Power Wire Terminations
  - b20. LF of Control Cable pulled
  - b21. # of I&C Panels
  - b22. # of Control Cable Terminations
  - c. EVMS reports on the same periodic basis as the schedule updates during the execution of the Project, or as requested by the Owner.
  - d. Progress Reporting
- 108.8 Monthly Progress Report:
- a. Each month, the Contractor shall provide a Project Status Report in narrative form that includes:
    - a1. Work accomplished in the previous period.
    - a2. Work planned for the next reporting period.
    - a3. List all changes made to the DPS with the schedule updates (this can be satisfied with P6 Digger Report or equivalent reporting software).
    - a4. Overall Project status including engineering, manufacturing, and deliveries.
    - a5. Current critical path of the schedule and comparison in the previous period to current update.
    - a6. Known or suspected problem areas.
    - a7. Recovery plans.
    - a8. Unresolved issues.
    - a9. Proposed and approved change orders and their effect on the progress of Contractor's Work.
    - a10. A comparison of Baseline Schedule dates to the current schedule dates with all variances identified.



- a11. Detailed reconciliation of the Contractor's invoicing.
- b. Relative to the work hour estimates as provided in Section 104.6n of this Section, the Contractor is also to provide the following in the Project Status Report:
  - b1. A comparison of the Baseline Schedule cumulative work hours to date to the current earned cumulative work hours to date, including histograms and S-curves graphs.
  - b2. A comparison of the Baseline Schedule deliveries and delivery quantities to date to the actual delivery quantities to date, including histograms and S-curves graphs.
  - b3. A comparison of the Baseline Schedule planned number submittals to date to the actual submittals to date including histograms and S-curves graphs.
  - b4. The Project Status Report delivery method will be mutually agreed upon in writing. The Contractor shall provide the Owner with the Project Status Report within one (1) business day of the close of the reporting period.
- 108.9 The Contractor will be required to participate in Weekly Conference Calls with Owner to discuss the status of the Detailed Project Schedule after site work has started. This is in addition to mutually agreed upon status meetings. During the weekly conference call, Contractor shall present the following:
  - a. Weekly Status updates using commodity curves.
  - b. Weekly Schedule updates.
- 108.10 Daily Reporting Requirements:
  - a. Daily reporting is required of Contractor when personnel are present at the site. Weekly and monthly reporting shall begin after contract award.
  - b. Contractor shall provide a Daily Report in a mutually agreed upon format between Contractor and Owner to the Owner each day by 4:00 p.m. If Contractor or Subcontractor has a standard Daily Report, then Contractor shall submit the format to the Owner for review and written approval. If acceptable to the Owner, the Contractor's or Subcontractor's form may be used. However, the Contractor's form shall contain, at a minimum, the same information as the Owner's form.
  - c. Contractor is responsible for providing a Daily Report for themselves and for each of its Subcontractors while performing work on Site. Contractor's report must identify all Subcontractors working on Site for any given Day, and shall include as an attachment those Subcontractors' daily reports. Any missing Subcontractor reports shall be identified for the day and provided within twenty-four (24) hours of the date and time they were originally due.
- 109. PHOTOGRAPHIC DOCUMENTATION REQUIREMENTS
- 109.1 The Contractor shall comply with the Owner's requirements for photographic documentation as defined in the Contract.

END OF SECTION 013216

**EXHIBIT H**

Intentionally Blank



**EXHIBIT I**

Intentionally Blank

**EXHIBIT J**

**FINAL INVOICE INCLUDING WAIVER AND RELEASE OF LIENS**

**WAIVER AND RELEASE OF LIEN UPON FINAL PAYMENT**

The undersigned lienor, in consideration of the final payment in the amount of \$\_\_\_\_\_, hereby waives and releases its lien and right to claim a lien for labor, services, or materials furnished to (insert the name of your customer) on the job of (insert the name of the owner) to the following described property:

(Description of property)

DATED on \_\_\_\_\_, 2022.

(Name and address of Lienor)

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

Sworn to (or affirmed) and subscribed before me by means of \_\_physical presence or \_\_\_online notarization this \_\_\_\_\_ day of \_\_\_\_\_, 2022, by \_\_\_\_\_(name of person making statement).

(Signature of Notary Public - State of Florida)

(Print, Type, or Stamp Commissioned Name of Notary Public)

Personally Known \_\_\_\_\_ OR Produced Identification \_\_\_\_\_

Type of Identification Produced \_\_\_\_\_

## **EXHIBIT K**

### **CITY FURNISHED EQUIPMENT**

Oil Water Separator

Pre-Engineered Metal Building, including crane

Sanitary lift station

Chattanooga Boiler and Tank will be on site 11/28/22 to start erection of the Heater recovery tank

MAN

Stack Anchor bolt assemblies (12 pieces) Late August

Per 2022-03-01\_Lakeland MAN supplied equipment list.xlsx