

**CONTRACT DOCUMENTS  
FOR CONSTRUCTION OF  
WATER SYSTEM  
IMPROVEMENTS  
ELEVATED STORAGE TANK PACKAGE**



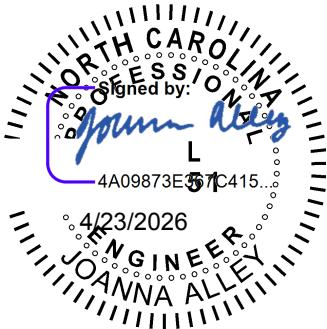
**FNI PROJECT NO. SMF24162**

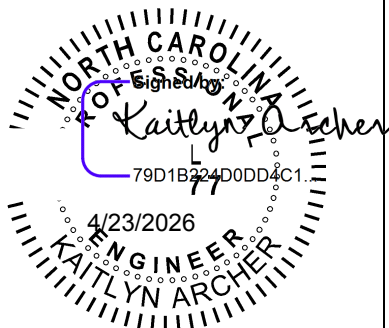


1001 TUCKASEEGEE ROAD, SUITE 120  
CHARLOTTE, NC 28208  
Phone - (704) 343-5734  
Web - [www.freese.com](http://www.freese.com)

**APRIL 2026**

00 01 07      DESIGN PROFESSIONAL SEALS

| Specification Sections Sealed                                                     |             |
|-----------------------------------------------------------------------------------|-------------|
|  | Division 00 |
|                                                                                   | Division 01 |
|                                                                                   | Division 03 |
|                                                                                   | Division 09 |
|                                                                                   | Division 10 |
|                                                                                   | Division 31 |
|                                                                                   | Division 32 |
|                                                                                   | Division 33 |
|                                                                                   | Division 40 |
| Joanna Alley, P.E.<br>License 054851<br>Freese and Nichols                        |             |

| Specification Sections Sealed                                                      |             |
|------------------------------------------------------------------------------------|-------------|
|  | Division 26 |
|                                                                                    |             |
| Kaitlyn Archer, P.E.<br>License 052977<br>Freese and Nichols                       |             |

END OF SECTION

**THIS PAGE INTENTIONALLY LEFT BLANK**

**00 01 10      TABLE OF CONTENTS**

| <b>Section</b>     | <b>Title</b>                                    |
|--------------------|-------------------------------------------------|
| <b>Division 00</b> | <b>Procurement and Contracting Requirements</b> |
| 00 01 01           | Project Cover Sheet                             |
| 00 01 07           | Design Professional Seals                       |
| 00 01 10           | Table of Contents                               |
| 00 11 16           | Invitation to Bid                               |
| 00 21 13           | Instructions to Offerors                        |
| 00 41 13           | Bid Form                                        |
| 00 41 16           | Bid Form Exhibit A                              |
| 00 43 13           | Bid Bond                                        |
| 00 45 01           | Nonresident Bidders                             |
| 00 45 02           | Non-Collusion Certification                     |
| 00 45 04           | State Sales Tax Requirements                    |
| 00 45 13           | Qualifications Statement                        |
| 00 52 13           | Agreement                                       |
| 00 61 13           | Performance Bond                                |
| 00 61 16           | Payment Bond                                    |
| 00 72 00           | General Conditions                              |
| 00 73 00           | Supplementary Conditions                        |
| 00 73 16           | Insurance Requirements                          |
|                    |                                                 |
| <b>Division 01</b> | <b>General Requirements</b>                     |
| 01 11 00           | Summary of Work                                 |
| 01 23 10           | Alternates and Allowances                       |
| 01 26 00           | Change Management                               |
| 01 29 00           | Application for Payment Procedures              |
| 01 29 01           | Measurement and Basis for Payment               |
| 01 31 00           | Project Management and Coordination             |
| 01 31 13           | Project Administration                          |
| 01 33 00           | Document Management                             |
| 01 33 02           | Shop Drawings                                   |
| 01 33 03           | Product Data                                    |
| 01 33 04           | Operations and Maintenance Data                 |
| 01 33 05           | Construction Progress Schedule                  |
| 01 33 06           | Graphic Documentation                           |
| 01 40 00           | Quality Management                              |
| 01 50 00           | Temporary Facilities and Controls               |
| 01 57 00           | Temporary Controls                              |
| 01 57 23           | Temporary Stormwater Pollution Control          |
| 01 60 00           | Product Requirements                            |
| 01 70 00           | Execution and Closeout Requirements             |



| Section            | Title                                            |
|--------------------|--------------------------------------------------|
| 01 75 00           | Starting and Adjusting                           |
| 01 78 36           | Warranties and Service Agreements                |
|                    |                                                  |
| <b>Division 03</b> | <b>Concrete</b>                                  |
| 03 30 00.01        | Cast-In-Place Concrete                           |
|                    |                                                  |
| <b>Division 09</b> | <b>High-Performance Coatings</b>                 |
| 09 95 00           | Coatings for Water Storage Tanks                 |
| 09 97 16           | Pipeline Coatings and Linings                    |
|                    |                                                  |
| <b>Division 10</b> | <b>Specialties</b>                               |
| 10 40 13           | Fall Prevention and Safety Systems               |
|                    |                                                  |
| <b>Division 26</b> | <b>Electrical</b>                                |
| 26 01 26           | Testing of Electrical Systems                    |
| 26 05 00           | Common Work Results for Electrical               |
| 26 05 19           | Low Voltage Electrical Power Conductors & Cables |
| 26 05 23           | Control-Voltage Electrical Power Cables          |
| 26 05 26           | Grounding & Bonding for Electrical Systems       |
| 26 05 29           | Hangers and Supports for Electrical Systems      |
| 26 05 33           | Raceways and Boxes for Electrical Systems        |
| 26 05 53           | Identification for Electrical Systems            |
| 26 05 73           | Overcurrent Protective Device Coordination Study |
| 26 09 23           | Lighting Control Devices                         |
| 26 22 13           | Low Voltage Distribution Transformers            |
| 26 24 16           | Panelboards                                      |
| 26 27 26           | Wiring Devices                                   |
| 26 28 16           | Enclosed Switches and Circuit Breakers           |
| 26 41 13           | Lightning Protection for Structures              |
| 26 50 00           | Lighting                                         |
|                    |                                                  |
| <b>Division 31</b> | <b>Earthwork</b>                                 |
| 31 05 13           | Soils for Earthwork                              |
| 31 05 16           | Aggregates for Earthwork                         |
| 31 11 00           | Clearing and Grubbing                            |
| 31 23 10           | Structural Excavation and Backfill               |
| 31 23 33           | Trenching and Backfill                           |
| 31 23 36           | Trench Safety                                    |
|                    |                                                  |
| <b>Division 32</b> | <b>Exterior Improvements</b>                     |
| 32 13 13           | Concrete Pavement                                |
| 32 31 13           | Chain Link Fences and Gates                      |

| <b>Section</b>     | <b>Title</b>                              |
|--------------------|-------------------------------------------|
| 32 91 19.13        | Topsoil Placement and Grading             |
| 32 92 13           | Hydro-Mulching                            |
|                    |                                           |
| <b>Division 33</b> | <b>Utilities</b>                          |
| 33 05 01.02        | Ductile Iron Pipe and Fittings            |
| 33 05 05.31        | Hydrostatic Testing                       |
| 33 12 19           | Water Utility Distribution Fire Hydrants  |
| 33 16 19           | Steel Elevated Water Utility Storage Tank |
|                    |                                           |
| <b>Division 40</b> | <b>Process Integration</b>                |
| 40 05 43           | Miscellaneous Valves                      |
| 40 05 61           | Gate Valves                               |
| 40 05 78           | Air Valves                                |
| 40 73 13           | Pressure Gauges                           |
| 40 90 01           | Instrumentation                           |
|                    |                                           |
|                    | <b>Appendices</b>                         |
| Appendix A         | Geotechnical Report                       |
| Appendix B         | FAA Permit                                |

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 00 11 16 INVITATION TO BID

### ARTICLE 1 – GENERAL NOTICE

- 1.01 The Town of Summerfield, NC (Owner) is requesting Bids for the construction of the following Project:
- Water System Improvements – Elevated Storage Tank Package  
FNI Project No.: SMF24162
- 1.02 Description of the Work
- A. The Town of Summerfield (Town) intends to construct a fire flow system consisting of a 150,000-gallon elevated storage tank (EST) and a supply well with a minimum well yield of 200 gpm. This will support a 1,000 gpm flow for a 2 hour duration for the fire flow system.
- 1.03 The Project is to be substantially complete and ready for operation on or before December 31, 2026. The Project is to be complete and eligible for final payment 60 days after the date for Substantial Completion. **Completing the project by December 31, 2026 is a priority for the Town for funding purposes. The Town is willing to negotiate incentives for prompt completion of the project.**

### ARTICLE 2 – EXAMINATION AND PURCHASE OF DOCUMENTS

- 2.01 Advertisement and bidding information for the Project can be found at the following procurement website:
- CivCastUSA.com**
- 2.02 Prospective Offerors must register with the procurement website as a plan holder, even if the Contract Documents are obtained from a plan room or other site. All official notifications, Addenda, and other documents will be offered only through the procurement website.
- 2.03 The Contract Documents may be downloaded from the procurement website by prospective Offerors registered as plan holders. Offerors are responsible for ensuring that a complete set of documents, as defined in Section 00 52 13 “Agreement,” are used in the preparation of their Bids. The documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download does not confer a license or grant permission or authorization for any other use. Authorization to download documents includes the right for Offerors to print documents for their sole use, provided they pay all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.
- 2.04 The procurement website will be updated periodically with Addenda, lists of interested parties, reports, or other information relevant to submitting a Bid for the Project.
- 2.05 Printed copies of the Contract Documents, Technical Data, and other information may be examined free of charge at the following address:
- The Town of Summerfield  
4117 Oak Ridge Road  
Summerfield, NC 27358  
Hours Available for Viewing: Monday – Friday, 9:00am – 3:00pm

### **ARTICLE 3 – PRE-BID CONFERENCE**

- 3.01 A non-mandatory pre-bid conference for the Project will be held on Friday, May 1, 2026 at 10:00am (EST) at the following location:

Microsoft Teams –

<https://teams.microsoft.com/meet/261527425800539?p=j1SEqUDSVIy9QgRtbF>

Meeting ID: 261 527 425 800 539

Passcode: 2aM7EC9k

- 3.02 Owner will identify the preferred brand alternates and performance standards that will be considered for approval on this Project at the pre-bid conference. Justification of any approvals will be made available to the public in writing no later than 7 days prior to the date of the opening of Bids.

### **ARTICLE 4 – SITE TOUR**

- 4.01 No tour of the Site will be held.

### **ARTICLE 5 – QUESTIONS REGARDING BIDDING PROCESS OR SOLICITATION DOCUMENTS**

- 5.01 Questions are to be submitted using the question and answer process on the procurement website. Responses to questions posted on the procurement website will be posted for the benefit of all Offerors. A response will be posted for questions submitted until 2:00pm (EST) on Friday, May 1, 2026.
- 5.02 A response to a question posted on the procurement website that requires modification of the Contract Documents will be made by Addenda. Modifications to the Contract Documents prior to the award of the Contract can only be made by Addenda. Only answers in Addenda posted on the procurement website will be binding. Oral and other interpretations or clarifications will be without legal effect.

### **ARTICLE 6 – BID SECURITY**

- 6.01 Offerors must submit an acceptable Bid Security with their Bids as a guarantee that the Successful Offeror will enter into a contract for the Project with the Owner within 15 days of Notice of Award of the Contract. The Bid Security must be payable to the Town of Summerfield, NC in the amount of 5 percent of the proposed Contract Price. The Successful Offeror must execute the Contract and bonds on the forms provided in the Contract Documents and provide evidence of insurance as required by the Contract Documents.
- 6.02 Bid Security must be in the form of a bid bond. The bid bond may be submitted on the form provided in Section 00 43 13 “Bid Bond” or Offerors may provide their surety’s standard penal sum bid bond form. The bid bond must reference the Owner and the Project by name as identified in this Section.
- 6.03 Bid Security may be in the form of a bid bond, a cashier’s check, or certified check. Checks must be made out to the Town of Summerfield, NC. The bid bond may be submitted on the form provided in Section 00 43 13 “Bid Bond” or Offerors may provide their surety’s standard penal sum bid bond form. The bid bond must reference the Owner and Project by name as identified in this Section.

## **ARTICLE 7 – DELIVERY OF BIDS**

- 7.01 Sealed Bids must be delivered to the Owner at the address below no later than Friday, May 8, 2026 at 2:00pm (EST) to be accepted and should include one hard copy and one electronic copy on a flash drive. The Bids will be publicly opened and read aloud at this time and place including the names of the Offerors and their Bids. Bids received after this time will be returned unopened. Address Bids to the Owner as follows:

Town of Summerfield  
4117 Oak Ridge Road  
Summerfield, NC 27358

## **ARTICLE 8 – AWARD OF CONTRACT**

- 8.01 It is the intent of the Owner to award this Contract to the lowest responsible Offeror. The Owner reserves the right to adopt the most advantageous interpretation of the Bids submitted in the case of ambiguity or lack of clearness in stating bid prices, to reject any or all Bids, and/or waive formalities. Bids will remain subject to acceptance and may not be withdrawn within 60 days from the date on which Bids are opened.

## **ARTICLE 9 – DIVERSE BUSINESS PARTICIPATION PROGRAM**

- 9.01 Selected Contractor will be required to comply with any applicable diverse business participation goals required by Chapter 143 of the North Carolina General Statutes.

## **ARTICLE 10 – OTHER CONTRACT REQUIREMENTS**

- 10.01 Offerors will be required to show evidence that they are licensed by the State of North Carolina to perform the Work required for this Project as required by Chapter 87, Article 1 of the North Carolina General Statutes and Section 00 21 13 "Instructions to Offerors."
- 10.02 Performance and payment bonds will be required for this Project.
- 10.03 Offerors will be required to submit Section 00 45 02 "Non-Collusion Certification" with their Bids. Failure of any Offeror to provide the required affidavit to the Owner may be grounds for disqualification of the Offeror's Bid.
- 10.04 This project is funded in whole or in part by the American Rescue Plan Act (ARPA), Coronavirus State and Local Fiscal Recovery Funds (CSLFRF). All bidders, contractors, and subcontractors shall comply with all applicable federal, state, and local requirements associated with these funds, including but not limited to 2 CFR Part 200 and 31 CFR Part 35, as incorporated into the funding agreement. Failure to comply with applicable requirements may result in disqualification, termination for default, or withholding of payment.

## **END OF SECTION**

## **00 21 13 INSTRUCTIONS TO OFFERORS**

### **ARTICLE 1 – DEFINED TERMS**

- 1.01 The terms used in these Instructions to Offerors have the meanings assigned to them in the General Conditions and Supplementary Conditions.

### **ARTICLE 2 – RECEIPT OF BIDS**

- 2.01 Refer to Section 00 11 16 “Invitation to Bid” for information on receipt of Bids.

### **ARTICLE 3 – COPIES OF CONTRACT DOCUMENTS**

- 3.01 Obtain a complete set of the Contract Documents as indicated in Section 00 52 13 “Agreement.”
- 3.02 Use complete sets of Contract Documents in preparing Bids. Offeror assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete sets of Contract Documents.
- 3.03 Owner makes copies of Contract Documents available for the sole purpose of obtaining Bids for completion of the Project and does not confer a license or grant permission or authorization for any other use.

### **ARTICLE 4 – QUALIFICATIONS OF OFFERORS**

- 4.01 Contractor Licensing Requirements:
- A. Offerors for this Project must be licensed in the following classifications and limitations as required by Chapter 87 of the North Carolina General Statutes:
1. General:
    - a. Offeror must have a general contractors license with one of the following classifications with a limitation appropriate to the Bid amount:
      - 1) Classifications:
        - a) Unlimited: Public Utility Contractor
      - 2) Limitations:
        - a) Limited: Up to \$500,000.
        - b) Intermediate: Up to \$1,000,000.
        - c) Unlimited: No limit on contract value.
    2. Plumbing: Intermediate
    3. Electrical: Intermediate
  - B. Provide documentation showing that Offeror meets the licensing requirements for this Project with Section 00 41 13 “Bid Form.”
- 4.02 Qualifications Statement: Submit information as required in Section 00 45 13 “Qualifications Statement” within 5 days of the date Bids are due if requested to do so by the Owner.

## **ARTICLE 5 – EXAMINATION OF THE CONTRACT DOCUMENTS AND THE SITE**

5.01 Examine the Contract Documents, the Site, and other information readily available before submitting a Bid.

A. Examine the Contract Documents and supplemental data:

1. Carefully study the Contract Documents.
2. Carefully study supplemental information, including Technical Data, record drawings from previous projects, available utility maps, reports, and studies referenced or made available to the Offeror.
3. Promptly notify the Construction Manager of all conflicts, errors, ambiguities, or discrepancies that the Offeror discovers in the Contract Documents, Addenda, and supplemental information.
4. Determine that the Contract Documents, Addenda, and supplemental data are generally sufficient to indicate and convey understanding of all terms and conditions for completion of Work to the degree necessary to prepare a Bid for the Project.
5. Make observations and investigations, correlate knowledge and observations with the requirements of the Contract Documents, and consider these in preparation of a Bid for the Project.

B. Become familiar with all federal, state, and local Laws and Regulations that may affect cost, progress, or the completion of Work.

C. Visit the Site to become familiar with any general, local, or Site conditions that may affect the cost, progress, or performance of the Work in any manner. The Site is generally accessible to the public. Coordinate access to private property through the Owner.

D. Subsurface exploration using a backhoe, drilling rig, or other equipment can be done, providing the following procedures are followed:

1. Contact the following individual to coordinate the details for the subsurface exploration:
2. Backfill excavation with material acceptable to the Owner and process backfill to prevent future settling.
3. Pay all cost for soils investigation including the cost for excavation, backfill, access, and testing.

E. The submission of a Bid will constitute an incontrovertible representation by the Offeror that the Offeror has complied with every requirement of this Article, and that without exception the Bid is premised on the following:

1. Work will be completed in accordance with the Contract Documents for the Contract Price within the Contract Times;
2. Offeror has given the Construction Manager written notice of all conflicts, errors, ambiguities, and discrepancies that the Offeror has discovered in the Contract Documents, Addenda, and the related supplemental data;
3. Written resolutions provided by the Construction Manager are acceptable to the Offeror; and



4. Contract Documents, Addenda, and the related supplemental data are generally sufficient to indicate and convey understanding of all terms and conditions for completion of Work.

#### **ARTICLE 6 – PRE-BID CONFERENCE**

- 6.01 A non-mandatory pre-bid conference will be held at the time and location indicated in Section 00 11 16 “Invitation to Bid.”

#### **ARTICLE 7 – INTERPRETATIONS AND ALTERNATE BIDS**

- 7.01 Submit all questions about the meaning or intent of the Contract Documents, Addenda, and the related supplemental data to the Construction Manager using the procurement website as indicated in Section 00 11 16 “Invitation to Bid.”
- 7.02 Submit any offer of alternate terms and conditions, or offer of Work not in strict compliance with the Contract Documents to the Construction Manager no later than 10 days after the date Project is advertised. Construction Manager and Design Professional will issue Addenda as appropriate if any of the proposed changes to the Contract Documents are accepted. A Bid submitted with clarifications or taking exceptions to the Contract Documents, except as modified by Addenda, will be considered non-responsive.
- 7.03 Offeror may submit a separate and additional Bid if the Offeror includes exceptions or the Offeror wishes to make a Bid that is not in accordance with the terms and conditions of the Contract Documents, or for Work that is not in strict compliance with the Contract Documents. Describe the intent and substance of the changes in the additional Bid in adequate detail so they are clearly understood. Alternate Bids will not be considered in the evaluation of the Bids. Upon selection of the Bid of the lowest responsible Offeror, and after the award of the Contract, the Construction Manager may issue a Request for a Change Proposal if Owner chooses to accept any Bid alternates.
- 7.04 Addenda may be issued to clarify, correct, or change the Contract Documents, Addenda, or the related supplemental data as deemed advisable by the Owner or Designer.

#### **ARTICLE 8 – BID SECURITY**

- 8.01 Offerors must submit an acceptable bid bond, cashier’s check, or certified check as Bid Security with their Bid as required by Section 00 11 16 “Invitation to Bid.” The acceptable bid bond must be issued by a surety legally authorized to do business in North Carolina and meet the requirements of the General Conditions. Cashier’s or certified checks must be made payable to the Town of Summerfield, NC and are to be effective on the day Bids are submitted and valid for a period of at least **60** days from the date the check is issued.
- 8.02 Owner may annul the Notice of Award and retain the Bid Security of the apparent Successful Offeror upon Offeror’s failure to execute and deliver the Agreement or Amendments to the Agreement.
- 8.03 Bid Securities are to remain in effect until the Contract is executed. Bid bonds will become void when the Contract is awarded or all Bids are rejected. Cashier’s or certified checks will be returned by the Owner when the Contract is executed or all Bids are rejected.

## **ARTICLE 9 – CONTRACT TIMES**

9.01 See applicable provisions for Contract Times in the Agreement.

## **ARTICLE 10 – LIQUIDATED DAMAGES, RETAINAGE, AND INTEREST**

10.01 Provisions for liquidated damages and the payment of retainage and interest are set forth in the Agreement.

## **ARTICLE 11 – PREPARATION OF THE BID FORM**

11.01 The Bid Form is included with the Contract Documents and is also available at the procurement website. Complete all blanks on the Bid Form by typing or printing in ink. Indicate prices for each item or alternate shown in the Bid Form.

11.02 Execute the Bid Form as indicated in the document and include evidence of authority to sign.

11.03 Acknowledge receipt of all Addenda by filling in the number and date of each Addendum. Provide a signature as indicated to verify that the Addenda were received. A Bid that does not acknowledge the receipt of all Addenda may be considered non-responsive.

11.04 Provide the name, address, and telephone number of the individual to be contacted for any communications regarding the Bid in the Bid Form.

11.05 Provide evidence of the Offeror's authority and qualification to do business in North Carolina or agree to obtain such qualification prior to award of the Contract. Failure to obtain this qualification will render the Bid non-responsive and Offeror will forfeit its Bid Security.

## **ARTICLE 12 – CONFIDENTIALITY OF BID INFORMATION**

12.01 Bids will be opened in a manner that avoids disclosure of trade secrets and confidential information to competing Offerors and that will keep the Bids from the public until a contract is awarded. All Bids submitted to the Owner will be open for public inspection after the Contract is awarded. Information that has designated as confidential or as a trade secret at the time Bids are submitted may not be subject to disclosure to the public under Chapter 132 of the North Carolina General Statutes.

12.02 Clearly indicate which specific documents are considered to be trade secrets or confidential information by stamping or watermarking all such documents with the word "confidential" prominently on each page or sheet or on the cover of bound documents. Place "confidential" stamps or watermarks so that they do not obscure any of the required information on the document, either in the original or in a way that would obscure any of the required information in a photocopy of the document. Submit all confidential information in a different binder so this confidential material is separate from the rest of the Bid.

12.03 The Owner will protect this information to the extent allowed by state Laws and Regulations. However, if the Owner is requested or becomes legally compelled (by oral questions, interrogatories, requests for information or documents, subpoena, civil or criminal investigative demand, public information requests, including requests under Chapter 132 of the North Carolina General Statutes, or similar process) or is required by a regulatory body to make any disclosure that is prohibited or otherwise constrained by this Agreement, the Owner will provide Offeror

with prompt notice of this request so that it may seek an appropriate protective order or other appropriate remedy.

#### **ARTICLE 13 – DELIVERY OF BIDS**

- 13.01 Complete and deliver the Bid Form along with all required documents identified in the Bid Form.
- 13.02 Submit the Bid no later than the date and time prescribed and at the place indicated in Section 00 11 16 “Invitation to Bid.” Offeror assumes full responsibility for ensuring that the Bid arrives at the prescribed location before the prescribed time.

#### **ARTICLE 14 – MODIFICATION OR WITHDRAWAL OF BIDS**

- 14.01 Modify or withdraw a Bid using a document executed in the same manner that a Bid must be executed. Deliver the document to the place where Bids are to be submitted prior to the date and time for the opening of Bids.
- 14.02 Bids may be withdrawn prior to the award of the Contract if the Offeror files a signed written notice with the Owner within 72 hours after Bids are opened. Any request made by an Offeror to withdraw its Bid for this Project will be subject to the requirements of NCGS §143-129.1.

#### **ARTICLE 15 – OPENING OF BIDS**

- 15.01 Bids will be opened at the time and place indicated in Section 00 11 16 “Invitation to Bid.” The Owner will publicly acknowledge receipt of Bids received in time to be considered and then open and read aloud the names of the Offerors and the amount bid as required by applicable Laws and Regulations.

#### **ARTICLE 16 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE**

- 16.01 All Bids will remain subject to acceptance for the number of days specified in Section 00 11 16 “Invitation to Bid.” The Owner may, at its sole discretion, release any Bid and return the Bid Security prior to the end of this period.

#### **ARTICLE 17 – EVALUATION OF BIDS**

- 17.01 The Owner will consider the proposed Contract Price and Contract Times and the qualifications of the Offerors to determine the lowest responsible Offeror.
- 17.02 Owner may conduct such investigations as it deems necessary to establish the responsibility, qualifications, and financial ability of consultants, individuals, or entities proposed to furnish parts of the Work in accordance with the Contract Documents.
- 17.03 Each Offeror agrees to waive any claim it has or may have against the members of the OPT and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any Bid.
- 17.04 Notwithstanding any other provision of the Contract Documents, it is stipulated and agreed that by accepting a Bid, the Owner has not and does not waive its sovereign immunity from suit and/or liability.

## **ARTICLE 18 – AWARD OF CONTRACT**

- 18.01 Owner reserves the right to reject any and all Bids, including non-conforming, non-responsive, or conditional Bids. The Owner may also reject the Bid of any Offeror if the Owner believes that it would not be in the best interest of the Owner to make an award to that Offeror. The Owner reserves the right to waive all formalities.
- 18.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered, except as additional Bids in accordance with Article 7. Reasonable grounds for believing that any Offeror has an interest in more than one Bid for the Work will be cause for disqualification of that Offeror and the rejection of all Bids in which that Offeror has an interest.
- 18.03 The Contract will be awarded to the lowest responsible Offeror if a contract is to be awarded.
- 18.04 Owner may consider the following in evaluating the Bids and awarding the Contract:
- A. Offeror's qualifications and ability to demonstrate current capability to complete the Project in conformance with the requirements of the Contract Documents.
  - B. Compliance of the Bids with requirements of the Contract Documents.
  - C. Alternates and unit prices if requested in the bid forms.
  - D. The amount bid.
  - E. Proposed date of completion and the ability to meet intermediate Milestones that may have been established for the Project.

## **ARTICLE 19 – BONDS AND INSURANCE**

- 19.01 The General Conditions set forth the Owner's requirements as to bonds and insurance. When the Successful Offeror delivers the executed Agreement to the Owner, it must be accompanied by the performance and payment bonds and required evidence of insurance.
- 19.02 Provide performance and payment bonds for this Project that fully comply with the provisions of Chapter 44A of the North Carolina General Statutes. Administration of these bonds will conform to Chapter 44A of the North Carolina General Statutes and the provisions of the Contract Documents.

## **ARTICLE 20 – SIGNING OF THE AGREEMENT**

- 20.01 The Notice of Award to the Successful Offeror will be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents that are identified in the Agreement. The Successful Offeror must sign and deliver the required number of counterparts of the Agreement and attached documents to the Owner within 15 days. The Owner will deliver two fully signed counterparts to the Successful Offeror within 10 days after receiving the signed documents from the Successful Offeror.

## **ARTICLE 21 – SALES AND USE TAXES**

- 21.01 Offerors will be required to comply with applicable state Laws and Regulations related to the payment of sales and use taxes for this Project. Additional requirements for the reporting of state

sales tax expenditures and reimbursable sales taxes are included in Section 00 45 04 "State Sales Tax Requirements."

**ARTICLE 22 – DIVERSE BUSINESS PARTICIPATION PROGRAM**

22.01 Offerors will be required to comply with any applicable diverse business participation goals required by Chapter 143 of the North Carolina General Statutes.

**ARTICLE 23 – FUNDING AGENCY PROVISIONS**

23.01 This Project is funded in whole or in part by the American Rescue Plan Act (Funding Agency).

23.02 The Funding Agency requirements govern in the event of any conflict between the Funding Agency requirements and any other provision of the Contract Documents.

**END OF SECTION**

00 41 13      **BID FORM**

**ARTICLE 1 – BID RECIPIENT**

- 1.01    The Offeror submits this Bid to:
- The Town of Summerfield  
          Attention: Charles “Twig” Rollins, Town Manager  
          4117 Oak Ridge Road  
          Summerfield, NC 27358  
          SMF24162 - Water System Improvements

**ARTICLE 2 – OFFEROR’S ACKNOWLEDGMENTS**

- 2.01    Offeror proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner on the form included in the Contract Documents, to perform all Work specified or indicated in Contract Documents for the Contract Price indicated in this Bid or as modified by Contract Amendment. Offeror agrees to complete the Work within the Contract Times established in the Agreement or as modified by Contract Amendment and comply with all terms and conditions of the Contract Documents.
- 2.02    Offeror accepts all terms and conditions of Section 00 11 16 “Invitation to Bid” and Section 00 21 13 “Instructions to Offerors.”
- 2.03    Offeror accepts the provisions of the Agreement as to liquidated damages in the event of its failure to complete Work in accordance with the schedule set forth in the Agreement.
- 2.04    Offeror acknowledges receipt of the following Addenda:

| Addendum No. | Addendum Date | Signature Acknowledging Receipt |
|--------------|---------------|---------------------------------|
|              |               |                                 |
|              |               |                                 |
|              |               |                                 |

**ARTICLE 3 – OFFEROR’S REPRESENTATIONS**

- 3.01    The Offeror is currently licensed as a general contractor in the State of North Carolina.

| Offeror’s License Information |  |
|-------------------------------|--|
| Name on License               |  |
| License Number                |  |
| Limitation                    |  |
| Classifications               |  |

- 3.02    The Offeror has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- 3.03    The Offeror has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

- 3.04 The Offeror is familiar with Laws and Regulations that may affect cost, progress, and performance of the Work.
- 3.05 The Offeror has carefully studied the following Site related reports and drawings as identified in the Supplementary Conditions:
- A. Geotechnical Data Reports regarding subsurface conditions at or adjacent to the Site;
  - B. Drawings of physical conditions relating to existing surface or subsurface structures at the Site;
  - C. Underground Facilities referenced in reports and drawings;
  - D. Reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site; and
  - E. Technical Data related to each of these reports and drawings.
- 3.06 The Offeror has considered the:
- A. Information known to Offeror;
  - B. Information commonly known to contractors doing business in the locality of the Site;
  - C. Information and observations obtained from visits to the Site; and
  - D. The Contract Documents.
- 3.07 The Offeror has considered the items identified in this Article with respect to the effect of such information, observations, and documents on:
- A. The cost, progress, and performance of the Work;
  - B. The means, methods, techniques, sequences, and procedures of construction to be employed by Offeror; and
  - C. Offeror's safety precautions and programs.
- 3.08 The Offeror agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents based on the information and observations referred to in the preceding paragraphs.
- 3.09 The Offeror is aware of the general nature of Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- 3.10 The Offeror has correlated the information known to the Offeror, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- 3.11 The Offeror has given the Construction Manager written notice of all conflicts, errors, ambiguities, or discrepancies that the Offeror has discovered in the Contract Documents, and the written resolution provided by the Construction Manager is acceptable to the Offeror.
- 3.12 The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

- 3.13 Offeror is not on the North Carolina State Treasurer's list of persons engaging in business activities in Iran, nor will Offeror utilize any Subcontractor on such list on this Project in violation of NCGS §147-86.55, et seq.
- 3.14 Offeror is not on the North Carolina State Treasurer's list of companies engaged in a boycott of Israel, nor will Offeror utilize any Subcontractor on such list on this Project in violation of NCGS §147-86.80, et seq.
- 3.15 Offeror's submittal of a Bid constitutes an incontrovertible representation that, without exception, all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

#### **ARTICLE 4 – BASIS OF OFFER**

- 4.01 Offeror will complete the Work in accordance with the Contract Documents at the unit prices shown in the attached in Section 00 41 16 "Bid Form Exhibit A":
  - A. Extended amounts have been computed in accordance with the General Conditions.
  - B. Offeror acknowledges that the estimated quantities are not guaranteed, and final payment for all Unit Price items will be based on actual quantities provided, measured as provided in the Contract Documents.
  - C. Unit Prices will be used to compute the actual Bid price.

#### **ARTICLE 5 – TIME OF COMPLETION**

- 5.01 Offeror agrees that the Work will be Substantially Complete and will be completed and ready for final payment in accordance with the General Conditions by December 31<sup>st</sup>, 2026. Completing the project by December 31, 2026 is a priority for the Town for funding purposes. The Town is willing to negotiate incentives for prompt completion of the project.

#### **ARTICLE 6 – ATTACHMENTS TO THIS BID**

- 6.01 The following documents are attached to and made a condition of this Bid:
  - A. Section 00 41 16 "Bid Form Exhibit A."
  - B. Section 00 43 13 "Bid Bond."
  - C. Section 00 45 01 "Nonresident Bidders."
  - D. Section 00 45 02 "Non-Collusion Certification."
  - E. Section 00 45 04 "State Sales Tax Requirements."
  - F. Documentation showing that the Offeror is currently licensed as a general contractor in the State of North Carolina, including the license limitations and classifications.

#### **ARTICLE 7 – VENUE**

- 7.01 Offeror agrees that venue lies exclusively in Guilford County, North Carolina for any legal action.



**ARTICLE 8 – BID DELIVERY**

8.01 This Bid is submitted by:

Offeror: \_\_\_\_\_  
*(typed or printed name of organization)*

Signature: \_\_\_\_\_  
*(individual's signature)*

Name: \_\_\_\_\_  
*(typed or printed)*

Title: \_\_\_\_\_  
*(typed or printed)*

Offeror’s License:

License No.: \_\_\_\_\_

Classification: \_\_\_\_\_

Limitation: \_\_\_\_\_

Address for giving notices:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

*(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)*

**END OF SECTION**

00 41 16 Bid Form Exhibit A

|                      |                                                           |  |              |
|----------------------|-----------------------------------------------------------|--|--------------|
| Project:             | Water System Improvements - Elevated Storage Tank Package |  | Project No.: |
| Owner:               | The Town of Summerfield, NC                               |  | SMF24162     |
| Design Professional: | Joanna Alley, Freese and Nichols Inc.                     |  |              |
| Offeror:             |                                                           |  |              |

| Base Bid                                                                                          |                                                                                   |      |                    |             |                 |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|--------------------|-------------|-----------------|
| Item No.                                                                                          | Item Description                                                                  | Unit | Estimated Quantity | Unit Price  | Extended Amount |
| Items in Base Bid (excluding Allowances) per Section 01 29 01 "Measurement and Basis for Payment" |                                                                                   |      |                    |             |                 |
| A-01                                                                                              | Mobilization                                                                      | LS   | 1                  |             |                 |
| A-02                                                                                              | 150,000 gal EST, Foundation, and Appurtenances                                    | LS   | 1                  |             |                 |
| A-03                                                                                              | Water Well & Appurtenances                                                        | LS   | 1                  |             |                 |
| A-04                                                                                              | 12" Ductile Iron Water Line                                                       | LF   | 70                 |             |                 |
| A-05                                                                                              | Fire Hydrant                                                                      | EA   | 1                  |             |                 |
| A-06                                                                                              | 12" Gate Valve                                                                    | EA   | 2                  |             |                 |
| A-07                                                                                              | Trench Safety                                                                     | LF   | 70                 |             |                 |
| A-08                                                                                              | Traffic Control                                                                   | LS   | 1                  |             |                 |
| A-09                                                                                              | 6" Thick Concrete Driveway                                                        | SY   | 670                |             |                 |
| A-10                                                                                              | Concrete Well Pad                                                                 | SY   | 25                 |             |                 |
| A-11                                                                                              | 2' Concrete Valley Gutter                                                         | LF   | 290                |             |                 |
| A-12                                                                                              | Gravel Construction Entrance                                                      | EA   | 1                  |             |                 |
| A-13                                                                                              | Class B Rock Riprap                                                               | CY   | 7                  |             |                 |
| A-14                                                                                              | Filter Fabric                                                                     | SY   | 30                 |             |                 |
| A-15                                                                                              | 45° Wingwall                                                                      | EA   | 4                  |             |                 |
| A-16                                                                                              | 18" RCP Driveway Culvert                                                          | LF   | 130                |             |                 |
| A-17                                                                                              | Clearing and Grubbing                                                             | LS   | 1                  |             |                 |
| A-18                                                                                              | Grading and Erosion Control                                                       | LS   | 1                  |             |                 |
| A-19                                                                                              | Chain Link Fencing                                                                | LF   | 700                |             |                 |
| A-20                                                                                              | Seeding and Hydromulch                                                            | AC   | 0.9                |             |                 |
| A-21                                                                                              | Storm Water Pollution Prevention                                                  | LS   | 1                  |             |                 |
| A-22                                                                                              | Swing Gate                                                                        | EA   | 2                  |             |                 |
| A-23                                                                                              | Instrumentation                                                                   | LS   | 1                  |             |                 |
| A-24                                                                                              | Tank and Site Electrical                                                          | LS   | 1                  |             |                 |
| A                                                                                                 | Total Base Bid Items Amount (Sum of Extended Amounts for each Base Bid Line Item) |      |                    |             | \$ -            |
| B                                                                                                 | Add (+) or Deduct (-) (See Note 1)                                                |      |                    |             |                 |
| C                                                                                                 | Total Adjusted Base Bid Amount (A plus B)                                         |      |                    |             | \$ -            |
| Allowances in Base Bid per Section 01 23 10 "Alternates and Allowances"                           |                                                                                   |      |                    |             |                 |
| D-01                                                                                              | Owner's Allowance                                                                 | LS   | 1                  | \$50,000.00 | 50,000.00       |
| D-02                                                                                              | Quality Control Testing by Owner Allowance                                        | LS   | 1                  | \$50,000.00 | 50,000.00       |
| D                                                                                                 | Total Allowance Amount (Sum of Extended Amounts for Each Allowance Line Item)     |      |                    |             | \$ 100,000.00   |
| E                                                                                                 | Total Base Bid with Allowances (Sum of C and D)                                   |      |                    |             | \$ 100,000.00   |

|               |                                                   |  |      |
|---------------|---------------------------------------------------|--|------|
| Contract Time |                                                   |  |      |
| L             | Offeror agrees to reach Substantial Completion in |  | days |
| M             | Offeror agrees to reach Final Completion in       |  | days |

|                        |                                        |    |            |
|------------------------|----------------------------------------|----|------------|
| Cost + Time Evaluation |                                        |    |            |
| N                      | Total Base Bid (Line E)                | \$ | 100,000.00 |
| O                      | Offeror Days to Substantial Completion |    | days       |
| P                      | Value per Day of Construction          | \$ | - per day  |
| Q                      | Value for Days of Construction (O X P) |    |            |
| R                      | Basis for Comparison of Bids (N + Q)   |    |            |

|       |                                                                                                                                                                                                                                                                                             |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Notes |                                                                                                                                                                                                                                                                                             |
| 1     | Provision is made for Offeror to include an addition or deduction in the Bid to reflect any last minute adjustments in price. The addition or deduction, if made, will be applied proportionately to the following Items: [List Base Bid Items to which the Add or Deduct will be applied.] |

|                   |  |
|-------------------|--|
| BID SUBMITTED BY: |  |
| Offeror:          |  |
| Signature:        |  |
| Printed Name:     |  |
| Title:            |  |
| Date:             |  |

**00 43 13      BID BOND**

|                                                                                                                                                              |                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Offeror as Principal</b></p> <p>Name:</p> <p>Mailing address (principal place of business):</p>                                                        | <p><b>Surety</b></p> <p>Name:</p> <p>Mailing address (principal place of business):</p>                                                                                                                       |
| <p><b>Owner</b></p> <p>Name:   The Town of Summerfield</p> <p>Mailing address (principal place of business):</p> <p>PO Box 970<br/>Summerfield, NC 27358</p> | <p>Physical address (principal place of business):</p> <p>Telephone (Main):</p> <p>Telephone (Claims):</p>                                                                                                    |
| <p><b>Contract</b></p> <p>Project name and number:</p> <p>Water System Improvements (SMF24162)</p> <p>Bid/Proposal Due Date:</p>                             | <p>Surety's state of incorporation:</p> <p><b><i>By submitting this bond, Surety affirms it is authorized to do business and licensed to execute bonds in the state where the Project is located.</i></b></p> |
| <p><b>Bond</b></p> <p>Contract Price Offered:</p> <p>Penal Sum of Bond:</p> <p>5% of Contract Price offered</p> <p>Date of Bond:</p>                         | <p><b>Local Agent for Surety</b></p> <p>Name:</p> <p>Company:</p> <p>Mailing address (principal place of business):</p> <p>Telephone (Main):</p>                                                              |

***Surety and Offeror, intending to be legally bound by this bond, do each cause this bond to be duly executed on its behalf by its authorized officer, agent, or representative. Surety and Offeror bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if Owner accepts the Offeror's Bid or Proposal and Offeror delivers the executed Agreement and the required bonds and evidence of insurance within the time stipulated in the Bidding or Proposal Documents this obligation is null and void. Payment under this bond will be due and payable upon default by Offeror and within 30 days after receipt by Offeror and Surety of written notice of default from Owner. This Agreement shall be administered and interpreted under the laws of the state where the Project is located. Venue lies exclusively in Guilford County, NC for any legal action.***

|                             |                            |
|-----------------------------|----------------------------|
| <b>Offeror as Principal</b> | <b>Surety</b>              |
| Signature: _____            | Signature: _____           |
| Name: _____                 | Name: _____                |
| Title: _____                | Title: _____               |
| Email: _____                | Email: _____               |
|                             | (Attach Power of Attorney) |

END OF SECTION

**00 45 01        NONRESIDENT BIDDERS**

NCGS §143-59 applies to the award of government contracts to nonresident bidders. This law provides that:

“For the purpose only of determining the low bidder on all contracts for equipment, materials, supplies, and services valued over twenty-five thousand dollars (\$25,000), a percent of increase shall be added to a bid of a non-resident bidder that is equal to the percent of increase, if any, that the state in which the bidder is a resident adds to bids from bidders who do not reside in that state.

1. Resident bidder - A bidder that has paid unemployment taxes or income taxes in this State and whose principle place of business is located in this State.”
2. Nonresident bidder - A bidder that is not a resident bidder as defined in subdivision (1) of this subsection.”
3. Principal place of business - The principal place from which the trade or business of the bidder is directed or managed.”

Check the statement that is correct for Offeror:

- ☐ Offeror (includes parent company or majority owner) qualifies as a resident bidder whose principal place of business is in North Carolina.
- ☐ Offeror qualifies as a nonresident bidder whose principal place of business or residency is in the state of: \_\_\_\_\_

Bidder preferences, if any, will be determined in accordance with NCGS §143-59 and the North Carolina Secretary of Administration’s annual list of states that give preference to in-state bidders.

Offeror: \_\_\_\_\_  
*(typed or printed name of organization)*

Signature: \_\_\_\_\_  
*(individual’s signature)*

Name: \_\_\_\_\_  
*(typed or printed)*

Title: \_\_\_\_\_  
*(typed or printed)*

Business Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_  
*(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)*

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

**00 45 02      NON-COLLUSION CERTIFICATION**

STATE OF    North Carolina    §

COUNTY OF    Guilford    §

Owner:            **The Town of Summerfield**  
                      **4117 Oak Ridge Road**  
                      **Summerfield, NC 27358**

Contract:        **Water System Improvements**  
                      **SMF24162**

Offeror certifies that it has not been a party to any collusion among Offerors in the restraint of freedom of competition by agreement to submit a Bid or Proposal at a fixed price or to refrain from submitting a Bid or Proposal; or with any official or employee of the Owner as to quantity, quality, or price in the prospective contract, or any other terms of said prospective contract; or in any discussion between Offerors and any official of the Owner concerning exchange of money or other thing of value for special consideration in the letting of a contract.

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

Offeror:            \_\_\_\_\_  
                      *(typed or printed name of organization)*

Signature:        \_\_\_\_\_  
                      *(individual's signature)*

Name:             \_\_\_\_\_  
                      *(typed or printed)*

Title:              \_\_\_\_\_  
                      *(typed or printed)*

Business Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone:            \_\_\_\_\_ Email:            \_\_\_\_\_

*(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)*

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**



## **00 45 04 STATE SALES TAX REQUIREMENTS**

### **ARTICLE 1 – PROCEDURE FOR REPORTING NORTH CAROLINA SALES TAX EXPENDITURES**

- 1.01 The following procedure for handling the North Carolina sales tax is applicable to this Project. The Contractor and its Subcontractors must comply fully with the requirements outlined in this Section, so that the Owner may recover the full amount of reimbursable taxes permitted by state law. For the purposes of this Section, “sales taxes” means sales and use taxes paid to the State of North Carolina or to local governments in North Carolina.
- 1.02 Reimbursable sales taxes are to be excluded from the Bid or Proposal for this Project. Contractor must include all other applicable sales and use taxes and other related costs in its Bid or Proposal.
- 1.03 Owner is entitled to refunds from the State of North Carolina for these reimbursable sales taxes. The Contractor that performs Work under this Contract is allowed to obtain a reimbursement from the Owner for those sales taxes for which the State will grant a refund to the Owner. The Owner will reimburse the Contractor, and the Owner later obtains a refund from the State.
- 1.04 Contractor must furnish the Owner documentary evidence showing the materials used and sales tax paid by the Contractor and each Subcontractor. Any county sales tax included in the Contractor’s statements must be shown separately from the state sales tax. If more than one county is shown, each county must be listed separately.
- 1.05 The documentary evidence must be in the form of the Reimbursable Sales and Use Tax Statement provided by the Construction Manager. This evidence must consist of a certified statement, by the Contractor and each Subcontractor individually, showing total purchases of materials from each separate vendor and total sales taxes by each county paid each vendor. The certified statement must show the invoice number(s) covered and inclusive dates of such invoices. State sales tax must be listed separately from county sales tax. If more than one county is shown, each county must be listed separately. The invoices must be provided to substantiate the information on the statement.
- 1.06 Materials used from the warehouse stock of the Contractor or its Subcontractors must be shown in a certified statement at warehouse stock prices.
- 1.07 Contractor will not be required to certify Subcontractor statements. However, any Subcontractor may submit for reimbursement by certifying a Reimbursable Sales and Use Tax Statement, submitting it to the Contractor for the Contractor to submit with the pay application for the properties listed on that form. The Owner will make the reimbursement payable to the Contractor.
- 1.08 The documentary evidence to be furnished to owners eligible for reimbursable sales tax refunds covers sales and/or use taxes paid on building materials used by contractors and subcontractors in the performance of contracts with churches, orphanages, hospitals not for profit, educational institutions not operated for profit and other charitable or religious institutions or organizations not operated for profit and incorporated cities, towns and counties in this State. The documentary evidence is to be submitted to the above-named institutions, organizations and governmental units to be included in claims for refunds to be prepared and submitted by them to obtain refunds provided by NCGS §105-164.14 and is to include the purchase of building materials, supplies, fixtures and equipment which become a part of or annexed to buildings or structures being erected, altered or repaired under contracts with such institutions, organizations or governmental units.

- 1.09 Contractor may seek reimbursement separately from, but at the same time as, the Application for Payment is made for the properties that were taxed. The Contractor must not file for reimbursement for sales taxes before the Contractor has the right to file an Application for Payment for the properties that were taxed.
- 1.10 If the State refuses to refund any such sales tax to the Owner, or if after a refund is made, the Owner is told to return a refund to the State, the Contractor must upon demand repay the Owner for the amount of the failed refunds.
- 1.11 Contractor is advised that all requests for payment, partial or final, for Work completed under this Contract must include a sales tax report submitted in accordance with the procedures outlined above.
- 1.12 Contractor to whom an award is made on this Project will be required to follow the procedure outlined above.

**END OF SECTION**

## **00 45 13 QUALIFICATIONS STATEMENT**

### **ARTICLE 1 – REQUIREMENTS FOR THE QUALIFICATIONS STATEMENT**

- 1.01 The Qualifications Statement must be submitted by the apparent low Offeror within 5 calendar days of the bid opening and include the information as described in this Section as a minimum. Failure to submit the required information in the Qualifications Statement may result in Owner considering the Bid non-responsive and may result in rejection of the Bid by Owner. Offerors may be required to provide supplemental information if requested by Owner to clarify, enhance, or supplement the information provided in the Qualifications Statement.
- 1.02 Offeror must provide the information requested in this Qualifications Statement using the forms attached to this Section. The information requested in these forms must be provided completely and in detail. Information that cannot be totally incorporated in the forms may be included as an appendix to the form. This appendix must be clearly referenced by appendix number on the form, and the appended material must include the appendix number on every sheet of the appendix. The appendix must include only the information that responds to the question or item number to which the appended information applies.
- 1.03 Offeror may provide supplemental information to the Qualifications Statement such as organizational brochures or other marketing information to help demonstrate their qualifications to Owner. This information may not be submitted as a substitute for the information specifically requested in this Section. The reference must include the specific paragraph or section that applies to that question or item if this information is included as an appendix to the information requested in Article 2.

### **ARTICLE 2 – INSTRUCTIONS FOR PREPARING THE QUALIFICATIONS STATEMENT**

- 2.01 Offeror's Organization and General Information:
  - A. Provide general information about the Offeror's organization using copies of Table 1. Provide the same information for each joint venture partner if the Offeror is a joint venture.
  - B. Provide information regarding the operational structure of the Offeror's organization, including a list of officers, the limits of authority for these individuals with regards to the proposed Project, documentation of authority to execute documents, and a copy of organizations' certificate of authorization to conduct business in the state the Project is located in. If the Project is located in a state that licenses contractors, Offeror must also provide documentation showing that the organization is licensed as a general contractor in that state, including any applicable classifications and limitations.
  - C. Financial Management:
    1. Provide the Offeror's most recent audited financial statement and the most recent financial statement if the most recent audited financial statement is more than 2 years old.

2. Provide the Offeror's financial summary information in Table 1, including the financial indicators from the Offeror's most recent financial statement using the formulas below:

Current Ratio:  $\text{Current Assets} \div \text{Current Liabilities}$

Quick Ratio:  $(\text{Cash and Cash Equivalents} + \text{Accounts Receivable} + \text{Short Term Investments}) \div \text{Current Liabilities}$

3. Describe the resources that are available to Offeror to provide adequate cash flow for the Project if the Offeror's Current Ratio or Quick Ratio are less than 1.0.

D. Safety:

1. Provide a narrative not to exceed four pages describing the Offeror's success in implementing an effective project site safety program. Provide a narrative describing the Offeror's safety program and a statement regarding the organization's commitment to safety. Do not provide copies of safety manuals or programs.
2. Provide Experience Modification Ratio (EMR) and Total Recordable Frequency Rate (TRFR) history for the last 3 years for Offeror and any proposed subcontractors that will provide Work valued at 25 percent or more of the Contract Price. Provide this information in Table 1.
  - a. Offeror's EMR is a computation by the insurance industry that compares a company's annual losses in workers' compensation insurance claims against its policy premiums over a three-year period, excluding the current year.
  - b. Offeror's TRFR is a calculation of a firm's total number of OSHA-recordable injuries and illnesses over a given period (usually a year), divided by the total number of personnel-hours worked.

- E. Claims Experience and Litigation History: Provide a list of all claims or litigation involving owners on other construction projects that have been active over the last 5 years or that are currently unresolved. Include this information in Table 1. Provide a narrative describing the issues being contested and when it is anticipated that the disputes will be resolved. Claims are to include only those items which have progressed through the change management process for the project and are being disputed by Offeror or the project owner.

- F. Past Experience with the Owner: Provide a list of projects that have been completed with Owner over the last 5 years. Include this information in Table 1. Provide a narrative not to exceed two pages describing how this experience will impact the performance of Offeror on this Project.

2.02 Project Experience:

- A. Provide a list of projects completed by Offeror in the last 5 years using copies of Table 2.
- B. Provide detailed descriptions of projects which demonstrate the experience of the Offeror's team with construction of similar projects. Experience must include, as a minimum, the satisfactory completion of at least five similar projects within the last 5 years. Offerors not

meeting the requirement for similar projects may be disqualified as being non-responsive. Similar projects must include:

- C. Provide a narrative not to exceed two pages for each project describing up to five specific projects that qualify as similar projects. Projects selected must demonstrate the capabilities of Offeror.

## 2.03 Experience and Qualifications of Proposed Key Personnel:

- A. Provide a narrative not to exceed four pages describing the Offeror's project management structure and the qualifications of the project management team for this Project. Include an organization chart showing the relationship between Offeror and key subcontractors and suppliers.
- B. Provide information on the key personnel proposed for this Project on Tables 3 through 7. Key personnel include the project manager, project superintendent, safety manager, and quality control manager. Offeror may provide information on an alternate individual if it is not able to commit to one individual for the Project at the time the Bid is submitted. Qualifications of these individuals will be considered in evaluating the Offeror's qualifications. Offeror must commit to providing the services of the proposed key personnel or alternate for the life of the Project as a condition of qualification. Failure to provide the proposed key personnel may result in the disqualification of Offeror and will provide the basis for termination of the Contract at the discretion of Owner.
- C. Include a list of the current project assignments for each of the individuals proposed, the anticipated completion date for these assignments, and the percentage of the time they will have available to devote to this Project. The project superintendent must be dedicated to the Project full time for the duration of the Project. If any other key personnel are not devoted solely to the Project, indicate how time is to be divided between the Project and other assignments. Specifically address how and when individuals currently on other assignments will transition to the Project.
- D. Provide resumes not exceeding two pages for each individual proposed for the key personnel positions and their alternates. Resumes must describe the qualifications of the individual and include the following as a minimum: technical experience, managerial experience, education and formal training, primary language, and a work history which describes project experience, including the roles and responsibilities for each assignment. Additional information highlighting the experience which makes them the best candidate for the assignment should also be included. Focus on projects on which individuals proposed have had significant involvement in the last 5 years and which demonstrate experience with similar projects.
- E. Identify individuals that will fill one or more of these key roles and describe their ability to handle multiple responsibilities. Provide a written narrative describing the percentage of the time that will be devoted to each role and the qualifications to fulfill each role if an individual is to fulfill more than one of the key personnel roles.
- F. Provide a tabulation of the projects on which the key personnel have been personally involved using copies of Table 7. This tabulation is to include the name and a current telephone number for references for each of these project assignments.
- G. Provide a narrative not to exceed two pages for each project the proposed individuals have worked on that qualify as similar projects. Specifically identify the role and responsibilities of

the individual on these similar projects. Projects selected must demonstrate the capabilities of the proposed key personnel.

- H. Provide a narrative not to exceed ten pages to describe the overall performance of the individuals on these projects. This narrative may include references to letters of recommendation, project awards, and other references to demonstrate experience in constructing a project which meets the project owner's expectations for a quality project constructed on time and within budget.

**2.04 Offeror's Ability to Complete Projects within the Contract Price and Contract Times:**

- A. Provide a tabulation of budget performance on projects completed by Offeror within the last 5 years using copies of Table 8 to demonstrate the ability of the Offeror to complete projects for the Contract Price. Notes may be added to each line item to describe circumstances for change orders beyond the control of Offeror.
- B. Provide a tabulation of all projects completed by Offeror within the last 5 years on Table 9 to demonstrate performance in completing projects on time. Notes may be added to the tabulations to indicate the reasons for not meeting original contract completion dates.

**ARTICLE 3 – BID REQUIREMENTS**

- 3.01 Provide the Qualifications Statement using the referenced tables and narrative descriptions as described in this Section. Pages are to be 8-1/2 x 11, with a minimum font size of 10. Provide a tab to separate materials responding to each of the rating categories listed in Article 2.
- 3.02 Additional information may be included in appendices attached to the Bid. Each appendix must reference the section of the criteria it is in reference to.
- 3.03 Provide one printed copy of the Bid at the time and place set forth in Section 00 11 16 "Invitation to Bid." Provide a digital copy of the Bid in Portable Document Format (pdf) on a flash drive. This digital copy is to include all information required to evaluate the Bid.

**ARTICLE 4 – FORMS**

- 4.01 The following tables are attached to this Section:

| Table | Description                                                    |
|-------|----------------------------------------------------------------|
| 1     | General Information                                            |
| 2     | Current Projects and Project Completed within the last 5 Years |
| 3     | Proposed Project Managers                                      |
| 4     | Proposed Project Superintendents                               |
| 5     | Proposed Project Safety Managers                               |
| 6     | Proposed Project Quality Control Managers                      |
| 7     | Project Information for Key Personnel                          |
| 8     | Demonstration of Budget Performance                            |
| 9     | Demonstration of On-Time Performance                           |

ARTICLE 5 – CERTIFICATION

5.01 By submitting this Qualifications Statement and related information, Offeror certifies that it has read this Qualifications Statement and that the Offeror’s responses are true and correct and contain no material misrepresentations, and that the individual signing below is authorized to make this certification on behalf of the Offeror’s organization.

Offeror: \_\_\_\_\_  
*(typed or printed name of organization)*

Signature: \_\_\_\_\_  
*(individual’s signature)*

Name: \_\_\_\_\_  
*(typed or printed)*

Title: \_\_\_\_\_  
*(typed or printed)*

Attest: \_\_\_\_\_  
*(individual’s signature)*

Designated Representative:

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

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

Address for giving notices:

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

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

*(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)*

**Table 1 - General Information**

| Organization                                                                                                                                                                                      |           |                                       |                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------|-------------------|
| Legal Name of Business                                                                                                                                                                            |           |                                       |                   |
| Form of Business Entity: <input type="checkbox"/> Joint Venture <input type="checkbox"/> Corporation <input type="checkbox"/> General Partnership <input type="checkbox"/> Limited Partnership    |           |                                       |                   |
| Date Business was formed                                                                                                                                                                          |           | State under which Business was formed |                   |
| Is this Business authorized to operate in the Project location: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending                                         |           |                                       |                   |
| Is this Business licensed as a general contractor in the Project location: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending <input type="checkbox"/> N/A |           |                                       |                   |
| List of companies, firms, or organizations that own any part of this Business.                                                                                                                    |           |                                       |                   |
| Name of company, firm, or organization.                                                                                                                                                           |           |                                       | Percent ownership |
|                                                                                                                                                                                                   |           |                                       |                   |
|                                                                                                                                                                                                   |           |                                       |                   |
|                                                                                                                                                                                                   |           |                                       |                   |
| Principal Office                                                                                                                                                                                  |           |                                       |                   |
| Primary contact                                                                                                                                                                                   |           | Main telephone number                 |                   |
| Email address                                                                                                                                                                                     |           | Website address                       |                   |
| Business address of principal office                                                                                                                                                              |           |                                       |                   |
| Regional Office                                                                                                                                                                                   |           |                                       |                   |
| Primary contact                                                                                                                                                                                   |           | Main telephone number                 |                   |
| Email address                                                                                                                                                                                     |           | Website address                       |                   |
| Business address of regional office                                                                                                                                                               |           |                                       |                   |
| Business History                                                                                                                                                                                  |           |                                       |                   |
| List of names that this Business currently has or anticipates operating under over the history of the Business, including the names of related companies presently doing business.                |           |                                       |                   |
| Names of organization                                                                                                                                                                             | From date | To date                               |                   |
|                                                                                                                                                                                                   |           |                                       |                   |
|                                                                                                                                                                                                   |           |                                       |                   |
|                                                                                                                                                                                                   |           |                                       |                   |
| Indicators of Organization Size                                                                                                                                                                   |           |                                       |                   |
| Average number of current full-time employees                                                                                                                                                     |           |                                       |                   |
| Average estimate of revenue for the current year                                                                                                                                                  |           |                                       |                   |



**Table 1 - General Information Cont'd**

| Previous Contracting Experience                                                                                                                                                                                                                  |                                    |                            |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------|--------|
| Years of experience in projects similar to the proposed Project:                                                                                                                                                                                 |                                    |                            |        |
| As a general contractor                                                                                                                                                                                                                          |                                    | As a joint venture partner |        |
| Has this organization or a participating or predecessor organization ever been disqualified as a bidder by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes* <input type="checkbox"/> No                |                                    |                            |        |
| Has this organization or a participating or predecessor organization ever been barred from contracting by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes* <input type="checkbox"/> No                 |                                    |                            |        |
| Has this organization or a participating or predecessor organization been released from a bid or proposal in the past 5 years? <input type="checkbox"/> Yes* <input type="checkbox"/> No                                                         |                                    |                            |        |
| Has this organization or a participating or predecessor organization ever defaulted on a project or failed to complete any contract awarded to it? <input type="checkbox"/> Yes* <input type="checkbox"/> No                                     |                                    |                            |        |
| Has this organization or a participating or predecessor organization ever refused to construct or refused to provide materials defined in the contract documents or in a change order? <input type="checkbox"/> Yes* <input type="checkbox"/> No |                                    |                            |        |
| Is this organization or a participating or predecessor organization currently involved in any litigation or contemplating litigation? <input type="checkbox"/> Yes* <input type="checkbox"/> No                                                  |                                    |                            |        |
| Provide full details in a separate attachment for each statement above with a "yes" response above.                                                                                                                                              |                                    |                            |        |
| Previous History with Owner                                                                                                                                                                                                                      |                                    |                            |        |
| List projects that have been completed with the Owner over the last 5 years. If more than 5 projects, list only the most recent.                                                                                                                 |                                    |                            |        |
|                                                                                                                                                                                                                                                  | Project Name                       |                            | Year   |
| 1                                                                                                                                                                                                                                                |                                    |                            |        |
| 2                                                                                                                                                                                                                                                |                                    |                            |        |
| 3                                                                                                                                                                                                                                                |                                    |                            |        |
| 4                                                                                                                                                                                                                                                |                                    |                            |        |
| 5                                                                                                                                                                                                                                                |                                    |                            |        |
| Previous Claims History and Litigation Experience                                                                                                                                                                                                |                                    |                            |        |
| List all claims or litigation involving owners on other construction projects that have been active over the last 5 years or that are currently unresolved.                                                                                      |                                    |                            |        |
|                                                                                                                                                                                                                                                  | Description of Claim or Litigation |                            | Status |
| 1                                                                                                                                                                                                                                                |                                    |                            |        |
| 2                                                                                                                                                                                                                                                |                                    |                            |        |
| 3                                                                                                                                                                                                                                                |                                    |                            |        |
| 4                                                                                                                                                                                                                                                |                                    |                            |        |
| 5                                                                                                                                                                                                                                                |                                    |                            |        |

**Table 1 - General Information Cont'd**

| <b>Surety</b>                                                                                                                                                                                                                                                                                           |         |      |               |       |                                                 |      |                                                          |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------|---------------|-------|-------------------------------------------------|------|----------------------------------------------------------|------|
| Surety Name                                                                                                                                                                                                                                                                                             |         |      |               |       |                                                 |      |                                                          |      |
| Mailing address (principal place of business):                                                                                                                                                                                                                                                          |         |      |               |       | Physical address (principal place of business): |      |                                                          |      |
|                                                                                                                                                                                                                                                                                                         |         |      |               |       |                                                 |      |                                                          |      |
| Telephone (main number)                                                                                                                                                                                                                                                                                 |         |      |               |       | Telephone (claims notices)                      |      |                                                          |      |
| Name of Local Agent for Surety                                                                                                                                                                                                                                                                          |         |      |               |       |                                                 |      |                                                          |      |
| Telephone                                                                                                                                                                                                                                                                                               |         |      |               | Email |                                                 |      |                                                          |      |
| Surety is a corporation organized and existing under the laws of the state of                                                                                                                                                                                                                           |         |      |               |       |                                                 |      |                                                          |      |
| Is surety authorized to provide surety bonds in the Project location? <input type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                                          |         |      |               |       |                                                 |      |                                                          |      |
| Is surety listed in the U.S. Department of the Treasury's Listing of Approved Sureties (Department Circular 570 "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies")? <input type="checkbox"/> Yes <input type="checkbox"/> No |         |      |               |       |                                                 |      |                                                          |      |
| <b>Insurance</b>                                                                                                                                                                                                                                                                                        |         |      |               |       |                                                 |      |                                                          |      |
| Name of Insurance Provider                                                                                                                                                                                                                                                                              |         |      |               |       |                                                 |      |                                                          |      |
| Provider is a corporation organized and existing under the laws of the state of                                                                                                                                                                                                                         |         |      |               |       |                                                 |      |                                                          |      |
| Is Provider licensed or authorized to issue insurance policies in the Project location?                                                                                                                                                                                                                 |         |      |               |       |                                                 |      | <input type="checkbox"/> Yes <input type="checkbox"/> No |      |
| Does Provider have an A.M. Best Rating of A-VIII or Better?                                                                                                                                                                                                                                             |         |      |               |       |                                                 |      | <input type="checkbox"/> Yes <input type="checkbox"/> No |      |
| Mailing Address (principal place of business)                                                                                                                                                                                                                                                           |         |      |               |       |                                                 |      |                                                          |      |
| Physical Address (principal place of business)                                                                                                                                                                                                                                                          |         |      |               |       |                                                 |      |                                                          |      |
| Telephone (main number)                                                                                                                                                                                                                                                                                 |         |      |               |       |                                                 |      |                                                          |      |
| Telephone (for notice of claims)                                                                                                                                                                                                                                                                        |         |      |               |       |                                                 |      |                                                          |      |
| Local Agent for Provider                                                                                                                                                                                                                                                                                |         |      |               |       |                                                 |      |                                                          |      |
| Address for Local Agent                                                                                                                                                                                                                                                                                 |         |      |               |       |                                                 |      |                                                          |      |
| Telephone for Local Agent                                                                                                                                                                                                                                                                               |         |      |               |       |                                                 |      |                                                          |      |
| <b>Construction Site Safety Experience</b>                                                                                                                                                                                                                                                              |         |      |               |       |                                                 |      |                                                          |      |
| Provide Offeror's Experience Modification Ratio (EMR) and Total Recordable Frequency Rate (TRFR) for the last 3 years and the EMR and TRFR history for the last 3 years of any proposed Subcontractor that will provide Work valued at 25% or more of the Contract Price.                               |         |      |               |       |                                                 |      |                                                          |      |
| Year                                                                                                                                                                                                                                                                                                    | Offeror |      | Subcontractor |       | Subcontractor                                   |      | Subcontractor                                            |      |
|                                                                                                                                                                                                                                                                                                         | EMR     | TRFR | EMR           | TRFR  | EMR                                             | TRFR | EMR                                                      | TRFR |
| 1                                                                                                                                                                                                                                                                                                       |         |      |               |       |                                                 |      |                                                          |      |
| 2                                                                                                                                                                                                                                                                                                       |         |      |               |       |                                                 |      |                                                          |      |
| 3                                                                                                                                                                                                                                                                                                       |         |      |               |       |                                                 |      |                                                          |      |

**Table 1 - General Information Cont'd**

| Financial Summary Information for Offeror                                                                                                                           |                   |                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|
| Date of Offeror's most current financial statement                                                                                                                  |                   |                    |
| Date of Offeror's most current audited financial statement                                                                                                          |                   |                    |
| Financial indicators from the most current financial statement:                                                                                                     |                   |                    |
| Offeror's Current Ratio = Current Assets ÷ Current Liabilities                                                                                                      |                   |                    |
| Offeror's Quick Ratio = (Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities                                            |                   |                    |
| Describe the resources that are available to the Offeror to provide adequate cash flow for the Project if Offeror's Current Ratio or Quick Ratio are less than 1.0: |                   |                    |
|                                                                                                                                                                     |                   |                    |
| Disadvantaged Business Certifications                                                                                                                               |                   |                    |
| Name of Certification                                                                                                                                               | Certifying Agency | Certification Date |
| <input type="checkbox"/> Disadvantage Business Enterprise                                                                                                           |                   |                    |
| <input type="checkbox"/> Minority Business Enterprise                                                                                                               |                   |                    |
| <input type="checkbox"/> Woman Business Enterprise                                                                                                                  |                   |                    |
| <input type="checkbox"/> Disabled Veteran Owned Business                                                                                                            |                   |                    |
| <input type="checkbox"/> Historically Underutilized Business                                                                                                        |                   |                    |
| <input type="checkbox"/> Small Business Enterprise                                                                                                                  |                   |                    |
| <input type="checkbox"/> Other                                                                                                                                      |                   |                    |
| <input type="checkbox"/> None                                                                                                                                       |                   |                    |

**Table 2 - Current Projects and Project Completed within the last 5 Years**

|                                                                                                                     |                 |                        |                        |                         |       |
|---------------------------------------------------------------------------------------------------------------------|-----------------|------------------------|------------------------|-------------------------|-------|
| Name of Organization                                                                                                |                 |                        |                        |                         |       |
| Project Owner                                                                                                       |                 |                        | Project Name           |                         |       |
| General Description of Project                                                                                      |                 |                        |                        |                         |       |
| Project Cost                                                                                                        |                 |                        | Date Project Completed |                         |       |
| Key Project Personnel                                                                                               | Project Manager | Project Superintendent | Safety Manager         | Quality Control Manager |       |
| Name                                                                                                                |                 |                        |                        |                         |       |
| Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference) |                 |                        |                        |                         |       |
|                                                                                                                     | Name            | Title/Position         | Organization           | Telephone               | Email |
| Owner                                                                                                               |                 |                        |                        |                         |       |
| Designer                                                                                                            |                 |                        |                        |                         |       |
| Construction Manager                                                                                                |                 |                        |                        |                         |       |
|                                                                                                                     |                 |                        |                        |                         |       |
| Project Owner                                                                                                       |                 |                        | Project Name           |                         |       |
| General Description of Project                                                                                      |                 |                        |                        |                         |       |
| Project Cost                                                                                                        |                 |                        | Date Project Completed |                         |       |
| Key Project Personnel                                                                                               | Project Manager | Project Superintendent | Safety Manager         | Quality Control Manager |       |
| Name                                                                                                                |                 |                        |                        |                         |       |
| Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference) |                 |                        |                        |                         |       |
|                                                                                                                     | Name            | Title/Position         | Organization           | Telephone               | Email |
| Owner                                                                                                               |                 |                        |                        |                         |       |
| Designer                                                                                                            |                 |                        |                        |                         |       |
| Construction Manager                                                                                                |                 |                        |                        |                         |       |
|                                                                                                                     |                 |                        |                        |                         |       |
| Project Owner                                                                                                       |                 |                        | Project Name           |                         |       |
| General Description of Project                                                                                      |                 |                        |                        |                         |       |
| Project Cost                                                                                                        |                 |                        | Date Project Completed |                         |       |
| Key Project Personnel                                                                                               | Project Manager | Project Superintendent | Safety Manager         | Quality Control Manager |       |
| Name                                                                                                                |                 |                        |                        |                         |       |
| Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference) |                 |                        |                        |                         |       |
|                                                                                                                     | Name            | Title/Position         | Organization           | Telephone               | Email |
| Owner                                                                                                               |                 |                        |                        |                         |       |
| Designer                                                                                                            |                 |                        |                        |                         |       |
| Construction Manager                                                                                                |                 |                        |                        |                         |       |

**Table 3 - Proposed Project Managers**

|                                                                                                              |                                       |                                   |  |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------|--|
| Name of Organization                                                                                         |                                       |                                   |  |
| <b>Primary Candidate</b>                                                                                     |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as project manager                                                                       |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as project manager                                                                |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |
| <b>Alternate Candidate</b>                                                                                   |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as project manager                                                                       |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as project manager                                                                |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |

**Table 4 - Proposed Project Superintendents**

|                                                                                                              |                                       |                                   |  |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------|--|
| Name of Organization                                                                                         |                                       |                                   |  |
| <b>Primary Candidate</b>                                                                                     |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as project superintendent                                                                |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as project superintendent                                                         |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |
| <b>Alternate Candidate</b>                                                                                   |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as project superintendent                                                                |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as project superintendent                                                         |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |

**Table 5 - Proposed Project Safety Managers**

|                                                                                                              |                                       |                                   |  |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------|--|
| Name of Organization                                                                                         |                                       |                                   |  |
| <b>Primary Candidate</b>                                                                                     |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as project safety manager                                                                |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as project safety manager                                                         |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |
| <b>Alternate Candidate</b>                                                                                   |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as project safety manager                                                                |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as project safety manager                                                         |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |

**Table 6 - Proposed Project Quality Control Managers**

|                                                                                                              |                                       |                                   |  |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------|--|
| Name of Organization                                                                                         |                                       |                                   |  |
| <b>Primary Candidate</b>                                                                                     |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as quality control manager                                                               |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as quality control manager                                                        |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |
| <b>Alternate Candidate</b>                                                                                   |                                       |                                   |  |
| Name of individual                                                                                           |                                       |                                   |  |
| Years of experience as quality control manager                                                               |                                       |                                   |  |
| Years of experience with this organization                                                                   |                                       |                                   |  |
| Number of similar projects as quality control manager                                                        |                                       |                                   |  |
| Number of similar projects in other positions                                                                |                                       |                                   |  |
| Current Project Assignments                                                                                  |                                       |                                   |  |
| Name of assignment                                                                                           | Percent of time used for this project | Estimated project completion date |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
|                                                                                                              |                                       |                                   |  |
| Reference Contact Information (listing names indicates approval to contact named individuals as a reference) |                                       |                                   |  |
| Name                                                                                                         |                                       | Name                              |  |
| Title/Position                                                                                               |                                       | Title/Position                    |  |
| Organization                                                                                                 |                                       | Organization                      |  |
| Telephone                                                                                                    |                                       | Telephone                         |  |
| Email                                                                                                        |                                       | Email                             |  |
| Project                                                                                                      |                                       | Project                           |  |
| Role on project                                                                                              |                                       | Role on project                   |  |



**Table 7 - Project Information for Key Personnel**

|                                                                                                                            |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
|----------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------|-----------------|-----------------------------------------------------------|--------------|-----------------------------------------|-----------|----------------|-------|-------------------------|--|
| Name of Organization                                                                                                       |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| <b>Provide information on all projects completed by the Organization within the last 5 years.</b>                          |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Project Owner                                                                                                              |        |                                          |                 |                                                           |              | Project Name                            |           |                |       |                         |  |
| General Description of Project                                                                                             |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| <b>Project Budget and Schedule Performance</b>                                                                             |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Budget History                                                                                                             | Amount |                                          | % of Bid Amount | Schedule Performance                                      |              |                                         | Date      |                | Days  |                         |  |
| Original Contract Price                                                                                                    |        |                                          |                 | Notice to Proceed                                         |              |                                         |           |                |       |                         |  |
| Change Orders                                                                                                              |        |                                          |                 | Contract Substantial Completion Date at Notice to Proceed |              |                                         |           |                |       |                         |  |
| Owner Enhancements                                                                                                         |        |                                          |                 | Contract Final Completion Date at Notice to Proceed       |              |                                         |           |                |       |                         |  |
| Unforeseen Conditions                                                                                                      |        |                                          |                 | Change Order Authorized Substantial Completion Date       |              |                                         |           |                |       |                         |  |
| Design Issues                                                                                                              |        |                                          |                 | Change Order Authorized Final Completion Date             |              |                                         |           |                |       |                         |  |
| Total                                                                                                                      |        |                                          |                 | Actual / Estimated Substantial Completion Date            |              |                                         |           |                |       |                         |  |
| Final Cost                                                                                                                 |        |                                          |                 | Actual / Estimated Final Completion Date                  |              |                                         |           |                |       |                         |  |
| <b>Key Project Personnel</b>                                                                                               |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
|                                                                                                                            |        |                                          |                 | Project Manager                                           |              | Project Superintendent                  |           | Safety Manager |       | Quality Control Manager |  |
| Name                                                                                                                       |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Percentage of time devoted to the project                                                                                  |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Percentage of time proposed for this Project                                                                               |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Did Individual start and complete the project?                                                                             |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| If not, who started or completed the project in their place?                                                               |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Reason for change?                                                                                                         |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| <b>Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)</b> |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
|                                                                                                                            | Name   |                                          | Title/Position  |                                                           | Organization |                                         | Telephone |                | Email |                         |  |
| Owner                                                                                                                      |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Designer                                                                                                                   |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Construction Manager                                                                                                       |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Surety                                                                                                                     |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| <b>Issues / disputes resolved or pending resolution by arbitration, litigation or dispute review boards</b>                |        |                                          |                 |                                                           |              |                                         |           |                |       |                         |  |
| Number of issues resolved                                                                                                  |        | Total amount involved in resolved issues |                 | Number of issues pending                                  |              | Total amount involved in issues pending |           |                |       |                         |  |

**Table 8 - Demonstration of Budget Performance**

| Name of Offeror                                                                              |                     |                         |                        |                       |               |                     |                                               |
|----------------------------------------------------------------------------------------------|---------------------|-------------------------|------------------------|-----------------------|---------------|---------------------|-----------------------------------------------|
| <b>Provide information on all projects completed by the Offeror within the last 5 years.</b> |                     |                         |                        |                       |               |                     |                                               |
| Owner Name                                                                                   | Project Description | Original Contract Price | Value of Change Orders |                       |               | Total Change Orders | Percent of Changes to Original Contract Price |
|                                                                                              |                     |                         | Owner Enhancements     | Unforeseen Conditions | Design Issues |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |
|                                                                                              |                     |                         |                        |                       |               |                     |                                               |
| Notes:                                                                                       |                     |                         |                        |                       |               |                     |                                               |

**Table 9 - Demonstration of On-Time Performance**

| Name of Organization                                                                              |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|---------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------|---------------------------------------------|--------------------------------------------------|--------------------------------------------|-------------------------------------------------|-------------------------------------------|
| <b>Provide information on all projects completed by the Organization within the last 5 years.</b> |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Owner Name                                                                                        | Project Description | Original Contract Date for Substantial Completion | Original Contract Date for Final Completion | Amended Contract Date for Substantial Completion | Amended Contract Date for Final Completion | Actual Contract Date for Substantial Completion | Actual Contract Date for Final Completion |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
|                                                                                                   |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |
| Notes:                                                                                            |                     |                                                   |                                             |                                                  |                                            |                                                 |                                           |

**END OF SECTION**

## **00 52 13      AGREEMENT**

This Agreement is between The Town of Summerfield (Owner) and **[name of Contractor to be inserted at time of contract execution]** (Contractor).

Owner and Contractor agree as follows:

### **ARTICLE 1 – WORK**

- 1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is designated as follows:

#### **Water System Improvements – SMF24162**

The Town of Summerfield intends to construct a fire flow system consisting of a 150,000-gallon elevated storage tank, a supply well with a minimum well yield of 200 gpm, and approximately 3,700 linear feet of 12-inch fire flow distribution main. This will support a 1,000 gpm flow for a 2 hour duration for the fire flow system. This is the first phase of a potable water system that will serve the Town in the future.

### **ARTICLE 2 – DESIGN PROFESSIONAL**

- 2.01 The Design Professional for this Project is:

Freese and Nichols, Inc.  
1001 Tuckaseegee Road, Suite 120  
Charlotte, NC 28208

### **ARTICLE 3 – CONSTRUCTION MANAGER**

- 3.01 The Construction Manager for this Project is:

The Construction Manager for this Project has not yet been selected and is identified as “To Be Determined.” The Owner reserves the right to procure Construction Manager services separately. Upon selection, the Construction Manager’s identity and role, if applicable, will be communicated to the Contractor by addendum or prior to execution of the Contract.

### **ARTICLE 4 – CONTRACT TIMES**

- 4.01 Contract Times

- A. The Work is required to be substantially complete on or before December 31, 2026, and complete and ready for final payment in accordance with the General Conditions 60 days from substantial completion. Completing the project by December 31, 2026 is a priority for the Town for funding purposes. The Town is willing to negotiate incentives for prompt completion of the project.

- 4.02 Liquidated Damages

- A. Owner and Contractor recognize that the Contract Times specified for Substantial Completion and Final Completion are of the essence in the Contract. Owner and Contractor recognize that the Owner will suffer financial loss if the Work is not completed within the Contract Times specified in this Agreement as may be adjusted in accordance with the

General Conditions. Owner and Contractor also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration preceding the actual loss suffered by Owner if the Work is not completed within the Contract Times. Accordingly, instead of requiring proof of the amount of these damages, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Contractor agrees to pay Owner \$1,000 for each day that expires after the time specified in this Agreement for Substantial Completion until the Work is substantially complete.
  2. Contractor agrees to pay Owner \$1,000 for each day that expires after the time specified in this Agreement for Final Completion until the Work is completed and ready for final payment in accordance with the General Conditions.
- B. Liquidated damages for failing to timely attain Substantial Completion and Final Completion are not additive and will not be imposed concurrently.
- C. OPT will determine whether the Work has been completed within the Contract Times. Assessment of liquidated damages by the Owner does not waive the Owner's right to assess or collect additional damages which Owner may sustain by the failure of the Contractor to perform in accordance with the terms of its Contract.

#### **ARTICLE 5 – CONTRACT PRICE**

- 5.01 Owner will pay Contractor for completion of the Work in accordance with the Contract Documents at the prices shown in this Agreement. The Contract Price has been computed in accordance with the General Conditions. Contractor acknowledges that for unit price items, estimated quantities are not guaranteed and are solely for the purpose of comparing Bids, and that final payment will be based on actual quantities determined in accordance with the Contract Documents.

#### **ARTICLE 6 – PAYMENT PROCEDURES**

- 6.01 Submit Applications for Payment in accordance with the General Conditions. Applications for Payment will be processed by the Construction Manager per Section 01 29 00 "Application for Payment Procedures."
- 6.02 The Owner will make progress payments as invoices are received from the contractor during performance of the Work. Payment is based on the total earned value of Work completed in the previous month in accordance with the Schedule of Values established as provided in the General Conditions.
- 6.03 Payment will be made for the total earned value of Work completed in the previous month after deducting:
- A. Retainage calculated per this Agreement;
  - B. Set-offs determined in accordance with the General Conditions; and
  - C. The total amount of payments previously made.
- 6.04 Retainage
- A. Progress payments will be made in an amount equal to 100 percent of the total earned value to date for completed Work and properly stored materials if the Contract Price is

\$100,000.00 or less. No retainage will be held on payments made to the Contractor for Work completed on this Project.

- B. Progress payments will be made in an amount equal to 95 percent of the total earned value to date for completed Work and properly stored materials if the Contract Price is \$100,000.00 or more. The remaining 5 percent of the total earned value to date will be held as retainage.
- C. The Owner may authorize remaining payments be made in an amount equal to 100 percent of the total earned value for Work and properly stored materials completed after 50 percent of the Project has been completed provided the Contractor continues to perform satisfactorily and any nonconforming Work identified in writing prior to that time by the OPT has been corrected by the Contractor and accepted by the OPT. If the Owner determines the Contractor's performance is unsatisfactory, the Owner may reinstate retainage for each subsequent periodic Application for Payment up to the 5 percent. This retainage amount may be adjusted for changes in the Contract Price that occur after 50 percent of the Contract Price has been paid to the Contractor. The reduction in the amount of retainage held after 50 percent of the Work has been completed requires approval of the Owner's governing body.
- D. The Project shall be deemed 50 percent complete when the Contractor's gross project invoices, excluding the value of materials stored off-site, equal or exceed 50 percent of the value of the Contract, except the value of materials stored on-site shall not exceed 20 percent of the Contractor's gross project invoices for the purpose of determining whether the Project is 50 percent.
- E. Following 50 percent completion of the Project, the Owner shall be authorized to withhold additional retainage from a subsequent periodic payment, not to exceed 5 percent, in order to allow the Owner to retain 2.5 percent total retainage through the completion of the Project.
- F. The Owner will release all retainage payments held by the Owner, with written consent of the surety, to the Contractor within 60 days after the submission of a final Application for Payment if: (i) the Owner receives a Certificate of Substantial Completion from the Design Professional in charge of the Project; or (ii) the Owner receives beneficial occupancy or use of the Project. However, the Owner may retain sufficient funds to secure completion of the Project or corrections on any Work. If the Owner retains funds, the amount retained shall not exceed 2.5 times the estimated value of the Work to be completed or corrected.
- G. Any release or reduction in retainage is contingent upon the consent of surety to the reduction in retainage. Submit a Consent of Surety Company to Reduction of or Partial Release of Retainage form as provided by or approved by the Construction Manager. The release or reduction in the amount of retainage held also requires the approval of the Owner's governing body.
- H. Retainage provisions contained in Contractor's subcontracts may not exceed the terms and conditions for retainage provided herein. Contractors are further required to satisfy the retainage provisions of NCGS §143-134.1(b2) with regard to subcontracts for early finishing trades (structural steel, piling, caisson, and demolition) and to coordinate the release of retainage for such trades from the retainage held by the Owner from the Contractor pursuant to statute.

- I. Nothing shall prevent the Owner from the withholding payment to the Contractor in addition to the amounts identified herein for unsatisfactory job progress, defective construction not remedied, disputed Work, or third-party claims filed against the Owner or reasonable evidence that a third-party claim will be filed.
- 6.05 Owner will pay the remainder of the Contract Price as recommended by Construction Manager in accordance with the General Conditions upon Final Completion and acceptance of the Work.

#### **ARTICLE 7 – PAYMENT OF INTEREST**

- A. The Owner is not obligated to pay interest on moneys not paid except as provided in Chapter 143 of the North Carolina General Statutes.

#### **ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS**

- 8.01 The Contractor makes the following representations:
- A. The Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
  - B. The Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
  - C. The Contractor is familiar with Laws and Regulations that may affect cost, progress, and performance of the Work.
  - D. The Contractor has carefully studied the following Site related reports and drawings as identified in the Supplementary Conditions:
    - 1. Geotechnical Data Reports regarding subsurface conditions at or adjacent to the Site;
    - 2. Drawings of physical conditions relating to existing surface or subsurface structures at the Site;
    - 3. Underground Facilities referenced in reports and drawings;
    - 4. Reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site; and
    - 5. Technical Data related to each of these reports and drawings.
  - E. The Contractor has considered the:
    - 1. Information known to Contractor;
    - 2. Information commonly known to contractors doing business in the locality of the Site;
    - 3. Information and observations obtained from visits to the Site; and
    - 4. The Contract Documents.
  - F. The Contractor has considered the items identified in this Article with respect to the effect of such information, observations, and documents on:
    - 1. The cost, progress, and performance of the Work;
    - 2. The means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and

3. Contractor's safety precautions and programs.

- G. Based on the information and observations referred to in the preceding paragraphs, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
- H. The Contractor is aware of the general nature of Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- I. The Contractor has correlated the information known to the Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- J. The Contractor has given the Construction Manager written notice of all conflicts, errors, ambiguities, or discrepancies that the Contractor has discovered in the Contract Documents, and the written resolution provided by the Construction Manager is acceptable to the Contractor.
- K. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- L. The Contractor will comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes. Further, if Contractor utilizes a subcontractor, Contractor will require the subcontractor to comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes.
- M. Contractor has not been suspended by the State of North Carolina or any agency or department thereof for conviction or indictment of any of the offenses enumerated in NCGS §133-27 nor will award subcontracts of any tier to firms that have been suspended for conviction or indictment of any of the offenses enumerated in NCGS §133-27.
- N. The Contractor is not on the North Carolina State Treasurer's list of persons engaging in business activities in Iran, nor will Contractor utilize any Subcontractor on such list on this Project in violation of NCGS §147-86.55, et seq.
- O. The Contractor is not on the North Carolina State Treasurer's list of companies engaged in a boycott of Israel, nor will Contractor utilize any Subcontractor on such list on this Project in violation of NCGS §147-86.80, et seq.
- P. The Contractor's entry into this Agreement constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

## ARTICLE 9 – ACCOUNTING RECORDS

- 9.01 Accounting Record Availability: The Contractor is to establish and maintain, in accordance with generally accepted accounting practices, full and detailed accounting records of materials incorporated into the Project, and labor, tools, materials, and equipment used for the Work, consistent with the requirements of the General Conditions and as necessary for proper financial management under this Agreement. Subject to prior written notice, provide Owner reasonable access during normal business hours to Contractor's records, books, correspondence,



instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and the Contractor's fee. Preserve all such documents for a period of 3 years after the final payment by the Owner.

#### **ARTICLE 10 – VENUE**

10.01 Contractor agrees that venue lies exclusively in Guilford County, North Carolina for any legal action.

#### **ARTICLE 11 – CONTRACT DOCUMENTS**

##### **11.01 Contract Documents**

- A. Specifications Sections listed in Section 00 01 10 "Table of Contents" except as specifically excluded in Paragraph 11.02.
- B. Drawings listed in the Sheet Index on the Drawings.
- C. Addenda (Numbers 00 91 01 to 00 91 ~~XX~~, inclusive).
- D. Appendices listed in Section 00 01 10 "Table of Contents" except as specifically excluded in Paragraph 11.02.
- E. The following are also Contract Documents which may be delivered or issued on or after the Effective Date of the Contract:
  - 1. Notice to Proceed.
  - 2. Contract Amendment(s).
  - 3. Change Order(s).
  - 4. Field Order(s).
  - 5. Work Change Directive(s).
- F. There are no Contract Documents other than those listed above in this Paragraph. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

##### **11.02 Bidding Requirements and Informational Documents**

- A. The following Bidding Requirements are not Contract Documents:
  - 1. Section 00 41 16 "Bid Form Exhibit A."
  - 2. Section 00 43 13 "Bid Bond."
  - 3. Section 00 45 01 "Nonresident Bidders."
  - 4. Section 00 45 02 "Non-Collusion Certification."
  - 5. Section 00 45 03 "State Sales Tax Requirements."
- B. The following documents are provided for information only and are not part of the Contract Documents:
  - 1. Report of Subsurface Exploration
  - 2. Basis of Design Report

The Effective Date of the Contract is **[date to be inserted at the time of contract execution]**.

|                            |                                                             |                            |                                                                                       |
|----------------------------|-------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------|
| Owner:                     | <u>The Town of Summerfield</u><br><i>(typed or printed)</i> | Contractor:                | <u></u><br><i>(typed or printed)</i>                                                  |
| By:                        | <u></u><br><i>(individual's signature)</i>                  | By:                        | <u></u><br><i>(individual's signature)</i>                                            |
| Name:                      | <u></u><br><i>(typed or printed)</i>                        | Name:                      | <u></u><br><i>(typed or printed)</i>                                                  |
| Title:                     | <u></u><br><i>(typed or printed)</i>                        | Title:                     | <u></u><br><i>(typed or printed)</i><br><i>(Attach evidence of authority to sign)</i> |
| Address for giving notice: |                                                             | Address for giving notice: |                                                                                       |
| <u></u>                    |                                                             | <u></u>                    |                                                                                       |
| <u></u>                    |                                                             | <u></u>                    |                                                                                       |
| <u></u>                    |                                                             | <u></u>                    |                                                                                       |
| Designated representative: |                                                             | Designated representative: |                                                                                       |
| Name:                      | <u></u>                                                     | Name:                      | <u></u>                                                                               |
| Title:                     | <u></u>                                                     | Title:                     | <u></u>                                                                               |
| Address:                   |                                                             | Address:                   |                                                                                       |
| <u></u>                    |                                                             | <u></u>                    |                                                                                       |
| <u></u>                    |                                                             | <u></u>                    |                                                                                       |
| <u></u>                    |                                                             | <u></u>                    |                                                                                       |
| Phone:                     | <u></u>                                                     | Phone:                     | <u></u>                                                                               |
| Email:                     | <u></u>                                                     | Email:                     | <u></u>                                                                               |

END OF SECTION



**KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL AND SURETY above named, are held and firmly bound unto the above named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.**

**THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain contract with the Contracting Body, numbered as shown above and hereto attached:**

**NOW THEREFORE, if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the Contracting Body, with or without notice to the Surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.**

**IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.**

**Provisions of this bond shall be pursuant to the terms and provisions of Chapter 44A, Article 3 of the North Carolina General Statutes as amended and all liabilities on this bond will be determined in accordance with the terms and provisions of said Chapter to the same extent as if it were copied at length herein. Venue lies exclusively in Guilford County, North Carolina for any legal action.**

|                                |                                                        |
|--------------------------------|--------------------------------------------------------|
| <b>Contractor as Principal</b> | <b>Surety</b>                                          |
| Signature: _____               | Signature: _____                                       |
| Name: _____                    | Name: _____                                            |
| Title: _____                   | Title: _____                                           |
| Email: _____                   | Email: _____                                           |
|                                | (Attach Power of Attorney and place surety seal below) |

END OF SECTION

**00 61 16      PAYMENT BOND**

|                                                                                                                                                                                |                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Contractor as Principal</b><br><br>Name:<br><br>Mailing address (principal place of business):<br><br>                                                                      | <b>Surety</b><br><br>Name:<br><br>Mailing address (principal place of business):<br><br>                                                                                |
| <b>Owner (Contracting Body)</b><br><br>Name: The Town of Summerfield<br><br>Mailing address (principal place of business):<br>P.O. Box 970<br>Summerfield, NC 27358            | Physical address (principal place of business):<br><br><br><br><br><br><br><br><br>Telephone (Main):<br><br>Telephone (Claims):<br><br>Surety's state of incorporation: |
| <b>Contract</b><br><br>Contract No.:<br><br>Project name and number:<br>Water System Improvements (SMF24162)<br><br><br><br>Contract Price:<br><br>Effective Date of Contract: | <b><i>By submitting this bond, Surety affirms that it is licensed to provide and execute this bond and authorized to do business in North Carolina.</i></b>             |
| <b>Bond</b><br><br>Bond Amount: 100 percent of Contract Price<br><br>Date of Bond:<br><br>(Date of Bond cannot be earlier than Effective Date of Contract)                     | <b>Local Agent for Surety</b><br><br>Name:<br><br>Mailing address (principal place of business):<br><br><br><br><br><br><br>Telephone (Main):                           |

**KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL and SURETY above named, are held and firmly bound unto the above named Contracting Body, hereinafter called the Contracting Body, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.**

**THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain contract with the Contracting Body, numbered as shown above and hereto attached;**

**NOW THEREFORE, if the Principal shall promptly make payment to all persons supplying labor and material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.**

**IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.**

**Provisions of this bond shall be pursuant to the terms and provisions of Chapter 44A, Article 3 of the North Carolina General Statutes as amended and all liabilities on this bond will be determined in accordance with the terms provisions of said Chapter to the same extent as if it were copied at length herein. Venue lies exclusively in Guilford County, North Carolina for any legal action.**

|                                |                  |
|--------------------------------|------------------|
| <b>Contractor as Principal</b> | <b>Surety</b>    |
| Signature: _____               | Signature: _____ |
| Name: _____                    | Name: _____      |
| Title: _____                   | Title: _____     |
| Email: _____                   | Email: _____     |

*(Attach Power of Attorney and place surety seal below)*

**END OF SECTION**

**00 72 00 GENERAL CONDITIONS**

**TABLE OF CONTENTS**

|                                                                                                | Page |
|------------------------------------------------------------------------------------------------|------|
| Article 1 – Definitions and Terminology .....                                                  | 5    |
| 1.01 Defined Terms.....                                                                        | 5    |
| 1.02 Terminology .....                                                                         | 10   |
| Article 2 – Preliminary Matters .....                                                          | 12   |
| 2.01 Delivery of Bonds and Evidence of Insurance.....                                          | 12   |
| 2.02 Copies of Documents .....                                                                 | 12   |
| 2.03 Before Starting Construction .....                                                        | 12   |
| 2.04 Electronic Transmittals .....                                                             | 13   |
| Article 3 – Contract Documents: Intent, Requirements, Reuse.....                               | 13   |
| 3.01 Intent.....                                                                               | 13   |
| 3.02 Reference Standards .....                                                                 | 14   |
| 3.03 Reporting and Resolving Discrepancies .....                                               | 15   |
| 3.04 Interpretation of the Contract Documents.....                                             | 16   |
| 3.05 Reuse of Documents .....                                                                  | 16   |
| Article 4 – Commencement and Progress of the Work .....                                        | 16   |
| 4.01 Commencement of Contract Times; Notice to Proceed .....                                   | 16   |
| 4.02 Progress Schedule .....                                                                   | 16   |
| 4.03 Delays in Contractor’s Progress .....                                                     | 17   |
| Article 5 – Site; Subsurface and Physical Conditions; Hazardous Environmental Conditions ..... | 18   |
| 5.01 Availability of Lands .....                                                               | 18   |
| 5.02 Use of Site and Other Areas.....                                                          | 18   |
| 5.03 Subsurface and Physical Conditions.....                                                   | 19   |
| 5.04 Differing Subsurface or Physical Conditions .....                                         | 20   |
| 5.05 Underground Facilities.....                                                               | 21   |
| 5.06 Hazardous Environmental Conditions at Site .....                                          | 23   |
| Article 6 – Bonds and Insurance .....                                                          | 24   |
| 6.01 Performance, Payment, and Other Bonds .....                                               | 24   |
| 6.02 Licensed Sureties .....                                                                   | 25   |
| 6.03 Insurance - General Provisions .....                                                      | 25   |
| Article 7 – Contractor’s Responsibilities .....                                                | 26   |
| 7.01 Contractor’s Means and Methods of Construction .....                                      | 26   |
| 7.02 Supervision and Superintendence .....                                                     | 27   |
| 7.03 Labor; Working Hours .....                                                                | 27   |

|                                                                                                |                                                                                 |    |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----|
| 7.04                                                                                           | Services, Materials, and Equipment .....                                        | 27 |
| 7.05                                                                                           | Concerning Subcontractors, and Suppliers .....                                  | 28 |
| 7.06                                                                                           | Patent Fees and Royalties .....                                                 | 29 |
| 7.07                                                                                           | Permits .....                                                                   | 29 |
| 7.08                                                                                           | Taxes .....                                                                     | 29 |
| 7.09                                                                                           | Laws and Regulations.....                                                       | 29 |
| 7.10                                                                                           | Safety and Protection .....                                                     | 30 |
| 7.11                                                                                           | Hazard Communication Programs .....                                             | 31 |
| 7.12                                                                                           | Emergencies.....                                                                | 31 |
| 7.13                                                                                           | Contractor's General Warranty and Guarantee .....                               | 31 |
| 7.14                                                                                           | Correction Period .....                                                         | 32 |
| 7.15                                                                                           | Indemnification .....                                                           | 33 |
| 7.16                                                                                           | Delegation of Professional Design Services .....                                | 33 |
| Article 8 – Other Work at the Site.....                                                        |                                                                                 | 34 |
| 8.01                                                                                           | Other Work .....                                                                | 34 |
| 8.02                                                                                           | Coordination .....                                                              | 35 |
| 8.03                                                                                           | Legal Relationships.....                                                        | 35 |
| Article 9 – Owner's and OPT's Responsibilities.....                                            |                                                                                 | 36 |
| 9.01                                                                                           | Communications to Contractor .....                                              | 36 |
| 9.02                                                                                           | Replacement of Owner's Project Team Members.....                                | 36 |
| 9.03                                                                                           | Furnish Data .....                                                              | 36 |
| 9.04                                                                                           | Pay When Due.....                                                               | 36 |
| 9.05                                                                                           | Lands and Easements; Reports and Tests.....                                     | 36 |
| 9.06                                                                                           | Insurance.....                                                                  | 36 |
| 9.07                                                                                           | Modifications .....                                                             | 36 |
| 9.08                                                                                           | Inspections, Tests, and Approvals.....                                          | 36 |
| 9.09                                                                                           | Limitations on OPT's Responsibilities .....                                     | 36 |
| 9.10                                                                                           | Undisclosed Hazardous Environmental Condition.....                              | 37 |
| 9.11                                                                                           | Compliance with Safety Program.....                                             | 37 |
| Article 10 – Design Professional's and Construction Manager's Status During Construction ..... |                                                                                 | 37 |
| 10.01                                                                                          | Owner's Representative.....                                                     | 37 |
| 10.02                                                                                          | Visits to Site.....                                                             | 37 |
| 10.03                                                                                          | Rejecting Defective Work .....                                                  | 37 |
| 10.04                                                                                          | Decisions on Requirements of Contract Documents and Acceptability of Work ..... | 38 |
| Article 11 – Changes to the Contract .....                                                     |                                                                                 | 38 |
| 11.01                                                                                          | Amending and Supplementing the Contract Documents .....                         | 38 |
| 11.02                                                                                          | Contract Amendments.....                                                        | 39 |



|                                                                                                |                                                         |    |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------|----|
| 11.03                                                                                          | Change Orders .....                                     | 39 |
| 11.04                                                                                          | Work Change Directives.....                             | 40 |
| 11.05                                                                                          | Field Orders.....                                       | 40 |
| 11.06                                                                                          | Change Proposals.....                                   | 40 |
| 11.07                                                                                          | Change of Contract Price; Contract Times .....          | 41 |
| 11.08                                                                                          | Execution of Change Orders and Contract Amendments..... | 41 |
| 11.09                                                                                          | Notice to Surety .....                                  | 42 |
| Article 12 – Claims.....                                                                       |                                                         | 42 |
| 12.01                                                                                          | Claims.....                                             | 42 |
| Article 13 – Cost of the Work; Allowances; Unit Price Work.....                                |                                                         | 43 |
| 13.01                                                                                          | Cost of the Work .....                                  | 43 |
| 13.02                                                                                          | Allowances .....                                        | 46 |
| 13.03                                                                                          | Unit Price Work.....                                    | 47 |
| 13.04                                                                                          | Contingencies.....                                      | 47 |
| Article 14 – Tests and Inspections; Correction, Removal, or Acceptance of Defective Work ..... |                                                         | 48 |
| 14.01                                                                                          | Access to Work.....                                     | 48 |
| 14.02                                                                                          | Tests, Inspections, and Approvals.....                  | 48 |
| 14.03                                                                                          | Defective Work .....                                    | 49 |
| 14.04                                                                                          | Acceptance of Defective Work .....                      | 49 |
| 14.05                                                                                          | Uncovering Work .....                                   | 50 |
| 14.06                                                                                          | Owner May Stop the Work .....                           | 50 |
| 14.07                                                                                          | Owner May Correct Defective Work.....                   | 51 |
| Article 15 – Payments to Contractor; Set-offs; Final Completion.....                           |                                                         | 51 |
| 15.01                                                                                          | Progress Payments.....                                  | 51 |
| 15.02                                                                                          | Contractor’s Warranty of Title .....                    | 53 |
| 15.03                                                                                          | Substantial Completion.....                             | 53 |
| 15.04                                                                                          | Partial Utilization.....                                | 54 |
| 15.05                                                                                          | Final Inspection .....                                  | 54 |
| 15.06                                                                                          | Final Payment.....                                      | 54 |
| 15.07                                                                                          | Waiver of Claims .....                                  | 55 |
| Article 16 – Suspension of Work and Termination .....                                          |                                                         | 55 |
| 16.01                                                                                          | Owner May Suspend Work .....                            | 55 |
| 16.02                                                                                          | Owner May Terminate for Cause.....                      | 55 |
| 16.03                                                                                          | Owner May Terminate for Convenience .....               | 56 |
| 16.04                                                                                          | Contractor May Stop Work or Terminate .....             | 57 |
| Article 17 – Final Resolution of Disputes .....                                                |                                                         | 57 |
| 17.01                                                                                          | Methods and Procedures.....                             | 57 |

Article 18 – Miscellaneous ..... 58

18.01 Computation of Times ..... 58

18.02 Independent Contractor ..... 58

18.03 Cumulative Remedies ..... 58

18.04 Limitation of Damages ..... 58

18.05 No Waiver ..... 58

18.06 Severability..... 58

18.07 Survival of Obligations ..... 59

18.08 No Third-Party Beneficiaries ..... 59

18.09 Successors and Assigns ..... 59

18.10 Assignment of Contract ..... 59

18.11 No Waiver of Sovereign Immunity..... 59

18.12 Controlling Law ..... 59

## ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

### 1.01 Defined Terms

- A. A term with initial capital letters, including the term’s singular and plural forms, has the meaning indicated in this Paragraph wherever used in the Bidding Requirements or Proposal Requirements or Contract Documents. In addition to the terms specifically defined, terms with initial capital letters in the Contract Documents may include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Documents issued prior to the receipt of Bids or Proposals which clarify or modify the Bidding Requirements/Proposal Requirements or the proposed Contract Documents.
  2. *Agreement*—The document signed by Owner and Contractor that establishes the Contract Price and Contract Times, and designates the specific documents that are Contract Documents.
  3. *Application for Payment*—The documents used by Contractor to request payments from Owner and the supporting documentation required by the Contract Documents.
  4. *Bid; Proposal*—An offer submitted to Owner for the Project setting forth the Contract Price and Contract Times for the Work to be performed.
  5. *Bidding Documents; Proposal Documents*—The Bidding Requirements or Proposal Requirements, the proposed Contract Documents, and Addenda.
  6. *Bidding Requirements; Proposal Requirements*—The Invitation to Bid or Request for Proposals, Instructions to Offerors, Bid Security or Proposal Security, Bid Form or Proposal Form and attachments, and required certifications and affidavits.
  7. *Bid Security; Proposal Security*—The financial security provided by Offeror at the time the Bid or Proposal is submitted and held by Owner until the Agreement is executed and the evidence of insurance and bonds required by the Contract Documents are provided.
  8. *Change Order*—A document issued on or after the Effective Date of the Contract and signed by Owner and Contractor which modifies the Work, Contract Price, Contract Times, or terms and conditions of the Contract.
  9. *Change Proposal*—A document submitted by Contractor in accordance with the requirements of the Contract Documents:
    - a. Requesting an adjustment in Contract Price or Contract Times;
    - b. Contesting an initial decision concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents;
    - c. Challenging a Set-off against payment due; or
    - d. Seeking other relief with respect to the terms and conditions of the Contract.
  10. *Claim*—A demand or assertion by Owner or Contractor submitted in accordance with the requirements of the Contract Documents. A demand for money or services by an entity other than Owner or Contractor is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning any hazardous, toxic, or dangerous waste, substance, or material.
12. *Construction Manager*—The individual or entity named as Construction Manager in the Agreement and the consultants, subconsultants, individuals, or entities directly or indirectly employed or retained by them to provide construction management as advisor services to Owner.
13. *Construction Manager at Risk (CMAR)*—The individual or entity selected by Owner to construct the Project using the Construction Manager at Risk project delivery method. The term Contractor means Construction Manager at Risk in the Contract Documents when the Construction Manager at Risk project delivery method is used.
14. *Contract*—The entire integrated set of documents concerning the Work and describing the relationship between the Owner and Contractor.
15. *Contract Amendment*—A document issued on or after the Effective Date of the Contract and signed by Owner and Contractor which:
  - a. Authorizes new phases of the Work and establishes the Contract Price, Contract Times, or terms and conditions of the Contract for the new phase of Work; or
  - b. Modifies the terms and conditions of the Contract, but does not make changes in the Work.
16. *Contract Documents*—Those items designated as Contract Documents in the Agreement.
17. *Contract Price*—The monetary amount stated in the Agreement and as adjusted by Modifications, and increases or decreases in unit price quantities, if any, that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
18. *Contract Times*—The number of days or the dates by which Contractor must achieve specified Milestones, achieve Substantial Completion, and complete the Work.
19. *Contractor*—The individual or entity with which Owner has contracted to perform the Work.
20. *Contractor's Team*—Contractor, Subcontractors, Suppliers, and individuals or entities directly or indirectly employed or retained by Contractor, Subcontractors, or Suppliers to perform part of the Work, or anyone for whose acts they may be liable.
21. *Cost of the Work*—The sum of costs incurred for the performance of the Work as allowed by Article 13.
22. *Day*—A day of 24 hours measured from midnight to the next midnight.
23. *Defective*—When applied to Work, refers to Work that is unsatisfactory, faulty, or deficient in that it:
  - a. Does not conform to the Contract Documents;

- b. Does not meet the requirements of applicable inspections, reference standards, tests, or approvals referred to in the Contract Documents; or
  - c. Has been damaged prior to Construction Manager's recommendation of final payment unless responsibility for the protection of the Work has been assumed by Owner at Substantial Completion in accordance with Article 15.
24. *Design Professional*—The individuals or entity named as the Architect or Engineer in the Agreement and the subconsultants, individuals, or entities directly or indirectly employed or retained by Design Professional to provide design or other technical services to Owner. Design Professional has responsibility for design and technical issues related to the Contract Documents.
  25. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work. Shop Drawings and other documents generated by Contractor's Team are not Drawings.
  26. *Effective Date of the Contract*—The date indicated in the Agreement on which the Contract becomes effective.
  27. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including Shop Drawings and other Submittals, that are in an electronic or digital format.
  28. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.
  29. *Field Order*—A document issued by Construction Manager or Design Professional requiring changes in the Work that do not change the Contract Price or the Contract Times.
  30. *Final Completion*—The point where the Work is complete in accordance with the Contract Documents, items and documents required by the Contract Documents have been accepted by Owner and the Project is ready for Final Payment.
  31. *Guaranteed Maximum Price (GMP)*—The maximum amount to be paid by Owner for the sum of the Cost of the Work plus Contractor's fee as set forth in the Agreement, subject to increases or decreases for changes in the Work, when the Construction Manager at Risk project delivery method is used.
  32. *Hazardous Environmental Condition*—The presence of Constituents of Concern at the Site in quantities or circumstances that may present a danger to persons or property exposed to Constituents of Concern. The presence of Constituents of Concern at the Site necessary for the execution of the Work or to be incorporated into the Work is not a Hazardous Environmental Condition provided these Constituents of Concern are

controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract.

- a. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
  - b. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
33. *Indemnified Costs*—All costs, losses, judgments, and damages resulting from claims or demands against Owner’s Indemnitees. These costs include fees for design professionals, attorneys, and other professionals and any legal, court, arbitration, or other dispute resolution costs.
34. *Laws and Regulations; Laws or Regulations*—Applicable laws, statutes, rules, regulations, ordinances, codes, permits, and binding decrees, resolutions, and orders of governmental bodies, agencies, authorities, and courts having jurisdiction over the Project.
35. *Liens*—Charges, security interests, or encumbrances upon Contract related funds, real property, or private property.
36. *Manufacturer*—The individual or entity that designs, casts, fabricates, manufactures, assembles, tests, and provides materials or equipment to be incorporated in the Work.
37. *Milestone*—A principal event in the performance of the Work that Contractor is required by Contract to complete by a specified date or within a specified time.
38. *Modification*—Change made to the Contract Documents by Contract Amendment, Change Order, Field Order, or Work Change Directive.
39. *Notice of Award*—The notice of Owner’s acceptance of the Successful Offeror’s Bid or Proposal.
40. *Notice to Proceed*—A notice to Contractor of the Contract Times and the date Work is to begin.
41. *Offeror*—An individual or entity that submits a Bid or Proposal to Owner.
42. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
43. *Owner’s Budget*—The amount budgeted by Owner for the construction of the Project.
44. *Owner’s Indemnitees*—Each member of OPT and their officers, directors, members, partners, employees, agents, consultants, and subcontractors.
45. *Owner’s Project Team (OPT)*—The Owner, Design Professional, Construction Manager, and the other entities identified in the Supplementary Conditions and the consultants, subconsultants, individuals or entities directly or indirectly employed or retained by them to provide services to Owner.

46. *Progress Schedule*—A schedule prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
47. *Project*—The total undertaking to be accomplished for Owner under the Contract Documents.
48. *Project Construction Manager (PCM)*—The authorized representative of OPT assigned to assist Construction Manager at the Site. The term Project Construction Manager includes assistants and field staff of Construction Manager.
49. *Project Management Information System (PMIS)*—The online project management system that will be used by OPT and Contractor to submit and share documentation and other related communications and information for this Project.
50. *Samples*—Physical examples of materials, equipment, or workmanship representing some portion of the Work that are used to establish the standards for that portion of the Work.
51. *Schedule of Anticipated Payments*—A detailed tabulation, prepared and maintained by Contractor, showing the anticipated amount of each Application for Payment and the month in which they will be submitted.
52. *Schedule of Submittals*—A detailed tabulation, prepared and maintained by Contractor, of each required submittal and the time requirements for review and approval of each submittal.
53. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for Contractor’s Applications for Payment.
54. *Set-off*—A reduction in payment due to Contractor under Article 15.
55. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by Contractor’s Team and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
56. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed. The Site includes rights-of-way, easements, and other lands or areas furnished by Owner which are designated for use by Contractor.
57. *Specifications*—The part of the Contract that describes the requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
58. *Subcontractor*—An individual or entity having a direct contract with Contractor or with other Subcontractors or Suppliers for the performance of a part of the Work.
59. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Construction Manager, or that is indicated as a Submittal in the Schedule of Submittals accepted by Construction Manager. Submittals, whether approved or accepted by OPT, are not Contract Documents.

60. *Substantial Completion*—The point where the Work or a specified part of the Work is sufficiently complete to be used for its intended purpose in accordance with the Contract Documents.
61. *Successful Offeror*—The Offeror to which Owner awards the Contract.
62. *Supplementary Conditions*—The part of the Contract that amends or supplements the General Conditions.
63. *Supplier*—A Manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with Subcontractors or other Suppliers to furnish materials or equipment to be incorporated in the Work.
64. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions with respect to either:
  - a. Existing subsurface conditions at or adjacent to the Site;
  - b. Existing physical conditions at or adjacent to the Site including existing surface or subsurface structures at the Site, except Underground Facilities; or
  - c. Hazardous Environmental Conditions at the Site.
65. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site , including those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
66. *Unit Price Work*—Work to be paid for based on unit prices.
67. *Work*—The construction of the Project or its component parts as required by the Contract Documents. Work includes and is the result of performing and providing all labor, services, and documentation to construct the Project; providing all materials and equipment to be incorporated into the Project, and providing related services for testing, startup and commissioning, all as required by the Contract Documents.
68. *Work Change Directive*—A directive issued to Contractor on or after the Effective Date of the Contract ordering an addition, deletion, or revision in the Work. The Work Change Directive serves as a memorandum of understanding regarding the directive until a Change Order can be issued.

## 1.02 Terminology

- A. The words and terms discussed in this Paragraph 1.02 are not defined terms that require initial capital letters, but when used in the Bidding Requirements or Proposal Requirements or Contract Documents, have the indicated meaning.
- B. Contract Documents are written using imperative language:
  1. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words “furnish,” “install,” “perform,” “provide,”



or similar words include the meaning of the phrase "Contractor shall..." before these words.

2. Unless specifically stated that action is to be taken by OPT or others, it is understood that the action described is a requirement of Contractor.
- C. The use of the words "furnish," "install," "perform," and "provide" have the following meanings when used relating to services, materials, or equipment:
1. Furnish means to supply and deliver the specified services, materials, or equipment to the Site or other specified location ready for use or installation.
  2. Install means to complete construction or assembly of the specified services, materials, or equipment so they are ready for their intended use.
  3. Perform or provide means to furnish and install specified services, materials, or equipment, complete and ready for their intended use.
  4. Perform or provide the specified services, materials, or equipment complete and ready for intended use if the Contract Documents require specific services, materials, or equipment, but do not expressly use the words "furnish," "install," "perform," or "provide."
- D. The meaning and intent of certain terms or adjectives are described as follows:
1. The terms "as allowed," "as approved," "as ordered," "as directed," or similar terms in the Contract Documents indicate an exercise of professional judgment by OPT.
  2. Adjectives like "reasonable," "suitable," "acceptable," "proper," "satisfactory," or similar adjectives are used to describe a determination of OPT regarding the Work.
  3. Any exercise of professional judgment by OPT will be made solely to evaluate the Work for general compliance with the Contract Documents unless there is a specific statement in the Contract Documents indicating otherwise.
  4. The use of these or similar terms or adjectives does not assign a duty or give OPT authority to supervise or direct the performance of the Work, or assign a duty or give authority to OPT to undertake responsibilities contrary to the provisions of Article 9, Article 10 or other provisions of the Contract Documents.
- E. Requirements apply to all Work of the same kind, class, and type even though the word "all" or "any" is not stated.
- F. The terms "includes" and "including" are used as terms of enlargement and not of limitation or exclusive enumeration, and use of these terms does not create a presumption that components not expressed are excluded. The terms "consist of" or "consisting of" limits the interpretation to only those items specifically listed.
- G. It is understood that the cost of providing Work is included in the Contract Price and no additional compensation is to be paid by Owner unless specifically stated otherwise in the Contract Documents. Expressions like "at no additional cost to Owner," "at Contractor's expense," or similar words mean that Contractor is to include the cost of this Work in their Contract Price and perform or provide specified Work without an increase in the Contract Price.

- H. Words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with this recognized meaning unless stated otherwise in the Contract Documents.
- I. Written documents are required where reference is made to notices, reports, approvals, consents, statements, instructions, opinions, or other types of documentation or communications required by the Contract Documents. Approval and consent documents must be received by Contractor prior to the action or decision for which approval or consent is given. These may be made in printed or electronic format through OPT's Project Management Information System or other electronic media as required by the Contract Documents or approved by Construction Manager.
- J. Giving notice as required by the Contract Documents may be by printed or electronic media using a method that requires acknowledgment of the receipt of that notice.

## **ARTICLE 2 – PRELIMINARY MATTERS**

### **2.01 Delivery of Bonds and Evidence of Insurance**

- A. Provide required bonds and evidence of insurance required by the Contract Documents to Construction Manager with the executed Agreement.
- B. Evidence of insurance must include copies of the insurance policies, including all endorsements, and identification of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

### **2.02 Copies of Documents**

- A. OPT will furnish one copy of the executed Contract Documents in electronic portable document format (PDF). This document is the Project Record Copy of the Contract Documents.

### **2.03 Before Starting Construction**

- A. Provide the following preliminary documents in accordance with the Contract Documents within 10 days after the Effective Date of the Contract:
  - 1. Progress Schedule;
  - 2. Schedule of Submittals;
  - 3. Schedule of Values; and
  - 4. Schedule of Anticipated Payments.
- B. Designate the specific individuals authorized to act as representatives of Contractor. These individuals must have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of Contractor.
- C. Owner will designate the specific individuals authorized to act as representatives of Owner and the limits of their authority regarding acting on behalf of Owner.

## 2.04 Electronic Transmittals

- A. Except as otherwise stated elsewhere in the Contract Documents, the OPT and Contractor will send and accept Electronic Documents sent by Electronic Means using the protocols specified in Section 01 33 00 "Document Management."

## ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

### 3.01 Intent

- A. Requirements of each part of the Contract Documents are as binding as if required by all Contract Documents. It is the intent of the Contract Documents to describe a functionally complete project. The Contract Documents do not indicate or describe all the Work required to complete the Project. Additional details required for construction of the Project are to be provided by Contractor and coordinated with OPT.
- B. Provide the labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result, whether specifically called for in the Contract Documents or not. Include these related costs in the offered Contract Price.
- C. Provide equipment that is functionally complete as described in the Contract Documents. The Drawings and Specifications do not indicate or describe all the Work required to complete the installation of equipment purchased by the Owner or Contractor. Additional details required for the correct installation of selected equipment are to be provided by Contractor and coordinated with Design Professional through Construction Manager.
- D. Comply with the most stringent requirements where compliance with two or more standards is specified and they establish different or conflicting requirements for the Work, unless the Contract Documents indicate otherwise.
- E. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the Project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the Drawings but are not included in the Specifications.
- F. The Project Record Copy of the Contract Documents governs if there is a discrepancy between the Project Record Copy of the Contract Documents and subsequent electronic or digital versions of the Contract Documents, including printed copies derived from these electronic or digital versions.
- G. The Contract supersedes all prior written or oral negotiations, representations, and agreements. The Contract Documents comprise the entire Agreement between Owner and Contractor. The Contract Documents may be modified only by a Modification.
- H. Request clarification from Construction Manager for a decision before proceeding if Contractor is not clear on the meaning of the Contract Documents. Construction Manager is to issue clarifications and interpretations of the Contract Documents in accordance with the Contract Documents.

I. Organization of the Documents:

1. Organization of the Contract Documents is not intended to control or lessen the responsibility of Contractor when dividing Work among Subcontractors or Suppliers, or to establish the extent of Work to be performed by trades, Subcontractors, or Suppliers, except on multi-prime contracts. Specifications or details do not need to be indicated or specified in each Specification or Drawing. Items shown in the Contract Documents are applicable regardless of their location in the Contract Documents.
2. Standard Paragraph titles and other identifications of subject matter in the Specifications are intended to aid in locating and recognizing various requirements of the Specifications. Titles do not define, limit, or otherwise restrict Specification text.
3. The Contract requirements described in the General Conditions, Supplementary Conditions, and General Requirements (Division 01 of the Specifications) apply to Work regardless of where it is described in the Contract Documents, unless specifically noted otherwise.
4. Specifications or details do not need to be indicated or specified in each Specification or Drawing. Items shown in the Contract Documents are applicable regardless of their location in the Contract Documents.

J. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

K. Nothing in the Contract Documents creates:

1. a contractual relationship between OPT and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
2. an obligation on the part of OPT to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 Reference Standards

A. Standard Specifications, Codes, Laws and Regulations:

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of technical societies, organizations, or associations, or to Laws or Regulations, whether specific or implied, are those in effect at the time Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price unless specifically stated otherwise in the Contract Documents.
2. No provision of referenced standard specifications, manuals, reference standards, codes, or instructions of a Supplier changes the duties or responsibilities of OPT or Contractor from those described in the Contract Documents or assigns a duty to or gives authority to OPT to supervise or direct the performance of the Work or undertake responsibilities inconsistent with the Contract Documents.

3. The provisions of the Contract Documents take precedence over standard specifications, manuals, reference standards, codes, or instructions of a Supplier unless specifically stated otherwise in the Contract Documents.
- B. Comply with applicable construction industry standards, whether referenced or not.
  1. Standards referenced in the Contract Documents govern over standards not referenced but recognized as applicable in the construction industry.
  2. Comply with the requirements of the Contract Documents if they produce a higher quality of Work than the applicable construction industry standards.
  3. Submit questions regarding which code or standard is applicable to Construction Manager. Design Professional will determine whether a code or standard is applicable, which of several codes or standards are applicable, or if the Contract Documents produce a higher quality of Work. Construction Manager will respond to the question as appropriate.
- C. Make copies of reference standards available if requested by Construction Manager.

### 3.03 Reporting and Resolving Discrepancies

- A. Reporting Discrepancies:
  1. Carefully study the Drawings and verify pertinent figures and dimensions with respect to actual field measurements before undertaking the Work. Immediately report conflicts, errors, ambiguities, or discrepancies that Contractor discovers or has actual knowledge of to Construction Manager.
  2. Immediately notify the Construction Manager of conflicts, errors, ambiguities, or discrepancies in the Contract Documents or discrepancies between the Contract Documents and:
    - a. Applicable Laws or Regulations;
    - b. Actual field conditions;
    - c. Standard specifications, manuals, reference standards, or codes; or
    - d. Instructions of Suppliers.
  3. Do not proceed with affected Work until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation from Construction Manager or by a Modification to the Contract Documents issued pursuant to Paragraph 11.01, except in an emergency as required by Paragraph 7.12.
  4. Contractor is liable to OPT for failure to report conflicts, errors, ambiguities, or discrepancies in the Contract Documents of which Contractor has actual knowledge.
  5. Contractor is deemed to have included the most expensive item, system, procedure, etc. in the Contract Price if a conflict, error, ambiguity, or discrepancy in the Contract Documents was known, but not reported prior to submitting the Bid or Proposal or when Contractor negotiates the Contract Price.

### 3.04 Interpretation of the Contract Documents

- A. Submit questions concerning the non-technical or contractual/administrative requirements of the Contract Documents to Construction Manager immediately after the question arises. Construction Manager will provide an interpretation of the Contract Documents regarding these questions and will coordinate the response of OPT to Contractor.
- B. Submit questions regarding the design of the Project described in the Contract Documents to Construction Manager immediately after the question arises. Construction Manager will request an interpretation of the Contract Documents from Design Professional. Construction Manager will coordinate the response of OPT to Contractor.
- C. OPT may initiate a Modification to the Contract Documents through Construction Manager if a response to the question indicates that a change in the Contract Documents is required. Contractor may appeal Design Professional's or Construction Manager's interpretation by submitting a Change Proposal.

### 3.05 Reuse of Documents

- A. Contractor's Team has no rights to the Contract Documents and may not use the Contract Documents or copies or electronic media editions of the Contract Documents other than for the construction of this Project. This provision survives final payment or termination of the Contract.
- B. Contractor can retain a copy of the Contract Documents for record purposes, unless specifically prohibited by Owner for security reasons. Surrender paper and digital copies of the Contract Documents and other related documents and remove these documents from computer equipment or storage devices as a condition of final payment if Owner so directs.

## **ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK**

### 4.01 Commencement of Contract Times; Notice to Proceed

- A. The Contract Times commence to run on the date indicated in the Notice to Proceed. If a Notice to Proceed is not issued, the Contract Times will commence to run 15 days after the Contract is signed by all parties.
- B. Begin performing the Work on the date indicated in the Notice to Proceed. Do not begin Work before the date indicated in the Notice to Proceed or prior to providing evidence that insurance required in Article 6 is in effect.

### 4.02 Progress Schedule

- A. Construct the Work in accordance with the Progress Schedule established in accordance with the Contract Documents.
  - 1. Adjust the Progress Schedule as required to accurately reflect actual progress on the Work.
  - 2. Submit proposed adjustments in the Progress Schedule that change the Contract Times in accordance with the requirements of Article 11.

- B. Continue performing Work and adhere to the Progress Schedule during disputes or disagreements with Owner. Do not delay or postpone Work pending resolution of disputes or disagreements, or during an appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree.

#### 4.03 Delays in Contractor's Progress

- A. Contractor is not entitled to an adjustment in Contract Price or Contract Times for delays, disruptions, or interference caused by or within the control of Contractor's Team.
- B. Contractor is entitled to an equitable adjustment in Contract Price or Contract Times if OPT directly delays, disrupts, or interferes with the performance or progress of the Work. Contractor is not entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Owner if this delay is concurrent with a delay, disruption, or interference attributable to or within the control of Contractor's Team.
- C. Contractor is entitled to an equitable adjustment in the Contract Times, but not Contract Price, if Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of OPT or Contractor. These adjustments in Contract Times are Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. These unanticipated causes include:
  - 1. Severe and unavoidable natural catastrophes e.g. fires, floods, epidemics, and earthquakes;
  - 2. Acts of war or terrorism;
  - 3. Acts or failures to act of utility owners or other third-party entities other than those third-party utility owners performing other work at or adjacent to the Site as arranged by Owner and, as contemplated in Article 8;
  - 4. The existence of a differing subsurface or physical condition;
  - 5. An Underground Facility not shown or not indicated with reasonable accuracy by the Contract Documents;
  - 6. Hazardous Environmental Conditions; and
  - 7. Delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site unless this other work also for Owner.
- D. Contractor is entitled to an equitable adjustment in the Contract Times, but not Contract Price, if Contractor's performance or progress is delayed or disrupted by weather conditions provided such weather conditions exceed those that could normally be expected for the Site in that month of the year, unless other provisions for weather related delays are included in the Contract Documents. Contractor is to include time associated with normal weather-related delays in the Project Schedule and assumes the risks, including costs, associated with delays related to normal weather conditions.
- E. Contractor is only entitled to an adjustment of the Contract Times for specific delays, disruptions, and interference to the performance or progress of the Work that can be

demonstrated to directly impact the ability of Contractor to complete the Work within the Contract Times. No adjustments in Contract Times are allowed for delays on components of the Work which were or could have been completed without impacting the Contract Times.

- F. Notify Construction Manager immediately of a potential delaying, disrupting, or interfering event. Submit a Change Proposal seeking an adjustment in Contract Price or Contract Times within 30 days of the commencement of the delaying, disrupting, or interfering event. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11. Change Proposal seeking an increase in Contract Times or Contract Price submitted must include supporting data that details the following:
1. The circumstances that form the basis for the requested adjustment;
  2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
  3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
  4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference;
  5. A revised Progress Schedule indicating all the activities affected by the delay, disruption, or interference;
  6. An explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work;
  7. The impact on Contract Price; and
  8. Such additional supporting documentation as OPT may require.

## **ARTICLE 5 – SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

### **5.01 Availability of Lands**

- A. Owner will furnish the Site and inform Contractor of encumbrances or restrictions known to Owner related to use of the Site with which Contractor must comply in performing the Work.
- B. Provide for additional lands and access Contractor requires for temporary construction facilities or storage of materials and equipment, other than those identified in the Contract Documents. Provide documentation of authority to use these additional lands to Construction Manager before using them.

### **5.02 Use of Site and Other Areas**

- A. Confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Owner or Contractor has arranged to use through construction easements or agreements, and other adjacent areas as permitted by Laws and Regulations. Assume full responsibility for damage



or injuries which result from the performance of the Work or from other actions or conduct of Contractor's Team, including:

1. Damage to the Site;
  2. Damage to adjacent areas used for Contractor's Team's operations;
  3. Damage to other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and
  4. Injuries and losses sustained by the owners or occupants of these lands or areas.
- B. Take the following action if a damage or injury claim is made by the owner or occupant of adjacent land or area because of the performance of the Work, or because of other actions or conduct of Contractor's Team:
1. Take immediate corrective or remedial action as required by Paragraph 7.10; and
  2. Attempt to settle the claim through negotiations with the owner or occupant, or otherwise resolve the claim by mediation or other dispute resolution proceeding or at law; and
  3. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, INDEMNIFY AND HOLD HARMLESS OWNER'S INDEMNITEES FROM AND AGAINST ANY SUCH CLAIM AND ALL INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO ANY CLAIM OR ACTION BROUGHT BY ANY SUCH OWNER OR OCCUPANT AGAINST OWNER'S INDEMNITEES TO THE EXTENT CAUSED DIRECTLY OR INDIRECTLY, IN WHOLE OR IN PART BY, OR BASED UPON, CONTRACTOR'S PERFORMANCE OF THE WORK, OR BECAUSE OF OTHER ACTIONS OR CONDUCT OF CONTRACTOR'S TEAM.**

#### 5.03 Subsurface and Physical Conditions

- A. The Supplementary Conditions identify:
1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
  2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site, except Underground Facilities, that contain Technical Data; and
  3. Technical Data contained in these reports and drawings.
- B. If no Technical Data have been identified in the Supplementary Conditions, then Technical Data is defined, with respect to conditions at the Site, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, or environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
- C. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

- D. Contractor may rely upon the accuracy of the Technical Data contained in these reports and drawings, but these reports and drawings are not Contract Documents. Except for this reliance on Technical Data, Contractor may not rely upon or make claims against Owner's Indemnitees with respect to:
  - 1. The completeness of reports and drawings for Contractor's purposes, including aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, or Contractor's safety precautions and programs;
  - 2. Other data, interpretations, opinions, and information contained in these reports or shown or indicated in the drawings;
  - 3. The contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
  - 4. Contractor's interpretation of or conclusions drawn from Technical Data or other data, interpretations, opinions, or information.

#### 5.04 Differing Subsurface or Physical Conditions

- A. Notify Construction Manager immediately, but in no event later than 3 days, after becoming aware of a subsurface or physical condition that is uncovered or revealed at the Site, and before further disturbing the subsurface or physical conditions or performing any related Work that:
  - 1. Establishes that the Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
  - 2. Requires a change in the Drawings or Specifications;
  - 3. Differs materially from that shown or indicated in the Contract Documents; or
  - 4. Is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.
- B. Do not further disturb or perform Work related to this subsurface or physical condition, except in an emergency as required by Paragraph 7.12, until permission do so is issued by Construction Manager.
- C. Construction Manager is to notify OPT after receiving notice of a differing subsurface or physical condition from Contractor. OPT will:
  - 1. Promptly review the subsurface or physical condition;
  - 2. Determine the necessity of OPT's obtaining additional exploration or tests with respect to the subsurface or physical condition;
  - 3. Determine if the subsurface or physical condition falls within one or more of the differing site condition categories in Paragraph 5.04.A;
  - 4. Prepare recommendations regarding Contractor's resumption of Work relating to the subsurface or physical condition in question;
  - 5. Determine the need for changes in the Drawings or Specifications; and

6. Advise Contractor of OPT's findings, conclusions, and recommendations.
- D. Construction Manager is to issue a statement to Contractor regarding the subsurface or physical condition in question and recommend action as appropriate after review of OPT's findings, conclusions, and recommendations. Construction Manager may instruct Contractor to resume Work if OPT determines that the subsurface or physical condition in question has been adequately documented.
- E. Contractor is entitled to an equitable adjustment in Contract Price or Contract Times to the extent that a differing subsurface or physical condition causes a change in Contractor's cost or time to perform the Work provided the condition falls within one or more of the categories described in Paragraph 5.04.A. Any adjustment in Contract Price for Work that is paid for on a unit price basis is subject to the provisions of Paragraph 13.03. Contractor is not entitled to an adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
1. Contractor knew of the existence of the subsurface or physical condition at the time Contractor made an offer to Owner with respect to Contract Price and Contract Times;
  2. The existence of the subsurface or physical condition could have been discovered or revealed by examinations, investigations, explorations, tests, or studies of the Site and contiguous areas expressly required by the Bidding Requirements or Proposal Requirements or the Contract Documents prior to when Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price; or
  3. Contractor failed to give notice as required by Paragraph 5.04.A.
- F. Contractor may submit a Change Proposal no later than 30 days after Construction Manager's issuance of the OPT's statement to Contractor regarding the subsurface or physical condition in question.

#### 5.05 Underground Facilities

- A. The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to OPT by the owners of these Underground Facilities or by others. OPT is not responsible for the accuracy or completeness of information or data provided by others that OPT makes available to Contractor. Contractor is responsible for:
1. Reviewing and checking available information and data regarding existing Underground Facilities at the Site;
  2. Complying with Laws and Regulations related to locating Underground Facilities before beginning Work;
  3. Locating Underground Facilities shown or indicated in the Contract Documents;
  4. Coordinating the Work with the owners, including Owner, of Underground Facilities during construction; and
  5. The safety and protection of existing Underground Facilities at or adjacent to the Site and repairing damage resulting from the Work.
- B. Notify Construction Manager and the owner of the Underground Facility immediately if an Underground Facility is uncovered or revealed at the Site that was not shown in the

Contract Documents or was not shown with reasonable accuracy in the Contract Documents. Do not further disturb conditions or perform Work affected by this discovery, except in the event of an emergency as required by Paragraph 7.12.

- C. OPT is to take the following action after receiving notice from Construction Manager:
  - 1. Promptly review the Underground Facility to determine if the Underground Facility was shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy;
  - 2. Identify and communicate with the owner of the Underground Facility;
  - 3. Prepare recommendations to OPT regarding Contractor's resumption of Work relating to this Underground Facility;
  - 4. Determine the extent to which a change is required in the Drawings or Specifications to document the consequences of the existence or location of the Underground Facility; and
  - 5. Construction Manager will advise Contractor of OPT's findings, conclusions, and recommendations and provide revised Drawings and Specifications if required.
- D. Construction Manager is to issue a statement to Contractor regarding the Underground Facility in question and recommend action as appropriate after review of OPT's findings, conclusions, and recommendations.
- E. Contractor is entitled to an equitable adjustment in the Contract Price or Contract Times to the extent that the existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy. Any adjustment in Contract Price for Work that is paid for on a unit price basis is subject to the provisions of Paragraph 13.03.
- F. Contractor is not entitled an adjustment in the Contract Price or Contract Times with respect to an existing Underground Facility at the Site if:
  - 1. Contractor knew of the existence of the existing Underground Facility at the Site at the time Contractor made an offer to Owner with respect to Contract Price and Contract Times;
  - 2. The existence of the existing Underground Facility at the Site could have been discovered or revealed by examinations, investigations, explorations, tests, or studies of the Site and contiguous areas expressly required by the Bidding Requirements or Proposal Requirements or the Contract Documents prior to when Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price; or
  - 3. Contractor failed to give notice as required by Paragraph 5.05.B.
- G. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of adjustments in the Contract Price or Contract Times no later than 30 days after Construction Manager's issuance of OPT's statement to Contractor regarding the Underground Facility.

## 5.06 Hazardous Environmental Conditions at Site

- A. The Supplementary Conditions identify those reports and drawings known to OPT relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and the Technical Data contained in these reports and drawings.
- B. Contractor may rely upon the accuracy of the Technical Data contained in reports and drawings relating to Hazardous Environmental Conditions identified in the Supplementary Conditions, but these reports and drawings are not Contract Documents. Except for the reliance on expressly identified Technical Data, Contractor may not rely upon or make claims against Owner's Indemnitees with respect to:
  - 1. The completeness of these reports and drawings for Contractor's purposes, including aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor or Contractor's safety precautions and programs related to Hazardous Environmental Conditions;
  - 2. Other data, interpretations, opinions, and information contained in these reports or shown or indicated in the drawings; or
  - 3. Any Contractor interpretation of or conclusion drawn from Technical Data or other data, interpretations, opinions, or information.
- C. The results of tests performed on materials described in environmental reports specifically prepared for the Project and made available to Contractor are defined as Technical Data unless Technical Data has been defined more specifically in the Supplementary Conditions.
- D. Contractor is not responsible for removing or remediating Hazardous Environmental Conditions encountered, uncovered, or revealed at the Site unless this removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- E. Contractor is responsible for controlling, containing, and duly removing and remediating Constituents of Concern brought to the Site by Contractor's Team and paying associated costs.
  - 1. Owner may remove and remediate the Hazardous Environmental Condition and impose a Set-off against payments to Contractor for associated costs if Contractor's Team creates a Hazardous Environmental Condition and Contractor does not take acceptable action to remove and remediate the Hazardous Environmental Condition.
  - 2. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER'S INDEMNITEES FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO THE FAILURE TO CONTROL, CONTAIN, OR REMOVE A CONSTITUENT OF CONCERN BROUGHT TO THE SITE BY CONTRACTOR'S TEAM, OR TO A HAZARDOUS ENVIRONMENTAL CONDITION CREATED BY CONTRACTOR'S TEAM. NOTHING IN THIS PARAGRAPH SHALL OBLIGATE CONTRACTOR TO INDEMNIFY ANY INDIVIDUAL OR ENTITY FROM AND AGAINST THE CONSEQUENCES OF THAT INDIVIDUAL'S OR ENTITY'S OWN NEGLIGENCE.**

- F. Immediately notify Construction Manager and take the following action if Contractor uncovers or reveals a Hazardous Environmental Condition at the Site or adjacent areas used by Contractor's Team that was not created by Contractor's Team:
  - 1. Secure or otherwise isolate this condition;
  - 2. Stop Work in affected areas or connected with the condition, except in an emergency as required by Paragraph 7.12; and
  - 3. Do not resume Work relating to the Hazardous Environmental Condition or in affected areas until after OPT has obtained required permits and Construction Manager sends notice to Contractor:
    - a. Specifying that this condition and affected areas are or have been rendered safe for the resumption of Work; or
    - b. Specifying special conditions under which Work may be resumed safely.
  - 4. Owner may order the portion of the Work that is in the area affected by the Hazardous Environmental Condition to be deleted from the Work following the procedures in Article 11 if Contractor does not agree to:
    - a. Resume the Work based on a reasonable belief it is unsafe; or
    - b. Resume the Work under the special conditions provided by Construction Manager.
  - 5. Owner may have this deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- G. Contractor may submit a Change Proposal or Owner may impose a Set-off if an agreement is not reached within 10 days of Construction Manager's notice regarding the resumption of Work as to whether Contractor is entitled to an adjustment in Contract Price or Contract Times or on the amount or extent of adjustments resulting from this Work stoppage or special conditions under which Contractor agrees to resume Work.
- H. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or a Hazardous Environmental Condition uncovered or revealed at the Site.

## **ARTICLE 6 – BONDS AND INSURANCE**

### **6.01 Performance, Payment, and Other Bonds**

- A. Furnish a performance bond in an amount equal to the Contract Price as security for the faithful performance of Work. Contractor is to use amounts paid by Owner to Contractor under the Contract for the performance of the Contract. This bond is to remain in effect until 1 year after the date of final payment.
- B. Furnish a payment bond in an amount equal to the Contract Price as security to ensure payment of Contractor's obligations under the Contract Documents. This bond is to remain in effect until 1 year after the date of final payment.
  - 1. Notify Construction Manager of claims filed against the payment bond. Notify the claimant and Construction Manager of undisputed amounts and the basis for

challenging disputed amounts when a claimant has satisfied the conditions prescribed by Laws and Regulations. Promptly pay undisputed amounts.

2. Owner is not liable for payment of costs or expenses of claimants under the payment bond. Owner has no obligations to pay, give notice, or take other action to claimants under the payment bond.
  3. OPT will provide a copy of the payment bond and payment information to Subcontractors, Suppliers, or other persons or entities claiming to have furnished labor or materials used in the performance of the Work that request this information in accordance with Laws and Regulations.
- C. Notify Construction Manager immediately if the surety on bonds furnished by Contractor:
1. Is declared bankrupt, or becomes insolvent;
  2. Has its right to do business in state in which the Project is located is terminated; or
  3. Ceases to meet the requirements of Paragraph 6.02.
- D. Provide a bond and surety which comply with the requirements of Paragraph 6.02 within 20 days after the event giving rise to this notification.
- E. Furnish other bonds as required by the Contract Documents.
- F. Owner may exclude Contractor from the Site and exercise Owner's termination rights under Article 16 if Contractor fails to obtain or maintain required bonds.

#### 6.02 Licensed Sureties

- A. Provide bonds in the form prescribed by the Contract Documents from sureties named in the U.S. Department of the Treasury's Listing of Approved Sureties (Department Circular 570 "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies").
- B. Provide bonds required by the Contract Documents from surety companies that are duly licensed or authorized to provide bonds in the state in which the Project is constructed.

#### 6.03 Insurance - General Provisions

- A. Obtain and maintain insurance with coverage amounts equal to or greater than the amounts specified in Section 00 73 16 "Insurance Requirements" or greater where required by Laws and Regulations.
- B. Obtain insurance from companies that are duly licensed or authorized in the state in which the Project is constructed to issue insurance policies and that have an A.M. Best rating of A-VIII or better.
- C. Deliver evidence of insurance in accordance with Section 00 73 16 "Insurance Requirements" to Owner to demonstrate that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Provide copies of these certificates to Owner and additional insured.
- D. Furnish copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles upon request by Owner or any additional insured. Contractor

may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this paragraph.

- E. OPT's failure to demand such certificates or other evidence of Contractor's full compliance with the insurance requirements or failure to identify a deficiency in compliance from the evidence provided is not a waiver of Contractor's obligation to obtain and maintain the insurance required by the Contract Documents.
- F. Notify Owner if Contractor fails to purchase or maintain the insurance required by the Contract Documents. Do not perform any Work on the Project unless the required insurance policies are in effect. Owner may exclude Contractor from the Site and exercise Owner's termination rights under Article 16 if Contractor fails to obtain or maintain the required insurance.
- G. Owner may elect to obtain equivalent insurance to protect Owner's interests without prejudice to any other right or remedy if Contractor fails to obtain or maintain the required insurance. Owner may impose a reasonable Set-off against payments due under Article 15 to recover the cost of the insurance.
- H. Owner does not represent that the insurance coverage and limits established in this Contract are adequate to protect Contractor or Contractor's interests.
- I. The required insurance and insurance limits do not limit Contractor's liability under the indemnities granted to Owner's Indemnitees in the Contract Documents.
- J. Provide for an endorsement that the "other insurance" clause will not apply to OPT where OPT is an additional insured shown on the policy. Contractor's insurance is primary and non-contributory with respect to any insurance or self-insurance carried by OPT for liability arising out of operations under this Agreement.
- K. Include and list OPT and any other individuals or entities identified in Section 00 73 16 "Insurance Requirements" as additional insureds on all policies except for the workers' compensation policy and Contractor's professional liability policy.

## **ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES**

### **7.01 Contractor's Means and Methods of Construction**

- A. Contractor is solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. Provide professional engineering or other design services if the Contract Documents require such services or if Contractor determines that such services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety. Engineering or other design services are to be provided by a properly licensed design professional authorized to provide these services in the state in which the Project is constructed. Such services are not Owner-delegated professional design services under this Contract, and OPT does not have any responsibility with respect to:
  - 1. Contractor's determination of the need for such services;



2. The qualifications or licensing of the design professionals retained or employed by Contractor;
3. The performance of such services; or
4. Any errors, omissions, or defects in such services.

#### 7.02 Supervision and Superintendence

- A. Supervise, inspect, and direct the performance of the Work.
- B. Provide a competent resident superintendent acceptable to OPT. The resident superintendent or acceptable qualified assistant is to always be present when Work is being done. Do not replace this resident superintendent except under extraordinary circumstances. Provide a replacement resident superintendent equally competent to the previous resident superintendent if replacement is required. Notify Owner prior to replacing the resident superintendent and obtain Owner's consent to the change in superintendent.

#### 7.03 Labor; Working Hours

- A. Provide competent, suitably qualified personnel to complete the Work. Maintain good discipline and order at the Site. Contractor is responsible for all acts and omissions of Contractor's Team.
- B. Perform Work at the Site during regular working hours except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent to the Site and except as otherwise stated in the Contract Documents.
- C. Do not perform Work on a Saturday, Sunday, or Owner-observed holiday without Construction Manager's consent. If a legal holiday falls on a Saturday, it will be observed the preceding Friday. If a legal holiday falls on a Sunday, it will be observed the following Monday.
- D. Pay additional cost incurred by Owner for services of Construction Manager to observe Work constructed outside of regular working hours. Construction Manager will issue a Set-off in the Application for Payment for this cost per Paragraph 15.01.B.

#### 7.04 Services, Materials, and Equipment

- A. Provide services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and other facilities and incidentals necessary for the performance, testing, startup, and completion of the Work, whether or not these items are specifically called for in the Contract Documents.
- B. Provide new materials and equipment to be incorporated into the Work. Provide special warranties and guarantees required by the Contract Document. Provide satisfactory evidence, including reports of required tests, as to the source, kind, and quality of materials and equipment as required by the Contract Documents or as requested by Construction Manager.

- C. Store, apply, install, connect, erect, protect, use, clean, and condition materials and equipment in accordance with instructions of the applicable Supplier, unless otherwise required by the Contract Documents.

#### 7.05 Concerning Subcontractors, and Suppliers

- A. Contractor may retain Subcontractors and Suppliers which are acceptable to Owner for the performance of parts of the Work. Contractor must retain specific Subcontractors or Suppliers if required to do so by the Contract Documents. Contractor must use Subcontractors or Suppliers named in the Bid or Proposal if Contractor was selected in part based on these named Subcontractors or Suppliers.
- B. Submit a list of proposed Subcontractors and Suppliers to Construction Manager prior to entering into binding subcontracts or purchase orders. These proposed Subcontractors or Suppliers are deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 10 days after receiving this list.
- C. Owner may require the replacement of Subcontractors or Suppliers retained by Contractor. Provide an acceptable replacement for the rejected Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements, subject to Contractor's reasonable objections.
- D. Contractor may be entitled to an adjustment in Contract Price or Contract Times with respect to a replacement of Subcontractors or Suppliers required by Owner. Notify Construction Manager immediately if a replacement of Subcontractors or Suppliers increases the Contract Price or Contract Times. Initiate a Change Proposal for the adjustment within 10 days of Owner's notice to replace a Subcontractor or Supplier. Do not make the replacement until the change in Contract Price or Contract Times has been accepted by Owner if Change Proposal is to be submitted. Contractor is not entitled to an adjustment in Contract Price or Contract Times if OPT requires the replacement of the Subcontractor or Supplier based on an unacceptable safety record, lack of experience or qualifications, or other cause.
- E. Acceptance by Owner of Subcontractors, Suppliers, or other individuals or entities, whether initially or as a replacement, does not constitute a waiver of the obligation of Contractor to complete the Work in accordance with the Contract Documents.
- F. Maintain a current and complete list of Subcontractors and Suppliers that are to perform or furnish part of the Work.
- G. Contractor is fully responsible for the acts and omissions of Subcontractors and Suppliers and is solely responsible for scheduling and coordinating their Work.
- H. Require Subcontractors, Suppliers, and other individuals or entities performing or furnishing Work to communicate with OPT through Contractor.
- I. Contracts between Contractor and their Subcontractors or Suppliers may specifically bind the Subcontractors or Suppliers to the applicable terms and conditions of the Contract Documents. Contractor is responsible for meeting the requirements of the Contract Documents if they choose to not bind the Subcontractors or Suppliers to applicable terms or conditions of the Contract Documents.

- J. OPT may furnish information about amounts paid to Contractor for Work provided by Subcontractors or Suppliers to the entity providing the Work.
- K. Nothing in the Contract Documents:
  - 1. Creates a contractual relationship between members of OPT and members of Contractor's Team; or
  - 2. Creates an obligation on the part of Owner to pay or to see to the payment of money due members of Contractor's Team, except as may be required by Laws and Regulations.

#### 7.06 Patent Fees and Royalties

- A. Pay license fees, royalties, and costs incident to the use of inventions, designs, processes, products, or devices which are patented or copyrighted by others in the performance of the Work, or to incorporate these inventions, designs, processes, products, or devices which are patented or copyrighted by others in the Work. The Contract Documents identify inventions, designs, processes, products, or devices OPT knows are patented or copyrighted by others, or that its use is subject to patent rights or copyrights calling for the payment of a license fee or royalty to others. Contractor is to include the cost associated with the use of patented or copyrighted products or processes, whether specified or selected by Contractor, in the Contract Price.
- B. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER'S INDEMNITEES FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO ANY INFRINGEMENT OF PATENT RIGHTS OR COPYRIGHTS BY CONTRACTOR'S TEAM INCIDENT TO THE USE IN THE PERFORMANCE OF THE WORK OR RESULTING FROM THE INCORPORATION IN THE WORK OF ANY INVENTION, DESIGN, PROCESS, PRODUCT, OR DEVICE.**

#### 7.07 Permits

- A. Obtain and pay for construction permits and licenses, and certificates of occupancy, if required. OPT is to assist Contractor in obtaining permits and licenses when required to do so by applicable Laws and Regulations. Pay governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time the Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price.

#### 7.08 Taxes

- A. Contractor is responsible for all taxes and duties arising out of the Work. Contractor is responsible for including in the Contract Price any applicable sales and use taxes and is responsible for complying with all applicable Laws and Regulations. Pay sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations.

#### 7.09 Laws and Regulations

- A. Give required notices and comply with Laws and Regulations applicable to the performance of the Work. OPT is not responsible for monitoring Contractor's compliance with Laws or Regulations except where expressly required by applicable Laws and Regulations.

- B. Pay costs resulting from actions taken by Contractor that are contrary to Laws or Regulations. Contractor is not responsible for determining that the design aspects of the Work described in the Contract Documents is in accordance with Laws and Regulations. This does not relieve Contractor of its obligations under Paragraph 3.03.
- C. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER'S INDEMNITEES HARMLESS FROM ALL CLAIMS AND INDEMNIFIED COSTS RESULTING FROM ACTIONS TAKEN BY CONTRACTOR'S TEAM THAT ARE CONTRARY TO LAWS OR REGULATIONS.**
- D. Owner or Contractor may give notice to the other party of changes in Laws or Regulations that may affect the cost or time of performance of the Work, including:
  - 1. Changes in Laws or Regulations affecting procurement of permits; and
  - 2. Sales, use, value-added, consumption, and other similar taxes which come into effect after Contractor's Bid or Proposal is submitted or when Contractor negotiates the Contract Price.
- E. Contractor may submit a Change Proposal or Owner may initiate a Claim within 30 days of this notice if Owner and Contractor are unable to agree on entitlement to or on the amount or extent of adjustments in Contract Price or Contract Times resulting from these changes.

#### 7.10 Safety and Protection

- A. Contractor is solely responsible for initiating, maintaining, and supervising safety precautions and programs relating to the Work. This responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their Work, nor for compliance with applicable safety Laws and Regulations.
- B. Take necessary precautions for the safety of persons on the Site or who may be affected by the Work, and provide the necessary protection to prevent damage, injury, or loss to:
  - 1. Work and materials and equipment to be incorporated in the Work, whether stored on or off the Site; and
  - 2. Other property at or adjacent to the Site, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement during construction.
- C. Comply with applicable Laws and Regulations relating to the safety and protection of persons or property. Erect and maintain necessary safeguards for safety and protection. Notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site when prosecution of the Work may affect them. Cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- D. Remedy damage, injury, or loss to property referred to in Paragraph 7.10.B caused by Contractor's Team. Pay remediation costs unless the damage or loss is:
  - 1. Attributable to the fault of the Contract Documents;
  - 2. Attributable to acts or omissions of OPT; or

3. Not attributable to the actions or failure to act of Contractor's Team.

- E. Contractor's duties and responsibilities for safety and protection of persons or the Work or property at or adjacent to the Site continues until Work is completed and resumes whenever Contractor's Team returns to the Site to fulfill warranty or correction obligations or to conduct other tasks.
- F. Comply with the applicable requirements of the Owner's safety program if required to do so in the Supplementary Conditions. A copy of the Owner's safety program will be provided in the Bidding Documents or Proposal Documents.
- G. Provide a qualified and experienced safety representative at the Site whose duties and responsibilities are the prevention of accidents and maintaining and supervising safety programs.

#### 7.11 Hazard Communication Programs

- A. Coordinate the exchange of safety data sheets or other hazard communication information required to be made available or exchanged between or among employers at the Site in accordance with Laws or Regulations.

#### 7.12 Emergencies

- A. Act to prevent threatened damage, injury, or loss in emergencies affecting the safety or protection of persons or the Work or property at or adjacent to the Site. Notify Construction Manager immediately if Contractor believes that significant changes in the Work or variations from the Contract Documents have been caused or are required because of this need to act. A Modification is to be issued by Construction Manager if OPT determines that the incident giving rise to the emergency action was not the responsibility of Contractor and that a change in the Contract Documents is required because of the action taken by Contractor in response to this emergency.

#### 7.13 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that Work is in accordance with the Contract Documents and is not Defective. Owner is entitled to rely on Contractor's warranty and guarantee. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 7.14. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.13 is limited only by applicable Laws and Regulations restricting actions to enforce such rights. Assume and bear responsibility for costs and time delays associated with variations from the requirements of the Contract Documents.
- B. This Contractor's warranty and guarantee excludes defects or damage caused by abuse, improper maintenance or operation, or modification by OPT; or normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete Work in accordance with the Contract Documents is absolute. None of the following constitute an acceptance of Defective Work,

a release of Contractor's obligation to perform Work in accordance with the Contract Documents or a release of Owner's warranty or guarantee rights under this Paragraph:

1. Observations by OPT;
  2. Recommendation by Construction Manager or payment by Owner of progress or final payments;
  3. The issuance of a certificate of Substantial Completion;
  4. The issuance of a certificate of Final Completion;
  5. The end of the correction period established in Paragraph 7.14;
  6. Use or occupancy of part of the Work by Owner;
  7. Review and approval of a Shop Drawing or Sample;
  8. Inspections, tests, or approvals by others; or
  9. Correction of Defective Work by Owner.
- D. The Contract Documents may require Contractor to accept the assignment of a contract between the Owner and a contractor or supplier. The specific warranties, guarantees, and correction obligations contained in an assigned contract govern with respect to Contractor's performance obligations to Owner for the Work described in an assigned contract.

#### 7.14 Correction Period

- A. Promptly correct Defective Work without cost to Owner for 1 year after the date of Substantial Completion or longer periods of time prescribed by the terms of the Contract Documents.
- B. Promptly correct damages to the Site or adjacent areas that Contractor has arranged to use through construction easements or other agreements. Promptly correct damages to Work or the work of others. Make corrections without cost to Owner.
- C. Owner may have the Defective Work and damages described in Paragraphs 7.14.A and 7.14.B corrected if Contractor does not comply with the terms of Construction Manager's instructions, or in an emergency where delay would cause serious risk of loss or damage.
- D. **NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS AGREEMENT OR THE CONTRACT DOCUMENTS AND TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER'S INDEMNITEES HARMLESS FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO THE CORRECTION OF DEFECTIVE WORK.**
- E. The correction period starts to run from the date when a specific item of equipment or systems are placed in continuous beneficial use by Owner before Substantial Completion of Work if so provided in the Specifications or if accepted for beneficial use by Owner.
- F. The correction period is extended for an additional period of 1 year for Defective Work corrected after the date of Substantial Completion or after the accepted date the correction period starts to run as described in Paragraph 7.14.E. This extended correction

period starts to run when Defective Work has been satisfactorily corrected under this Paragraph 7.14.

- G. Contractor's obligations under this Paragraph 7.14 are in addition to other obligations or warranties. The provisions of this Paragraph 7.14 are not a substitute for, or a waiver of, the provisions of applicable statutes of limitation or repose.

#### 7.15 Indemnification

- A. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, AND IN ADDITION TO ANY OTHER OBLIGATIONS OF CONTRACTOR UNDER THE CONTRACT OR OTHERWISE, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER'S INDEMNITEES FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RELATING TO THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, ACTION, LOSS, OR DAMAGE IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE, OR DEATH, OR TO DAMAGE TO OR DESTRUCTION OF TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF), INCLUDING THE LOSS OF USE RESULTING THEREFROM BUT ONLY TO THE EXTENT CAUSED BY ANY NEGLIGENT ACT OR OMISSION OF CONTRACTOR'S TEAM.**
- B. The indemnification obligation under Paragraph 7.15.A is not limited by the amount or type of damages, compensation, or benefits payable by or for members of Contractor's Team or other individuals or entities under workers' compensation acts, disability benefit acts, or other employee benefit acts in claims against Owner's Indemnitees by an employee or the survivor or personal representative of employee of Contractor's Team.

#### 7.16 Delegation of Professional Design Services

- A. Contractor is to provide professional design services required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures.
- B. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. This delegation will specify the performance and design criteria that such services must satisfy and the Submittals that Contractor must furnish to Construction Manager with respect to Owner delegated design. Contractor is not required to provide these professional services in violation of applicable Laws and Regulations.
- C. Owner-delegated professional design services provided through Contractor are to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and other Submittals prepared by such design professional. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Construction Manager, then such Shop Drawing or other Submittal must bear the design professional's written approval when submitted by Contractor to Construction Manager.
- D. OPT is entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by Contractor's design professionals, provided OPT has specified to Contractor the performance and design criteria that these services must satisfy.

- E. Pursuant to this Paragraph 7.16, OPT's review and approval of design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
  - 1. Checking for conformance with the requirements of this paragraph;
  - 2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
  - 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor is not responsible for the adequacy of the performance or design criteria specified by OPT. Advise OPT if the performance or design criteria are known or considered likely to be inadequate or otherwise deficient.

## **ARTICLE 8 – OTHER WORK AT THE SITE**

### **8.01 Other Work**

- A. Owner may arrange for other work at or adjacent to the Site which is not part of the Contractor's Work. This other work may be performed by Owner's employees or through other contractors. Utility owners may perform work on their utilities and facilities at or adjacent to the Site. Include costs associated with coordinating with entities performing other work or associated with connecting to this other work in the Contract Price if this other work is shown in the Contract Documents.
- B. OPT is to notify Contractor of other work prior to starting the work and provide any knowledge they have regarding the start of utility work at or adjacent to the Site to Contractor.
- C. Provide other contractors:
  - 1. Proper and safe access to the Site;
  - 2. Reasonable opportunity for the introduction and storage of materials and equipment; and
  - 3. Reasonable opportunity to execute their work.
- D. Provide cutting, fitting, and patching of the Work required to properly connect or integrate with other work. Do not endanger the work of others by cutting, excavating, or otherwise altering the work of others without the consent of Construction Manager and the others whose work will be affected.
- E. Inspect the work of others and immediately notify Construction Manager if the proper execution of part of Contractor's Work depends upon work performed by others and this work has not been performed or is unsuitable for the proper execution of Contractor's Work. Contractor's failure to notify Construction Manager constitutes an acceptance of this other work as acceptable for integration with Contractor's Work. This acceptance does not apply to latent defects or deficiencies in the work of others.
- F. Take adequate measures to prevent damages, delays, disruptions, or interference with the work of Owner, other contractors, or utility owners performing other work at or adjacent to the Site.



- G. The provisions of this Article 8 are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.03.

#### 8.02 Coordination

- A. Owner has sole authority and responsibility for coordination of this other work unless otherwise provided in the Contract Documents. Owner is to identify the entity with authority and responsibility for coordination of the activities of the various contractors, the limitations of their authority, and the work to be coordinated prior to the start of other work at or adjacent to the Site.

#### 8.03 Legal Relationships

- A. Contractor may be entitled to a change in Contract Price or Contract Times if, while performing other work at or adjacent to the Site for Owner, the OPT, other contractor, or utility owner:
  - 1. Damages the Work or property of Contractor's Team;
  - 2. Delays, disrupts, or interferes with the execution of the Work; or
  - 3. Increases the scope or cost of performing the Work through their actions or inaction.
- B. Notify Construction Manager immediately of the event leading to a potential Change Proposal so corrective or mitigating action can be taken. Submit the Change Proposal within 30 days of the event if corrective action has not adequately mitigated the impact of the actions or inactions of others. Information regarding this other work in the Contract Documents is used to determine if Contractor is entitled to a change in Contract Price or Contract Times. Changes in Contract Price require that Contractor assign rights against the other contractor or utility owner to Owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Changes in Contract Times require that the time extension is essential to Contractor's ability to complete the Work within the Contract Times.
- C. Take prompt corrective action if Contractor's Team damages, delays, disrupts, or interferes with the work of Owner's employees, other contractors, or utility owners performing other work at or adjacent to the Site or agree to compensate other contractors or utility owners for correcting the damage. Promptly attempt to settle claims with other contractors or utility owners if Contractor damages, delays, disrupts, or interferes with the work of other contractors or utility owners performing other work at or adjacent to the Site.
- D. Owner may impose a Set-off against payments due to Contractor and assign the Owner's contractual rights against Contractor with respect to the breach of the obligations described in this Paragraph 8.03 to other contractors or utility owners if damages, delays, disruptions, or interference occur.
- E. **NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS AGREEMENT OR THE CONTRACT DOCUMENTS AND TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD OWNER'S INDEMNITEES**

**HARMLESS FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS RESULTING FROM CONTRACTOR'S TEAM'S ACTION OR INACTION RELATED TO DAMAGES, DELAYS, DISRUPTIONS, OR INTERFERENCE WITH THE WORK OF OWNER'S EMPLOYEES, OTHER CONTRACTORS, OR UTILITY OWNERS PERFORMING OTHER WORK AT OR ADJACENT TO THE SITE.**

**ARTICLE 9 – OWNER'S AND OPT'S RESPONSIBILITIES**

9.01 Communications to Contractor

- A. OPT issues communications to Contractor through Construction Manager except as otherwise provided in the Contract Documents.

9.02 Replacement of Owner's Project Team Members

- A. Owner may replace members of OPT at its discretion.

9.03 Furnish Data

- A. OPT is to furnish the data required of OPT under the Contract Documents.

9.04 Pay When Due

- A. Owner is to make payments to Contractor when due as described in Article 15.

9.05 Lands and Easements; Reports and Tests

- A. Owner's duties with respect to providing lands and easements are described in Paragraph 5.01. OPT will make copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site available to Contractor in accordance with Paragraph 5.03.

9.06 Insurance

- A. Owner's responsibilities with respect to purchasing and maintaining insurance are described in Article 6.

9.07 Modifications

- A. Owner's responsibilities with respect to Modifications are described in Article 11.

9.08 Inspections, Tests, and Approvals

- A. OPT's responsibility with respect to certain inspections, tests, and approvals are described in Paragraph 14.02.

9.09 Limitations on OPT's Responsibilities

- A. OPT does not supervise, direct, or have control or authority over, and is not responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or related safety precautions and programs, or for failure of Contractor to comply with Laws

and Regulations applicable to the performance of the Work. OPT is not responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

- B. OPT is not responsible for the acts or omissions of Contractor's Team. No actions or failure to act, or decisions made in good faith to exercise or not exercise the authority or responsibility available under the Contract Documents creates a duty in contract, tort, or otherwise of OPT to the Contractor or members of Contractor's Team.

9.10 Undisclosed Hazardous Environmental Condition

- A. OPT's responsibility for undisclosed Hazardous Environmental Conditions is described in Paragraph 5.06.

9.11 Compliance with Safety Program

- A. Contractor is to inform OPT of its safety programs and OPT is to comply with the specific applicable requirements of this program.

**ARTICLE 10 – DESIGN PROFESSIONAL'S AND CONSTRUCTION MANAGER'S STATUS DURING CONSTRUCTION**

10.01 Owner's Representative

- A. Construction Manager is Owner's representative. The duties and responsibilities and the limitations of authority of Construction Manager as Owner's representative are described in the Contract Documents.

10.02 Visits to Site

- A. Design Professional is to make periodic visits to the Site to observe the progress and quality of the Work. Design Professional is to determine, in general, if the Work is proceeding in accordance with the Contract Documents based on observations made during these visits. Design Professional is not required to make exhaustive or continuous inspections to check the quality or quantity of the Work. Design Professional is to inform OPT of issues or concerns and Construction Manager is to work with Contractor to address these issues or concerns. Design Professional's visits and observations are subject to the limitations on Design Professional's authority and responsibility described in the Contract Documents.
- B. Construction Manager is to observe the Work to check the quality and quantity of Work, implement Owner's quality assurance program and administer the Contract as Owner's representative as described in the Contract Documents. Construction Manager's visits and observations are subject to the limitations on Construction Manager's authority and responsibility described in the Contract Documents.

10.03 Rejecting Defective Work

- A. OPT has the authority to reject Work in accordance with Article 14. Construction Manager is to notify Contractor of Defective Work of which it is aware and document when Defective Work has been corrected or accepted in accordance with Article 14.

#### 10.04 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Construction Manager is to render decisions regarding non-technical or contractual/administrative requirements of the Contract Documents and will coordinate the response of OPT to Contractor.
- B. Design Professional is to render decisions regarding the conformance of the Work to the requirements of the Contract Documents. Design Professional will render a decision to either correct the Defective Work, or accept the Work under the provisions of Paragraph 14.04, if Work does not conform to the Contract Documents. Construction Manager will coordinate the response of OPT to Contractor.
- C. Construction Manager will issue a Request for a Change Proposal if a Modification is required. Construction Manager will provide documentation for changes related to the non-technical or contractual/administrative requirements of the Contract Documents. Design Professional will provide documentation if design related changes are required through Construction Manager.
- D. Contractor may appeal OPT's decision by submitting a Change Proposal if Contractor does not agree with the OPT's decision.

### ARTICLE 11 – CHANGES TO THE CONTRACT

#### 11.01 Amending and Supplementing the Contract Documents

- A. A Contract Amendment, Change Order, Work Change Directive, or Field Order may modify the Contract Documents. Modifications that include a change in the Contract Price or Contract Times can only be made in a Contract Amendment or Change Order.
- B. Changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other design or technical matters, must be supported by Design Professional's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of Design Professional.
- C. Proceed with the Changes in the Work or, in the case of a deletion in the Work, immediately cease construction activities related to the deleted Work upon receipt of the Modification.
- D. Contractor is not entitled to an increase in the Contract Price or an extension of the Contract Times with respect to Work performed that is not required by the Contract Documents, except in the case of an emergency as provided in Paragraph 7.12, or in the case of uncovering Work as provided in Paragraph 14.05. Contractor is responsible for costs and time delays associated with variations from the requirements of the Contract Documents unless the variations are specifically approved by Change Order.
- E. Acceptance of a Modification by Contractor constitutes agreement that the compensation provided by that Modification is the full, complete, and final compensation for all costs Contractor has or may incur because of or relating to this Modification whether these costs are known, unknown, foreseen, or unforeseen at this time, including any cost for delay, extended overhead, ripple or impact cost, or any other effect on changed or unchanged Work as a result of this Modification.

- F. Acceptance of a Modification by Contractor constitutes agreement that the changes in Contract Times are the complete and final adjustments for direct impacts to the ability of Contractor to complete the Work within the Contract Times and are the only adjustments to which Contractor is entitled.
- G. Perform added or revised Work under the applicable provisions of the Contract Documents for the same or similar Work unless different Drawings, Specifications, or directions are provided in the Modification.
- H. Nothing in this paragraph obligates Contractor to undertake Work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

#### 11.02 Contract Amendments

- A. Owner and Contractor may modify the terms and conditions of the Contract Documents without the recommendation of Design Professional using a Contract Amendment.
- B. A Contract Amendment may also be used for authorizing a new task order for task order contracts or a new phase of the Work when using phased construction or purchasing Goods and Special Services to be incorporated into the Project. The Contract Amendment may be used to establish the Contract Price, Contract Times, or terms and conditions of the Contract for the new task order or phase of Work if not already established in the Contract Documents.

#### 11.03 Change Orders

- A. All changes to the Contract Documents that include a change in the Contract Price or the Contract Times for previously authorized Work and changes to the Work requiring Design Professional's approval must be made by a Change Order. Change Orders prepared by Construction Manager may cover:
  - 1. Changes in Contract Price or Contract Times which are submitted by Contractor as a Change Proposal and agreed to by the parties;
  - 2. Changes in Contract Price or Contract Times to pay for undisputed Work performed in accordance with a Work Change Directive;
  - 3. Changes in Contract Price or Contract Times making final adjustments for Work covered under Alternates and Allowances;
  - 4. Changes in Contract Price or Contract Times making final adjustments to actual quantities for Unit Price Work;
  - 5. Changes in Contract Price resulting from an Owner Set-off, unless the set off has been successfully challenged by Contractor;
  - 6. Changes in Contract Price or Contract Times resulting from resolution of Claims;
  - 7. Changes in Contract Price or Contract Times required because of Owner's acceptance of Defective Work under Paragraph 14.04 or Owner's correction of Defective Work under Paragraph 14.07; or
  - 8. Other similar provisions that will modify the Contract Price or Contract Times.

- B. A Change Order may also be used to establish modifications of the Contract Documents that do not affect the Contract Price or Contract Times.

#### 11.04 Work Change Directives

- A. A Work Change Directive does not change the Contract Price or the Contract Times, but is evidence that the parties expect that the modifications ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations on the Contract Price and Contract Times.
- B. Contractor must submit a Change Proposal seeking an adjustment of the Contract Price or the Contract Times no later than 30 days after the completion of the Work set out in the Work Change Directive if negotiations are unsuccessful under the terms of the Contract Documents governing adjustments.

#### 11.05 Field Orders

- A. Design Professional may require minor changes in the Work that do not change the Contract Price or Contract Times using a Field Order through Construction Manager. Construction Manager may issue a Field Order for non-technical, administrative issues. Submit a Change Proposal if Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times before proceeding with the Work described in the Field Order.

#### 11.06 Change Proposals

- A. Submit a Change Proposal to Construction Manager to:
  - 1. Request an adjustment in the Contract Price or Contract Times;
  - 2. Contest an initial decision by OPT concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents;
  - 3. Contest a Set-off against payment due; or
  - 4. Seek other relief under the Contract Documents.
- B. Notify Construction Manager immediately if a Change Proposal is to be submitted. Submit each Change Proposal to Construction Manager no later than 30 days after the event initiating the Change Proposal. Submit the following as part of the Change Proposal:
  - 1. Any proposed change in Contract Price, Contract Times, or other relief, accompanied by a statement that the requested Change Order is the entire adjustment to which Contractor believes it is entitled;
  - 2. The reason for the proposed change; and
  - 3. Supporting data, accompanied by a statement that the supporting data is accurate and complete.
- C. Construction Manager is to advise OPT regarding the Change Proposal. OPT is to review each Change Proposal and Contractor's supporting data, and within 30 days after receipt of the documents, direct Construction Manager to either approve or deny the Change Proposal in whole or in part. Construction Manager is to issue a Change Order for an approved Change Proposal. Change Proposals are denied if Construction Manager does not

act on the Change Proposal within 30 days. Contractor may start the time for appeal of the denial under Article 12.

#### 11.07 Change of Contract Price; Contract Times

- A. Change Proposals for an adjustment in the Contract Price must comply with the provisions of this Paragraph 11.07. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12. Any adjustment of the Contract Times is subject to the limitations described in Paragraph 4.03.
- B. An adjustment in the Contract Price is to be determined as follows:
  - 1. By applying unit prices to the quantities of the items involved, subject to the provisions of Paragraph 13.03, where the Work involved is covered by unit prices in the Contract Documents;
  - 2. By a mutually agreed lump sum where the Work involved is not covered by unit prices in the Contract Documents; or
  - 3. Payment based on the Cost of the Work determined as provided in Article 13 when the Work involved is not covered by unit prices in the Contract Documents or the parties do not reach a mutual agreement to a lump sum.
- C. The original Contract Price may not be increased by more than 25 percent unless further limited by Laws and Regulations. Owner may decrease the Work by up to 25 percent of the Contract Price without adjusting Contractor's fee.

#### 11.08 Execution of Change Orders and Contract Amendments

- A. Each Change Order or Contract Amendment must be specific and final as to changes in Contract Price and Contract Times for the changes described in the Change Order or Contract Amendment. Acceptance of a Change Order or Contract Amendment by Contractor constitutes a full accord and satisfaction for all claims and costs of any kind, whether direct or indirect, including impact, delay, or acceleration damages related to the Change Order or Contract Amendment. The execution of a Change Order or Contract Amendment by Contractor constitutes conclusive evidence of Contractor's agreement to the ordered changes in the Work, with no reservations or other provisions allowing for future changes in the Contract Price or Contract Times. This Contract, as amended, forever releases any claim against Owner for additional time or compensation for matters relating to or arising out of or resulting from the Work included within or affected by the executed Change Order or Contract Amendment. This release applies to claims related to the cumulative impact of all Change Orders or Contract Amendment and to any claim related to the effect of a change on unchanged Work.
- B. A Change Order or Contract Amendment is deemed to be in full force as if executed by Contractor if Contractor refuses to execute a Change Order or Contract Amendment that is required to be executed under the terms of this Paragraph 11.08.

## 11.09 Notice to Surety

- A. Notify the surety of Modifications affecting the general scope of the Work, changes in the provisions of the Contract Documents, or changes in Contract Price or Contract Times. Adjust the amount of each bond when Modifications change the Contract Price.

## ARTICLE 12 – CLAIMS

### 12.01 Claims

- A. Follow the Claims process described in this Article for a demand or assertion by Contractor:
  - 1. Contesting an initial decision by OPT concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents;
  - 2. Contesting OPT's decision regarding a Change Proposal;
  - 3. Seeking resolution of a contractual issue that OPT has declined to address;
  - 4. Seeking other relief with respect to the terms of the Contract; or
  - 5. Any issue, request, demand, or dispute arising after Construction Manager's recommendation of Final Payment not specifically listed in the Certificate of Final Completion.
- B. Notify Construction Manager no later than 7 days after the start of the event giving rise to the Claim or, in the case of appeals regarding Change Proposals, within 7 days of the decision under appeal. The responsibility to substantiate a Claim rests with the entity making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Price or Contract Times, Contractor must certify that the Claim is made in good faith, that the supporting data is accurate and complete, and that to the best of Contractor's knowledge and belief, the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. The entity receiving a Claim is to review the Claim and consider its merits. The Owner and Contractor are to seek to resolve the Claim through the exchange of information and direct negotiations. The Owner and Contractor may extend the time for resolving the Claim by mutual agreement. Notify Construction Manager of actions taken on a Claim.
- D. Owner and Contractor may mutually agree to mediate the underlying dispute at any time after initiation of a Claim.
  - 1. The agreement to mediate suspends the Claims process.
  - 2. Owner or Contractor may unilaterally terminate the mediation process after 60 days from the agreement to mediate and resume the Claims process as of the date of the termination. The Claim process resumes as of the date of the conclusion of the mediation, as determined by the mediator, if the mediation is unsuccessful in resolving the dispute.
  - 3. Owner and Contractor are to each pay one-half of the mediator's fees and costs.
- E. If the entity receiving a Claim approves the Claim in part or denies it in part, this action is final and binding unless the other entity invokes the procedure described in Article 17 for final resolution of disputes within 30 days of this action.



- F. Notify Construction Manager if efforts to resolve the Claim are not successful and the Claim is denied. A denial of the Claim is final and binding unless the other entity invokes the procedure described in Article 17 for the final resolution of disputes within 30 days of the denial.
- G. The results of the agreement or action on the Claim is to be incorporated in a Change Order by Construction Manager to the extent they affect the Contract Documents, the Contract Price, or the Contract Times if the Owner and Contractor reach an agreement regarding a Claim.

## **ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

### **13.01 Cost of the Work**

- A. The Cost of the Work is the sum of costs described in this Paragraph 13.01, except those excluded in Paragraph 13.01.D, necessary for the proper performance of the Work. The provisions of this Paragraph 13.01 are used for two distinct purposes:
  - 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price under cost-plus, time-and-materials, or other cost-based terms; or
  - 2. To determine the value of a Change Order, Change Proposal, Claim, Set-off, or other adjustment in Contract Price.
- B. Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the events giving rise to the adjustment when the value of the adjustment is determined on the basis of the Cost of the Work.
- C. Costs included in the Cost of the Work may not exceed the costs commonly incurred in the proximate area of the Site for similar work unless agreed to by Owner. Cost of the Work includes only the following items:
  - 1. Payroll costs for Contractor's employees performing the Work, including one foreman per crew, and other required and agreed upon personnel for the time they are employed on the Work. Employees are to be paid according to wage rates for job classifications as agreed to by Owner in advance of the Work. Rates paid for this Work are to be the same as paid for Contract Work as established by certified payroll. Payroll costs may include:
    - a. Actual costs paid for salaries and wages;
    - b. Actual cost paid for fringe benefits, which consists of:
      - 1) Social security contributions,
      - 2) Unemployment,
      - 3) Excise and payroll taxes,
      - 4) Workers' compensation,
      - 5) Health and retirement benefits, and
      - 6) Paid time off for sick leave, vacations and holidays; and

- c. Actual cost of additional compensation paid for performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, to the extent authorized by Owner.
- 2. Cost of materials and equipment furnished and incorporated in the Work, including transportation and storage costs and required Suppliers' field services. Contractor may retain cash discounts unless Owner provided funds to Contractor for early payment of these materials and equipment. Cash discounts are to be credited to Owner if Owner provides funds for early payment. Make provisions for trade discounts, rebates, refunds, and returns from sale of surplus materials and equipment and reduce the Cost of the Work by these amounts.
- 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. Obtain competitive bids from Subcontractors acceptable to Owner if required by OPT. Bids are to be opened in the presence of Construction Manager and other designated members for OPT. Provide copies of bids to Construction Manager to use in determining, with OPT, which bids are acceptable. The Subcontractor's Cost of the Work and fee are determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01 if the subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee.
- 4. Supplemental costs consisting of the following:
  - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work;
  - b. Costs of materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site including transportation and maintenance costs related specifically to the Work;
  - c. Costs of engineers, architects, testing laboratories, surveyors, employed or retained for services specifically related to the Work.
  - d. Actual cost for construction equipment, including the costs of transporting, loading, unloading, assembling, dismantling, and removing construction equipment, whether owned by Contractor or rented from others.
    - 1) Cost for construction equipment must not exceed the cost shown in the most current edition of the rental rate book named in the Supplemental Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
    - 2) With respect to Work that is the result of a Change Order, Change Proposal, Claim, Set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

- e. Applicable sales, consumer, use, and other similar taxes related to the Work for which Owner is not exempt, and which Contractor pays consistent with Laws and Regulations;
  - f. Deposits lost for causes other than negligence of Contractor's Team;
  - g. Royalty payments and fees for permits and licenses;
  - h. Cost of additional utilities, fuel, and sanitary facilities at the Site;
  - i. Minor expense items directly required by the Work; and
  - j. Premiums for bonds and insurance required by the Contract Documents.
- D. The Cost of the Work does not include the following administrative costs which are to be covered by the Contractor's fee:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, safety managers, superintendents, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office, for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.C.1.
  - 2. The cost of purchasing, renting or furnishing any tool or equipment whose current price would be less than \$500 if purchased new at retail.
  - 3. Office expenses other than Contractor's office at the Site.
  - 4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
  - 5. Costs due to the actions of Contractor's Team for the correction of Defective Work, disposal of materials or equipment that do not comply with Specifications, and correcting damage to property.
  - 6. Losses, damages, and related expenses caused by damage to the Work or sustained by Contractor in connection with the performance of the Work. Contractor is entitled to recover costs if covered by Owner's insurance, if applicable. Such losses may include settlements made with the approval of Owner. Do not include these losses, damages, and expenses in the Cost of the Work when determining Contractor's fee.
  - 7. Expenses incurred in preparing and advancing Claims.
  - 8. Any Indemnified Cost paid with regard to Contractor's indemnification of Owner's Indemnitees.
  - 9. Other overhead or general expense costs and the costs of items not described in Paragraph 13.01.C.
- E. Contractor's fee is determined in accordance with the Agreement when the Work is performed on a cost-plus basis.

- F. Contractor's Fee is determined as follows for Work included in a Change Proposal.
  - 1. Contractor's fee is 15 percent of the costs included in the Cost of the Work per Paragraph 13.01.C.1 for payroll cost and per Paragraph 13.01.C.2 for cost of materials and equipment furnished and incorporated in the Work.
  - 2. Contractor's fee is 5 percent of costs included in the Cost of the Work paid by Contractor for Work performed by Subcontractors per Paragraph 13.01.C.3.
  - 3. No fee will be payable for costs included in the Cost of the Work for supplemental costs per Paragraph 13.01.C.4.
  - 4. Fees are to be determined as follows where one or more tiers of Subcontracts are used:
    - a. The Subcontractor's fee is 15 percent for costs incurred under Paragraphs 13.01.C (excluding Paragraph 13.01.C.3) for the Subcontractor that performs the Work;
    - b. The Contractor and Subcontractors of a tier higher than that of the Subcontractor that performs the Work are allowed a fee of 5 percent of the total costs incurred by the next lower tier Subcontractor; and
    - c. Regardless of the number of subcontractor tiers involved, the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that performs the Work.
- G. When a Change Proposal includes additions and credits, the Contractor's fee will be calculated on the sum of costs for each cost category in Paragraph 13.01.C. and applying the appropriate fee from Paragraph 13.01.E. The amount to be credited by Contractor to Owner for any Change Proposal which results in a net decrease in the Cost of Work will be the amount of the actual net decrease in the Cost of Work plus an additional amount equal to 5 percent of the actual net decrease in the Cost of Work.
- H. Establish and maintain records in accordance with generally accepted accounting practices and submit these records, including an itemized cost breakdown together with supporting data, in a form and at intervals acceptable to Construction Manager whenever the Cost of the Work is to be determined pursuant to this Paragraph 13.01.

## 13.02 Allowances

- A. Include allowances specified in the Contract Documents in the Contract Price and provide Work covered by the allowance as authorized by Owner through Construction Manager.
- B. Contractor agrees that:
  - 1. The cash allowance is used to compensate Contractor for the cost of furnishing materials and equipment for the Work covered by the allowance item in the Contract Documents. Cost may include applicable taxes. Make provisions for trade discounts, rebates, and refunds and reduce the allowance costs by these amounts.
  - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances; and

3. Costs for cash allowances and installation costs as described in Paragraphs 13.02.B.1 and 13.02.B.2 above are included in the Contract Price.
- C. Construction Manager will issue a Change Order to adjust the Contract Price by the difference between the allowance amount and the actual amount paid by Contractor for Work covered by the allowance. The Change Order will be issued at the time costs are incurred by Contractor for Work covered by the allowance and this Work is included on the Application for Payment.

### 13.03 Unit Price Work

- A. The initial Contract Price for Unit Price Work is equal to the sum of the unit price line items in the Agreement. Each unit price line item amount is equal to the product of the unit price for each line item times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparing offers and determining an initial Contract Price. Payments to Contractor for Unit Price Work are to be based on actual quantities measured for Work in place.
- C. Each unit price is deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Construction Manager is to determine the actual quantities and classifications of Unit Price Work performed by Contractor to be incorporated into each Application for Payment. Construction Manager's decision on actual quantities is final and binding, subject to the provisions of Paragraph 13.03.E.
- E. Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price within 30 days of Construction Manager's decision under Paragraph 13.03.D, if:
  1. The total cost of a particular item of Unit Price Work amounts to 20 percent or more of the total Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 20 percent from the estimated quantity of an item indicated in the Agreement;
  2. There is no corresponding adjustment with respect to other items of Work; and
  3. Contractor believes it has incurred additional expense as a result of this condition or if Owner believes that the quantity variation entitles Owner to an adjustment in the Contract Price.
- F. Construction Manager will issue a Change Order adjusting estimated quantities to actual quantities to determine the final Contract Price.

### 13.04 Contingencies

- A. Contingency funds may be included in the Contract Price to pay for Work not defined specifically by the Contract Documents that is essential to the completion of the Project. Contingency funds will be as described in the Agreement.

- B. The contingency funds may be used for costs incurred by Contractor, provided these costs are approved by Owner. Costs are to be determined and documented in accordance with Paragraph 13.01. The contingency funds are not to be used for the following items:
  - 1. Cost overruns due to changes in material costs after the Contract Price is established, unless specific price escalation provisions are made in the Agreement;
  - 2. Rework required to correct Defective Work;
  - 3. Inefficiencies in completing the Work due to Contractor's selected means, methods, sequences, or procedures of construction;
  - 4. Work Contractor failed to include in the Contract Price;
  - 5. Changes required by changes in Laws and Regulations enacted after the Contract Price is established; or
  - 6. Any Work that does not constitute a change in Scope in the Work included in the Contract Price.
- C. Construction Manager is to issue a Change Order for approved expenditures from contingency funds. When the Change Order is issued, the costs are to be added to the Application for Payment. Contractor is to maintain a tabulation showing the contingency amount, adjustments to the contingency amount, and amounts remaining as the Project progresses.
- D. Any contingency amounts that are not included in a Change Order are retained by Owner. A Change Order will be issued to deduct unused contingency amounts from the Contract Price prior to Final Payment.

#### **ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK**

##### **14.01 Access to Work**

- A. Provide safe access to the Site and the Work for the observation, inspection, and testing of the Work in progress. Contractor can require compliance with Contractor's safety procedures and programs as part of providing safe access.

##### **14.02 Tests, Inspections, and Approvals**

- A. OPT may retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform inspections. Cooperate with inspection and testing personnel and assist with providing access for required inspections, tests, and handling test specimens or Samples.
- B. Arrange for and facilitate inspections, tests, and approvals required by Laws or Regulations of governmental entities having jurisdiction that require Work to be inspected, tested, or approved by an employee or other representative of that entity. Pay associated costs and furnish Construction Manager with the required certificates of inspection or approval.
- C. Arrange, obtain, and pay for inspections and tests required:
  - 1. By the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to OPT;

2. To attain OPT's acceptance of materials or equipment to be incorporated in the Work;
  3. By manufacturers of equipment furnished under the Contract Documents;
  4. For testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work;
  5. For acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work;
  6. For re-inspecting or retesting Defective Work, including any associated costs incurred by the testing laboratory for cancelled tests or standby time; and
  7. For retesting due to failed tests.
- D. Provide independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to OPT to provide these inspections and tests.

#### 14.03 Defective Work

- A. It is Contractor's obligation to ensure that the Work is not Defective.
- B. OPT has the authority to determine whether Work is Defective and to reject Defective Work.
- C. Construction Manager is to notify Contractor of Defective Work of which OPT has actual knowledge.
- D. Promptly correct Defective Work.
- E. Take no action that would void or otherwise impair Owner's special warranties or guarantees when correcting Defective Work.
- F. Pay claims, costs, losses, and damages arising out of or relating to Defective Work, including:
  1. Costs for correction, removal, and replacement of Defective Work;
  2. Cost of the inspection and testing related to correction of Defective Work;
  3. Costs for Design Professional's fees associated with review and approval of design modifications for correction, removal, and replacement of Defective Work.
  4. Fines levied against Owner by governmental authorities because of Defective Work; and
  5. Costs of repair or replacement of work of others resulting from Defective Work.

#### 14.04 Acceptance of Defective Work

- A. Owner may elect to accept Defective Work instead of requiring correction or removal and replacement of Defective Work provided:
  1. This acceptance occurs prior to final payment;
  2. Design Professional confirms that the Defective Work is in general accordance with the design intent and applicable design principles; and

3. Design Professional confirms that acceptance of the Defective Work does not endanger public health or safety.
- B. Owner may impose a reasonable Set-off against payments due under Article 15 for costs associated with OPT's evaluation of Defective Work to determine if it can be accepted and to determine the diminished value of the Work. Owner may impose a reasonable Set-off against payments due under Article 15 if the parties are unable to agree as to the decrease in the Contract Price to compensate Owner for the diminished value of Defective Work accepted. Construction Manager is to issue a Change Order for acceptance of the Defective Work prior to final payment. Pay an appropriate amount to Owner if the acceptance of Defective Work occurs after final payment.

#### 14.05 Uncovering Work

- A. OPT has the authority to require inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. Work that is covered prior to approval of Construction Manager must be uncovered for OPT's observation if requested by Construction Manager. Pay for uncovering Work and its subsequent restoration unless Contractor has given Construction Manager timely notice of Contractor's intention to cover the Work and Construction Manager fails to act with reasonable promptness in response to this notice.
- C. Provide necessary labor, material, and equipment and uncover, expose, or otherwise make available the portion of the Work suspected of being Defective for observation, inspection, or testing if OPT considers it necessary or advisable that covered Work be observed by Design Professional or inspected or tested by others as directed by Construction Manager.
  1. Pay for claims, costs, losses, and damages associated with uncovering, exposing, observing, inspecting, and testing if it is found that the uncovered Work is Defective. Pay costs for correction of Defective Work. Pay for reconstruction, repair, or replacement of work of others if it is found that the uncovered Work is Defective.
  2. Submit a Change Proposal for an increase in the Contract Price or an extension of the Contract Times directly attributable to this uncovering, exposure, observation, inspection, testing, and reconstruction if the uncovered Work is found to not be Defective.

#### 14.06 Owner May Stop the Work

- A. Owner may order Contractor to stop the Work if:
  1. The Work is Defective;
  2. Contractor fails to supply sufficient skilled workers or suitable materials or equipment;  
or
  3. Contractor performs Work that may fail to conform to the Contract Documents when completed.
- B. This stop work order is to remain in effect until the reason for the stop work order has been eliminated. Owner's right to stop the Work does not create a duty to exercise this right for the benefit of Contractor's Team or surety.



#### 14.07 Owner May Correct Defective Work

- A. Owner may remedy Defective Work after 7 days' notice to Contractor if Contractor fails to correct Defective Work, or to remove and replace Defective Work as required by OPT;
- B. Owner may:
  - 1. Exclude Contractor from the Site;
  - 2. Take possession of the Work and suspend Contractor's services related to the Work; and
  - 3. Incorporate stored materials and equipment in the Work.
- C. Allow OPT access to the Site and off-site storage areas to enable Owner to exercise the rights and remedies under this paragraph.
- D. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 are to be charged against Contractor as a Set-off against payments due under Article 15. These claims, costs, losses, and damages include costs of repair and the cost of replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's Defective Work.
- E. Contractor is not allowed an extension of the Contract Times because of delays in the performance of the Work attributable to the exercise of the Owner's rights and remedies under this Paragraph 14.07.

### **ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; FINAL COMPLETION**

#### 15.01 Progress Payments

- A. Progress payments are to be submitted to Construction Manager on the Application for Payment form provided by Construction Manager following procedures in the Contract Documents.
  - 1. Progress payments for lump sum Work are to be paid based on the earned value to date at the amounts shown in the Schedule of Values submitted as required by Paragraph 2.03. Final payment will be for the total lump sum amount.
  - 2. Progress payments for Unit Price Work are based on the number of units completed as determined under the provisions of Paragraph 13.03.
  - 3. Progress payments for Work to be paid based on the Cost of the Work per Article 13 are to be paid for Work completed by Contractor during the pay period.
- B. Reduction in Payment by Owner:
  - 1. Owner is entitled to impose a Set-off against payment based on the following:
    - a. Claims made against Owner or costs, losses, or damages incurred by Owner related to:
      - 1) Contractor's conduct in the performance of the Work, including workplace injuries, non-compliance with Laws and Regulations, or patent infringement; or

- 2) Contractor's failure to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site, including workplace injuries, property damage, and non-compliance with Laws and Regulations.
- b. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
- c. Work is Defective, or completed Work has been damaged by Contractor's Team, requiring correction or replacement;
- d. Owner has been required to correct Defective Work or complete Work in accordance with Paragraph 14.07;
- e. The Contract Price has been reduced by Change Orders;
- f. Events have occurred that would constitute a default by Contractor justifying a termination for cause;
- g. Liquidated or other damages have accrued because of Contractor's failure to achieve Milestones, Substantial Completion, or completion of the Work;
- h. Liens have been filed regarding the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of these Liens;
- i. Owner has been notified of failure to make payments to Subcontractors, Suppliers, or Employees;
- j. Failure to submit up-to-date record documents as required by the Contract Documents;
- k. Failure to submit monthly Progress Schedule updates or revised schedules as requested by Construction Manager;
- l. Failure to provide Project photographs required by the Contract Documents;
- m. Failure to provide Certified Payroll required by the Contract Documents;
- n. Compensation for OPT for overtime charges of Construction Manager, third review of Shop Drawings, review of substitutions, re-inspection fees, inspections or designs related to correction of Defective Work, or other services identified as requiring payment by Contractor;
- o. Costs for tests performed by Owner to verify that Work previously tested and found to be Defective has been corrected;
- p. OPT has actual knowledge of the occurrence of events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents with associated cost impacts;
- q. Payment would result in an over-payment of the Contract Price; or
- r. Other items entitling Owner to a Set-off against the amount recommended.
2. Compensation for services of OPT staff is to be at the rates established in the Supplementary Conditions.

3. Construction Manager is to notify Contractor stating the amount and the reasons for an imposed Set-off. Owner is to pay Contractor amounts remaining after deduction of the Set-off. Owner is to pay the Set-off amount agreed to by Owner and Contractor if Contractor remedies the reasons for the Set-off. Contractor may submit a Change Proposal contesting the Set-off.
- C. No payment will be made for Work authorized by a Work Change Directive until the Work Change Directive is incorporated into a Change Order, unless arrangements or interim payments have been included in the Work Change Directive. Payment can be included in an Application for Payment when the Change Order is approved.
- D. Owner is to pay the amount of payment recommended by Construction Manager within 30 days after receipt of the Application for Payment and accompanying documentation from Construction Manager.
- E. Contractor certifies that all Work, including materials, covered by each Application for Payment have been completed or delivered and stored in accordance with the Contract Documents, that all amounts have been paid for Work, materials, and equipment for which previous payment has been made by Owner, and that the current payment amount shown in this Application for Payment is due.

#### 15.02 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to the Work, materials, and equipment furnished under the Contract is to pass to Owner free and clear of Liens, title defects, and patent, licensing, copyright, or royalty obligations no later than 7 days after the time of payment by Owner of the Application for Payment which includes these items.

#### 15.03 Substantial Completion

- A. Notify Construction Manager when the Work or portion of the Work to be accepted under Paragraph 15.04 is substantially complete and request a Certificate of Substantial Completion.
- B. OPT is to inspect the Work after Contractor's notification to determine if the Work is substantially complete. Construction Manager is to either issue the Certificate of Substantial Completion which sets the date of Substantial Completion or notify Contractor of the reasons the Project is not considered to be substantially complete.
- C. The OPT and Contractor are to meet to discuss Owner's use or occupancy of the Work following Substantial Completion. Items to be discussed at this meeting include:
  1. Review of insurance policies with respect to the end of the Contractor's coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner;
  2. Owner's assumption of responsibility for security, operation, protection of the Work, maintenance, and utilities upon Owner's use or occupancy of the Work;
  3. Contractor's obligations for operations and maintenance during performance and acceptance testing;
  4. Contractor's access to the Site to complete punch list items; and

5. Procedures for correction of Defective Work during the one-year correction period.

15.04 Partial Utilization

- A. Owner may use or occupy substantially completed parts of the Work which are specifically identified in the Contract Documents, or which OPT and Contractor agree constitutes a separately functioning and usable part of the Work prior to Substantial Completion of the Work. Owner must be able to use that part of the Work for its intended purpose without significant interference with Contractor's performance of the remainder of the Work. Contractor and OPT are to follow the procedures of Paragraph 15.03 for this part of the Work.
- B. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Article 6.

15.05 Final Inspection

- A. OPT is to make a final inspection upon notice from Contractor that the entire Work or portion to be accepted under Paragraph 15.04 is complete. Construction Manager is to notify Contractor of Work determined to be incomplete or Defective. Immediately take corrective measures to complete the Work and correct Defective Work.
- B. Notify Construction Manager when the entire Project and ready for Final Payment under Paragraph 15.06 and request a Certificate of Final Completion.
- C. OPT is to inspect the Work after Contractor's notification to determine if the Project is complete. Construction Manager is to either issue the Certificate of Final Completion which sets the date of Final Completion or notify Contractor of the reasons the Project is not considered to be complete.

15.06 Final Payment

- A. Make application for final payment after completing required corrections identified during the final inspection and delivering items and documents required by the Contract Documents. Provide the following with the final Application for Payment:
  - 1. Consent of Surety to Final Payment acknowledging unsettled disputes; or
  - 2. Affidavit of Payment of Debts and Claims or Affidavit of Release of Liens or furnish receipts or releases from Subcontractors and Suppliers when a payment bond is not required.
- B. Construction Manager is to either recommend payment of the final Application for Payment to Owner if OPT is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled or notify Contractor of OPT's reasons for not recommending final payment.
- C. The Work is complete, subject to surviving obligations, when it is ready for final payment as established by the Construction Manager's recommendation of payment of the final Application for Payment to Owner and the issuance of a Certificate of Final Completion.
- D. Owner is to pay the amount of final payment recommended by Construction Manager within 30 days after receipt of the final Application for Payment and accompanying

documentation from Construction Manager; unless additional time is required for approval of a governing board or entity. Payment will be within 30 days of approval by the governing board or entity.

#### 15.07 Waiver of Claims

- A. The making of final payment does not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from:
  - 1. Unsettled Liens or claims for non-payment;
  - 2. Defective Work appearing after final inspection pursuant to Paragraph 15.05;
  - 3. Contractor's failure to comply with the terms of special guarantees specified in the Contract Documents;
  - 4. Outstanding Claims or express reservation of rights by Owner; or
  - 5. Contractor's continuing obligations under the Contract Documents.
- B. Contractor waives claims and rights against Owner by accepting final payment except for those Claims made in accordance with the provisions of Article 17 and specifically noted in the Certificate of Final Completion.

### ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

#### 16.01 Owner May Suspend Work

- A. Owner may suspend the Work or a portion of the Work for a period of not more than 90 consecutive days, at any time and without cause, by notice to Contractor. This notice fixes the date on which Contractor is to resume Work. Contractor is entitled to adjustments in the Contract Price and Contract Times directly attributable to this suspension. Submit a Change Proposal seeking an adjustment no later than 30 days after the date fixed for resumption of Work.

#### 16.02 Owner May Terminate for Cause

- A. The occurrence of one or more of the following events constitutes a default by Contractor and justifies termination for cause:
  - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents, including failure to supply sufficient skilled workers or suitable materials or equipment;
  - 2. Failure to adhere to the Progress Schedule;
  - 3. Failure of Contractor to provide a satisfactory replacement bond or insurance in the event either is lost or canceled;
  - 4. Failure of Contractor to maintain financial solvency to adequately complete the Project as indicated by one or more of the following:
    - a. A petition of bankruptcy is filed by or against Contractor;
    - b. Contractor is adjudged as bankrupt or insolvent;

- c. Contractor or surety makes a general assignment for the benefit of creditors;
  - d. A receiver is appointed for the benefit of Contractor's creditors; or
  - e. A receiver is appointed because Contractor's insolvency;
- 5. Contractor's disregard of Laws or Regulations of public bodies having jurisdiction; or
- 6. Contractor's repeated disregard of the authority of OPT.
- B. Contractor and surety must provide adequate assurance of future performance in accordance with the Contract Documents that is satisfactory to Owner if Contractor is believed to be in financial distress due to the existence of one or more of the indicators listed in Paragraph 16.02.A.4. Owner may terminate this Contract if Contractor and surety fail to provide adequate documentation satisfactory to Owner within 10 days of Construction Manager's request for this information.
- C. Owner may declare Contractor to be in default, give notice to Contractor and surety that the Contract is terminated, and enforce the rights available to Owner under the performance bond after giving Contractor and surety 10 days' notice that one or more of the events identified in Paragraph 16.02.A has occurred.
- D. Owner may exclude Contractor from the Site, take possession of the Work, incorporate the materials and equipment stored and complete the Work as Owner may deem expedient if Owner has terminated the Contract for cause.
- E. Owner may elect not to proceed with termination of the Contract under this Paragraph 16.02 if Contractor begins to cure the cause for termination within 7 days of receipt of notice of intent to terminate.
- F. Contractor is not entitled to receive further payments until the Work is completed if Owner proceeds as provided in this Paragraph 16.02. The amount of the Contract Price remaining is to be paid to Contractor if the unpaid balance exceeds the cost to complete the Work. This cost to complete the Work may include related claims, costs, losses, damages, and the fees and charges of engineers, architects, attorneys, and other professionals retained by Owner. Pay the difference to Owner if the cost to complete the Work including related claims, costs, losses, and damages exceeds the unpaid balance of the Contract Price. Claims, costs, losses, and damages incurred by Owner are to be reviewed as to their reasonableness and incorporated in a Change Order by Construction Manager. Owner is not required to obtain the lowest price for the Work performed when exercising its rights or remedies under this paragraph.
- G. Termination does not affect the rights or remedies of Owner against Contractor or against surety under the payment bond or performance bond. Owner does not release Contractor from liability by paying or retaining money due Contractor.

#### 16.03 Owner May Terminate for Convenience

- A. Owner may terminate the Contract without cause after giving 7 days' notice to Contractor of the effective date of termination. Contractor is to be paid for the following if Owner terminates for convenience:
  - 1. Work completed in accordance with the Contract Documents prior to the effective date of termination;

2. Actual costs sustained prior to the effective date of termination for Work in progress, plus a fair and reasonable amount for overhead and profit; fee calculated in accordance with Paragraph 13.01; and
  3. Reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor will not be paid for loss of anticipated profits or revenue, post termination overhead costs, or other economic loss arising out of or resulting from this termination.

#### 16.04 Contractor May Stop Work or Terminate

- A. Contractor may terminate the Contract and issue a Change Proposal requesting payment from Owner on the same terms as provided in Paragraph 16.03 after 10 days' notice to Construction Manager provided that, through no act or fault of Contractor:
1. The Work is suspended for more than 90 consecutive days by Owner;
  2. Construction Manager fails to act on an Application for Payment within 30 days after it is submitted; or
  3. Owner fails to pay Contractor sums determined to be due, other than the final payment, within 30 days after payment is recommended by Construction Manager; and
  4. OPT does not remedy this suspension or failure within 10 days after receipt of the notice.
- B. Contractor may stop Work, without prejudice to other rights or remedies in lieu of terminating the Contract if Construction Manager has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed to pay Contractor within 30 days after payment is recommended by Construction Manager. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times for damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

### ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

#### 17.01 Methods and Procedures

- A. The Owner or Contractor may appeal a Claim, approved or denied in part or in full, by:
1. Electing to invoke the dispute resolution process if one is provided for in the Supplementary Conditions;
  2. Agreeing with the other party to submit the dispute to a dispute resolution process; or
  3. Notifying the other party of the intent to submit the dispute to a court of competent jurisdiction if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to.

## **ARTICLE 18 – MISCELLANEOUS**

### **18.01 Computation of Times**

- A. Exclude the first day and include the last day when determining dates for a period referred to in the Contract Documents by days. The last day of this period is to be omitted from the determination if it falls on a Saturday, Sunday, or a legal holiday.
- B. All references and conditions for a calendar day contract in the Contract Documents apply for a Fixed Date Contract. A fixed date contract is one in which the calendar dates for reaching Substantial Completion and/or Final Completion are specified in lieu of identifying the number of calendar days involved.

### **18.02 Independent Contractor**

- A. Contractor is to perform its duties under this Contract as an independent contractor. Contractor's Team and their personnel are not considered to be employees or agents of Owner. Nothing in this Agreement is to be interpreted as granting Contractor's Team the right or authority to make commitments for Owner. This Agreement does not constitute or create a joint venture, partnership, or formal business organization of any kind.

### **18.03 Cumulative Remedies**

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available to the Owner or Contractor by these General Conditions are in addition to, and are not a limitation of, the rights and remedies which are otherwise imposed or available by:
  - 1. Laws or Regulations,
  - 2. Special warranties or guarantees, or
  - 3. Other provisions of the Contract Documents.
- B. The provisions of this Paragraph 18.03 are as effective as if repeated specifically in the Contract Documents regarding each duty, obligation, right, and remedy to which they apply.

### **18.04 Limitation of Damages**

- A. Owner's Indemnitees are not liable to Contractor for claims, costs, losses, or damages sustained by Contractor's Team associated with other projects or anticipated projects.

### **18.05 No Waiver**

- A. The failure of Owner or Contractor to enforce any provision of this Contract does not constitute a waiver of that provision, affect the enforceability of that provision, or the enforceability of the remainder of this Contract.

### **18.06 Severability**

- A. If a court of competent jurisdiction renders a part of this Contract invalid or unenforceable, that part is to be severed and the remainder of this Contract continues in full force.



18.07 Survival of Obligations

- A. Representations, indemnifications, warranties, guarantees, and continuing obligations required by the Contract Documents survive completion and acceptance of the Work or termination of the Contract.

18.08 No Third-Party Beneficiaries

- A. Nothing in this Contract can be construed to create rights in any entity other than the Owner and Contractor. Neither the Owner nor Contractor intends to create third party beneficiaries by entering into this Contract.

18.09 Successors and Assigns

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents

18.10 Assignment of Contract

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights or interests in the Contract will be binding on the other party without the written consent of the other party. Money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.11 No Waiver of Sovereign Immunity

- A. Owner has not waived its sovereign immunity by entering into and performing its obligations under this Contract.

18.12 Controlling Law

- A. This Contract is to be governed by the law of the state in which the Project is located.
- B. Venue for legal proceedings lies exclusively in the county in which the Owner's home office is located unless specified elsewhere in the Contract Documents.

**END OF SECTION**

RULES IMPLEMENTING MEDIATED  
SETTLEMENT CONFERENCES IN  
NORTH CAROLINA PUBLIC CONSTRUCTION PROJECTS

Adopted  
February 26, 2002

Table of Rules

**Rule**

1. Initiating Mediated Settlement Conferences
  - A. Purpose of Mandatory Settlement Conferences.
  - B. Initiating the Dispute Resolution Process.
2. Selection of Mediator
  - A. Selection of Certified Mediator by Agreement of the Parties.
  - B. Nomination and Court Approval of a Non-Certified Mediator.
  - C. Appointment of Mediator by the SCO.
  - D. Mediator Information Directory.
  - E. Disqualification of Mediator.
3. The Mediated Settlement Conference
  - A. Where Conference is to be Held.
  - B. When Conference is to be Held.
  - C. Request to Extend Deadline for Completion.
  - D. Recesses.
  - E. The Mediated Settlement Conference shall not be cause for the Delay of the Construction Project which is the focus of the Dispute.
4. Duties of Parties and Other Participants in Formal Dispute Resolution Process
  - A. Attendance.
  - B. Finalizing Agreement.
  - C. The Mediation Fee shall be paid in accordance with G.S. 143-128(g).
  - D. Failure to Compensate Mediator.
5. Authority and Duties of Mediators
  - A. Authority of Mediator.
  - B. Duties of Mediator.
6. Compensation of the Mediator
  - A. By Agreement.
  - B. By Appointment.
7. Mediator Certification
8. Rule Making
9. Definitions
10. Time Limits

## **RULE 1. INITIATING MEDIATED SETTLEMENT CONFERENCES**

**A. Purpose of Mandatory Settlement Conferences.** Pursuant to G.S. 143-128(g) 143-135.26(11), these Rules are promulgated to implement a system of settlement events which are designated to focus the parties' attention on settlement rather than on claim preparation and to provide a structured opportunity for settlement negotiations to take place. Nothing herein is intended to limit or prevent the parties from engaging in settlement procedures voluntarily at any time prior to or during commencement of the dispute resolution process.

### **B. Initiating the Dispute Resolution Process**

- 1) Any party to a public construction contract governed by Article 8. Ch. 143 of the General Statutes and identified in G.S. 143-128(g) and who is a party to a dispute arising out of the construction process in which the amount in controversy is at least \$15,000 may submit a written request to the public owner for mediation of the dispute.
- 2) Prior to submission of a written request for mediation to the public owner, the parties requesting mediation,
  - a) If a prime contractor, must have first submitted its claim to the Project Designer for review as set forth in Exhibit A. If the dispute is not resolved through the Project Designer's instructions, then the dispute becomes ripe for mediation in the Formal Dispute Resolution Process, and the party may submit his written request for mediation to the public owner.
  - b) If the party requesting mediation is a subcontractor, it must first have submitted its claim for mediation to the prime contractor with whom it has a contract. If the dispute is not resolved through the Prime Contractor's involvement, then the dispute becomes ripe for mediation in the Formal Dispute Resolution Process, and the party may submit its written request for mediation to the public owner.
  - c) If the party requesting mediation is the Project Designer, then it must first submit its claim to the public owner to resolve. If the dispute is not resolved with the public owner's involvement, then the Project Designers' dispute is ripe for mediation in the Formal Dispute Resolution Process, and the Project Designer may submit its written request to the public owner for mediation.

## **RULE 2. SELECTION OF MEDIATOR**

**A. Selection of Certified Mediator by Agreement of the Parties.** The parties may select a mediator certified pursuant to the Rules by agreement within 21 days of requesting mediation. The requesting party shall file with the State Construction Office (hereinafter collectively referred to as the "SCO") or public owner if a non-State project a Notice of Selection of Mediator by Agreement within 10 days of the request; however, any party may file the notice. Such notice shall state the name, address and telephone number of the mediator selected; state the rate of compensation of the mediator; state that the mediator and opposing counsel have agreed upon the selection and rate of compensation; and state that the mediator is certified pursuant to these Rules.

- B. Nomination and Public Owner Approval of a Non-Certified Mediator.** The parties may select a mediator who does not meet the certification requirements of these rules but who, in the opinion of the parties and the SCO or public owner, is otherwise qualified by training or experience to mediate the action.

If the parties select a non-certified mediator, the requesting party shall file with the SCO a Nomination of Non-Certified Mediator within 10 days of the request. Such nomination shall state the name, address and telephone number of the mediator; state the training, experience or other qualifications of the mediator; state the rate of compensation of the mediator; and state that the mediator and opposing counsel have agreed upon the selection and rate of compensation.

The SCO or public owner shall rule on said nomination, shall approve or disapprove of the parties' nomination and shall notify the parties of its decision.

- C. Appointment of Mediator by the SCO.** If the parties cannot agree upon the selection of a mediator, the party or party's attorney shall so notify the SCO or public owner and request, on behalf of the parties, that the SCO or public owner appoint a mediator. The request for appointment must be filed within 10 days after request to mediate and shall state that the parties have had a full and frank discussion concerning the selection of a mediator and have been unable to agree. The request shall state whether any party prefers a certified attorney mediator, and if so, the SCO or public owner shall appoint a certified attorney mediator. If no preference is expressed, the SCO or public owner may appoint a certified attorney mediator or a certified non-attorney mediator.
- D. Mediator Information Directory.** To assist the parties in the selection of a mediator by agreement, the parties are free to utilize the list of certified mediators maintained in any county participating in the Superior Court Mediation Settlement Conference Program.
- E. Disqualification of Mediator.** Any party may request replacement of the mediator by the SCO or public owner for good cause. Nothing in this provision shall preclude mediators from disqualifying themselves.

### **RULE 3. THE MEDIATED SETTLEMENT CONFERENCE**

- A. Where Conference is to be Held.** Unless all parties and the mediator otherwise agree, the mediated settlement conference shall be held in the county where the project is located. The mediator shall be responsible for reserving a place and making arrangements for the conference and for giving timely notice of the time and location of the conference to all attorneys, unrepresented parties and other persons and entities required to attend.
- B. When Conference is to be Held.** The deadline for completion of the mediation shall be not less than 30 days nor more than 60 days after the naming of the mediator.
- C. Request to Extend Deadline for Completion.** A party, or the mediator, may request the SCO or public owner to extend the deadline for completion of the conference. Such request shall state the reasons the extension is sought and

shall be served by the moving party upon the other parties and the mediator. If any party does not consent to the request, said party shall promptly communicate its objection to the SCO or public owner.

The SCO or public owner may grant the request by setting a new deadline for completion of the conference.

- D. **Recesses.** The mediator may recess the conference at any time and may set times for reconvening. If the time for reconvening is set before the conference is recessed, no further notification is required for persons present at the conference.

- E. **The mediated settlement conference shall not be cause for the delay of the construction project which is the focus of the dispute.**

#### **RULE 4. DUTIES OF PARTIES AND OTHER PARTICIPANTS IN FORMAL DISPUTE RESOLUTION PROCESS**

A. **Attendance.**

- 1) All parties to the dispute originally presented to the Designer or Prime Contractor for initial resolution must attend the mediation. Failure of a party to a construction contract to attend the mediation will result in the public owner's withholding of monthly payment to that party until such party attends the mediation.
- 2) Attendance shall constitute physical attendance, not by telephone or other electronic means. Any attendee on behalf of a party must have authority from that party to bind it to any agreement reached as a result of the mediation.
- 3) Attorneys on behalf of parties may attend the mediation but are not required to do so.
- 4) Sureties or insurance company representatives are not required to attend the mediation unless any monies paid or to be paid as a result of any agreement reached as a result of mediation require their presence or acquiescence. If such agreement or presence is required, then authorized representatives of the surety or insurance company must attend the mediation.

- B. **Finalizing Agreement.** If an agreement is reached in the conference, parties to the agreement shall reduce its terms to writing and sign it along with their counsel.

- C. **The mediation fee shall be paid in accordance with G.S. 143-128(g).**

- D. **Failure to compensate mediator.** Any party's failure to compensate the mediators in accordance with G.S. 143-128(g) shall subject that party to a withholding of said amount of money from the party's monthly payment by the public owner.

Should the public owner fail to compensate the mediator, it shall hereby be subject to a civil cause of action from the mediator for the 1/3 portion of the mediator's total fee as required by G.S. 143-128(g).

#### **RULE 5. AUTHORITY AND DUTIES OF MEDIATORS**

**A. Authority of Mediator.**

- 1) *Control of Conference.* The mediator shall at all times be in control of the conference and the procedures to be followed.
- 2) *Private Consultation.* The mediator may communicate privately with any participant or counsel prior to and during the conference. The fact that private communications have occurred with a participant shall be disclosed to all other participants at the beginning of the conference.
- 3) *Scheduling the Conference.* The mediator shall make a good faith effort to schedule the conference at a time that is convenient with the participants, attorneys and mediator. In the absence of agreement, the mediator shall select the date for the conference.

**B. Duties of Mediator.**

- 1) The mediator shall define and describe the following at the beginning of the conference:
  - a) The process of mediation;
  - b) The difference between mediation and other forms of conflict resolution;
  - c) The costs of the mediated settlement conference;
  - d) That the mediated settlement conference is not a trial, the mediator is not a judge, and the parties retain their legal rights if they do not reach settlement;
  - e) The circumstances under which the mediator may meet and communicate privately with any of the parties or with any other person;
  - f) Whether and under what conditions communications with the mediator will be held in confidence during the conference;
  - g) The inadmissibility of conduct and statements as provided by G.S. 7A-38.1(1);
  - h) The duties and responsibilities of the mediator and the participants; and
  - i) That any agreement reached will be reached by mutual consent.
- 2) *Disclosure.* The mediator has a duty to be impartial and to advise all participants of any circumstance bearing on possible bias, prejudice or partiality.
- 3) *Declaring Impasse.* It is the duty of the mediator timely to determine that an impasse exists and that the conference should end.
- 4) *Reporting Results of Conference.* The mediator shall report to the SCO or public owner within 10 days of the conference whether or not an agreement was reached by the parties. If an agreement was reached, the report shall state the nature of said agreement. The mediator's report shall inform the SCO or public owner of the absence of any party known to the mediator to have been absent from the mediated settlement conference without permission. The SCO or public owner may require the mediator to provide statistical data for evaluation of the mediated settlement conference program.
- 5) *Scheduling and Holding the Conference.* It is the duty of the mediator to schedule the conference and conduct it prior to the deadline of completion set by the rules. Deadlines for completion of the conference shall be strictly observed by the mediator unless said time limit is changed by a written order of the SCO or public owner.

**RULE 6. COMPENSATION OF THE MEDIATOR**

- A. **By Agreement.** When the mediator is stipulated by the parties, compensation shall be as agreed upon between the parties and the mediator provided that the provision of G.S. 143-128(g) are observed.
- B. **By Appointment.** When the mediator is appointed by the SCO or public owner, the parties shall compensate the mediator for mediation services at the rate in accordance with the rate charged for Superior Court mediation. The parties shall also pay to the mediator a one-time per case administrative rate in accordance with the rate charged for Superior Court mediation, which is due upon appointment.

## **RULE 7. MEDIATOR CERTIFICATION.**

All mediators certified in the Formal Dispute Resolution Program shall be properly certified in accordance with the rules certifying mediators in Superior Court in North Carolina. \* When selecting mediators, the parties may designate a preference for mediators with a background in construction law or public construction contracting. Such requirements, while preferred, are not mandatory under these rules.

All mediators chosen must either demonstrate they are certified in accordance with the Rules Implementing Scheduled Mediated Settlement Conference in Superior Court or must gain the consent of the SCO or public owner to mediate any dispute in accordance with these rules.

\* Except when otherwise allowed by the SCO or public owner upon the request of the parties to the mediation.

## **RULE 8. RULE MAKING**

These Rules are subject to amendment by rule making by the State Building Commission.

These Rules are mandated for State projects when the contracting state entity has not otherwise adopted its own dispute resolution provision. These rules are optional for all other projects subject to Article 8, Ch. 143 of the General Statutes.

## **RULE 9. DEFINITIONS**

When the phrase "SCO or public owner" is used in these rules, "SCO" shall apply to state projects, "public owner" shall apply to non-state public projects.

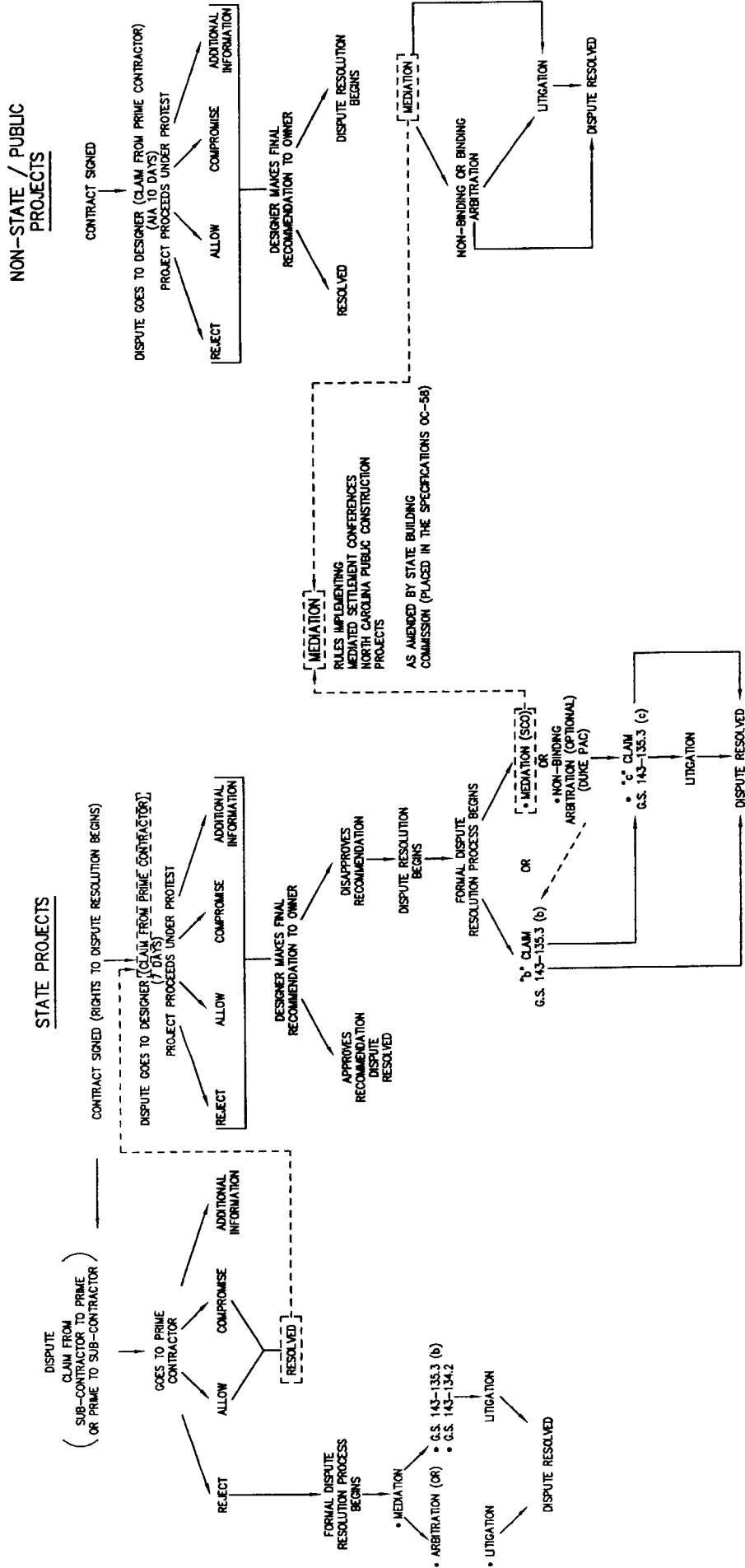
## **RULE 10. TIME LIMITS**

On state contracts, any time limit provided for by these Rules may be waived or extended by the SCO for good cause shown.

On non-state contracts, any time limit provided for by these Rules may be waived or extended by the mediator it appoints for good cause shown. If the mediator has not yet been appointed, the designer of record shall decide all waivers or extensions of time for good cause shown.

Exhibit A

# DISPUTE RESOLUTION









## **00 73 00      SUPPLEMENTARY CONDITIONS**

These Supplementary Conditions amend or supplement Section 00 72 00 "General Conditions." The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below.

The paragraph numbers used in the Supplementary Conditions correspond to the General Condition paragraphs they modify with the prefix "SC" added—for example, "Paragraph SC-4.05." modifies General Conditions Paragraph 4.05.

### **ARTICLE 1 – DEFINITIONS AND TERMINOLOGY**

#### *SC-1.01   Defined Terms*

- A. The Owner's Project Team as defined in the Paragraph 1.01.A.45 of the General Conditions consists of the following organizations:
  - 1. Owner  
Town of Summerfield  
4117 Oak Ridge Road  
Summerfield, NC 27358
  - 2. Design Professional  
Freese and Nichols, Inc  
1001 Tuckaseegee Road, Suite 120  
Charlotte, NC 28208
  - 3. Construction Manager  
(TBD)

## **ARTICLE 2 – PRELIMINARY MATTERS**

### *SC-2.02 Copies of Documents*

- A. Owner will furnish six printed copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

## **ARTICLE 5 – SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

### *SC-5.03 Subsurface and Physical Conditions*

- A. Reports and Drawings: The Supplementary Conditions hereby identify:
  - 1. those reports of explorations and tests of subsurface conditions at or adjacent to the Site (other than any Geotechnical Data Report or Geotechnical Baseline Report) that contain Technical Data. Such reports are as follows:
    - a. Report Title: Report of Subsurface Exploration
    - b. Date of Report: April 22, 2025
    - c. Technical Data in report upon which Contractor may rely: Appendix II - Boring Logs; Appendix III - Laboratory Test Results
  - 2. those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data. Such drawings are as follows:
    - a. Drawings Title: Town of Summerfield Water System Improvements – Elevated Storage Tank Package
    - b. Date of Drawings: April 22, 2026
    - c. Technical Data in drawings upon which Contractor may rely: All information in drawing of sheets C-1, C-2, C-3, C-4, and C-6.
  - 3. Contractor may examine copies of reports and drawings identified immediately above that were not included with the Bidding Documents at the Town of Summerfield Town Hall during regular business hours, or may request copies from Design Professional, at the cost of reproduction.
- B. Underground Facilities: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.
- C. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract

Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.63.

- D. Limitations of Other Data and Documents: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Design Professional, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
  - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
  - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
  - 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
  - 4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.
- E. Geotechnical Data Report:
  - 1. This Contract contains a Geotechnical Data Report (GDR), identified as follows: Report of Subsurface Exploration, dated April 22, 2025, prepared by S&ME, Inc., Greensboro, North Carolina.
  - 2. The GDR is not a Contract Document and is included for reference only. The GDR is to be used in conjunction with the Contract Documents, including the Drawings and Specifications.
  - 3. The GDR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations (referred to here in the Supplementary Conditions as "Baseline Conditions"). These may include ground, geological, groundwater, and other subsurface geotechnical conditions, and baselines of anticipated Underground Facilities or subsurface structures.
  - 4. The Baseline Conditions will be used to assist in the administration of the Contract's differing site conditions clause at locations where subsurface conditions have been baselined. If a condition is baselined in the GDR, then only the pertinent Baseline Conditions will be used to determine whether there is a differing site condition; and no other indication of that condition in the Contract Documents or Technical Data, or of a condition that describes, quantifies, or measures a similar characteristic of the subsurface, will be used for the differing site condition determination.
  - 5. The Baseline Conditions will not be used to make differing site conditions determinations at locations that have not been baselined in the GDR, or at any location with respect to subsurface conditions that the Baseline Conditions do not address. If Underground Facilities or Hazardous Environmental Conditions are expressly addressed in the Baseline Conditions, then comparison to such Baseline Conditions will be the primary means of determining (a) whether an Underground Facility was shown or indicated with reasonable accuracy, as provided in Paragraph 5.05 of the

General Conditions, or (b) whether a Hazardous Environmental Condition was shown or indicated in the Contract Documents as indicated in Paragraph 5.06. of the General Conditions. As indicated in Paragraph 5.04 below, the GDR will be the primary resource for differing site conditions determinations in cases in which the GDR is inapplicable.

6. The descriptions of subsurface conditions provided in the GDR are based on geotechnical investigations, laboratory tests, interpretation, interpolation, extrapolation, and analyses. Neither Owner, Design Professional, nor any geotechnical or other consultant warrants or guarantees that actual subsurface conditions will be as described in the GDR, nor is the GDR intended to warrant or guarantee the use of specific means or methods of construction.
7. The behavior of the ground during construction depends substantially upon Contractor's selected means, methods, techniques, sequences, and procedures of construction. If ground behavior conditions are baselined in the GDR, they are based on stated assumptions regarding construction means and methods.
8. The GDR will not reduce or relieve Contractor of its responsibility for the planning, selection, and implementation of safety precautions and programs incident to Contractor's means, methods, techniques, sequences, and procedures of construction, or to the Work.

*SC-5.04 Differing Subsurface or Physical Conditions*

- A. Notice: If Contractor believes that any subsurface condition that is uncovered or revealed at the Site:
  1. differs materially from conditions shown or indicated in the GDR; or
  2. differs materially from conditions shown or indicated in the GDR, to the extent the GDR is inapplicable; or
  3. differs materially from conditions shown or indicated in Contract Documents other than the GDR, to the extent the GDR is inapplicable; or
  4. to the extent the GDR is inapplicable, is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
  5. to the extent the GDR is inapplicable, is of such a nature as to require a change in the Drawings or Specifications; or
  6. to the extent the GDR is inapplicable, is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;
  7. then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.12), notify Owner and Design Professional in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. Design Professional's Review: After receipt of written notice as required by the preceding paragraph, Design Professional will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph SC-5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding Contractor's resumption or continuation of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Design Professional's findings, conclusions, and recommendations.
- C. Owner's Statement to Contractor Regarding Site Condition: After receipt of Design Professional's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Design Professional) regarding the subsurface or physical condition in question, addressing the resumption or continuation of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Design Professional's written findings, conclusions, and recommendations, in whole or in part.
- D. Early Resumption of Work: If at any time Design Professional determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Design Professional's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then Design Professional may at its discretion instruct Contractor to resume such Work.
- E. Possible Price and Times Adjustments:
  - 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
    - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
    - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03 of the General Conditions; and
    - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraph 4.03.
  - 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
    - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or

- b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
  - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
- 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment must be set forth in a Change Order.
- 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.
- F. Underground Facilities; Hazardous Environmental Conditions: Paragraph 5.05 of the General Conditions governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 of the General Conditions governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

**SC-5.06 Hazardous Environmental Conditions at Site**

- A. This Supplementary Condition identifies the reports and drawings referenced in Paragraph 5.06 of the General Conditions related to Hazardous Environmental Conditions at the Site.
  - 1. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

| Report Title | Report Date | Technical Data |
|--------------|-------------|----------------|
| (none)       |             |                |
|              |             |                |
|              |             |                |

- 2. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

| Drawing Title | Drawing Date | Technical Data |
|---------------|--------------|----------------|
| (none)        |              |                |
|               |              |                |
|               |              |                |

- 3. Copies of reports and drawings may be downloaded from the procurement website.



*SC-5.07 Sedimentation Pollution Control Act of 1973*

- A. Add a new Paragraph 5.07 as follows:

*“5.07 Sedimentation Pollution Control Act of 1973*

- A. Any land-disturbing activity performed by Contractor or any principal trade or specialty contractor in connection with the Project shall comply with all erosion control measures set forth in the Contract Documents and any additional measures which may be required in order to ensure that the Project is in full compliance with the North Carolina Sedimentation Pollution Control Act of 1973, as implemented by N.C. Gen. Stat Chapter 113A, Article 4 and Title 15A, N.C. Admin. Code, Chapter 4.
- B. Upon receipt of notice that a land-disturbing activity is in violation of said act, Contractor shall be responsible for ensuring that all steps or actions necessary to bring the Project in compliance with said act are promptly taken.
- C. Contractor will be responsible for defending any legal actions instituted pursuant to NCGS §113A-64.
- D. **TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER’S INDEMNITEES FROM AND AGAINST ALL CLAIMS AND INDEMNIFIED COSTS ARISING OUT OF OR RESULTING FROM THE PERFORMANCE OF WORK OR FAILURE OF PERFORMANCE OF WORK, PROVIDED THAT ANY SUCH CLAIM OR INDEMNIFIED COST IS ATTRIBUTABLE TO A VIOLATION OF THE SEDIMENTATION POLLUTION CONTROL ACT. SUCH OBLIGATION SHALL NOT BE CONSTRUED TO NEGATE, ABRIDGE, OR OTHERWISE REDUCED ANY OTHER RIGHT OR OBLIGATION OF INDEMNITY WHICH WOULD OTHERWISE EXIST AS TO ANY PARTY OR PERSONS DESCRIBED IN THIS PARAGRAPH.”**

**ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES**

*SC-7.15 Indemnification*

- A. Contractor’s obligations to indemnify or hold Owner’s Indemnitees harmless against losses, damages, or expenses specified in these General Conditions shall be subject to the applicable limitations of NCGS §22B-1.”

**ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

*SC-13.01 Cost of the Work*

- A. The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work

provisions of this Contract is the most current edition of EquipmentWatch Cost Recovery Rental Rate Blue Book.

## **ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; FINAL COMPLETION**

### *SC-15.01 Progress Payments*

- A. Compensation for services of OPT staff as specified in Paragraph 15.01 will be at the following rates:

| <b>Position</b>              | <b>Hourly Rate</b> |
|------------------------------|--------------------|
| Principal in Charge          | \$270              |
| Project Manager              | \$230              |
| Project Engineer             | \$195              |
| Construction Manager         | \$95               |
| Resident Engineer            | \$120              |
| Project Construction Manager | \$150              |
| Design Engineer              | \$145              |
| Engineering Technician       | \$135              |
| Clerk                        | \$95               |

- B. Expenses will be billed at the actual cost multiplied by 1.15.

### *SC-15.03 Substantial Completion*

- A. For project to be considered substantially complete, the well must be installed, operable, and connected to the elevated tank, the elevated tank must be constructed, operable, connected to the water system, and the water line must be installed and operable. In addition all site work as specified on the drawings must be complete.

## **ARTICLE 17 – FINAL RESOLUTION OF DISPUTES**

### *SC-17.01 Methods and Procedures*

- A. In accordance with NCGS §143-128(f1), any claim, dispute, or other matter in question involving greater than \$15,000 arising out of or related to this Agreement shall be subject to mediation as a condition precedent to the institution of legal or equitable proceeding by either party. Owner has adopted the North Carolina State Building Commission's dispute resolution process. The process entitled "Rules Implementing Mediated Settlement Conferences in North Carolina Construction Projects" is attached to this Section.
- B. For any claim, dispute, or other matter in question involving less than \$15,000, Owner and Contractor may agree to submit the matter to the dispute resolution process or exercise such rights or remedies as either may otherwise have under the Contract Documents or by Law.

**END OF SECTION**

## **00 73 16 INSURANCE REQUIREMENTS**

### **ARTICLE 1 – GENERAL PROVISIONS**

#### **1.01 CONTRACTOR’S INSURANCE**

- A. Obtain and maintain insurance that complies with this Section with coverage amounts equal to or greater than the amounts specified in Article 2 or greater where required by Laws and Regulations.
- B. Coverage is to remain in effect at least until the Work is complete and longer if expressly required elsewhere in this Contract, and when Contractor may be correcting, removing, or replacing Defective Work as a warranty or correction obligation, or returning to the Site to conduct other tasks arising from the Contract.
- C. Coverage is to apply with respect to the performance of the Work, whether performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
- D. Obtain insurance from companies that are duly licensed or authorized in the state in which the Project is constructed to issue insurance policies for the required limits and coverages and that have an A.M. Best rating of A-VIII or better.
- E. Alternative forms of insurance coverage, including self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not acceptable to meet the insurance requirements of this Contract.
- F. Owner will not purchase or maintain insurance to protect the interest of Contractor, subcontractors, or others in the Work. Owner does not represent that the insurance coverage and limits established in this Contract are adequate to protect Contractor or the Contractor’s interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that it deems necessary and including the cost of this insurance in the offered Contract Price.
- G. Contractor is fully responsible for all losses arising out of, resulting from, or connected with operations under this Contract whether or not these losses are covered by insurance. The acceptance of evidence of insurance by OPT, or others listed as an additional insured, that does not comply with the Contract requirements does not release Contractor from the requirement to comply with Contract requirements.
- H. The required insurance and insurance limits do not limit the Contractor’s liability under the indemnities granted to Owner’s Indemnitees in the Contract Documents.
- I. Do not perform any Work on the Project unless the required insurance policies are in effect. Owner may exclude Contractor from the Site and exercise the Owner’s termination rights under the General Conditions if Contractor fails to obtain or maintain the required insurance.
- J. Policies must provide notice before cancellation, non-renewal, or any material change in the policy’s terms and conditions as described in Paragraph 1.04.D. Contractor is to notify Owner and the additional insured of any notice received within 3 days of receipt of a notice by Contractor. Contractor is to cease all Work covered by cancelled or non-renewed insurance

if suitable coverage is not in place in time to prevent a lapse in coverage. Contractor is solely responsible for any delays associated with lapsed coverage.

- K. Owner may elect, but is in no way obligated, to obtain equivalent insurance to protect the Owner's interests without prejudice to any other right or remedy if Contractor fails to obtain or maintain the required insurance. Owner may impose a reasonable Set-off against payments to recover the cost of the insurance.
- L. Owner's policies, if any, operate separately and independently from policies required to be provided by Contractor and Contractor cannot rely upon the Owner's policies to meet any of the Contractor's obligations to Owner, Design Professional, or any third party.
- M. Insurance requirements shall meet or exceed the minimum requirements established by applicable federal funding agreements, including ARPA/CSLFRF. In the event of a conflict, the more stringent requirement shall govern.

#### 1.02 SUBCONTRACTOR OR SUPPLIER INSURANCE

- A. Require subcontractors to purchase and maintain workers' compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project. Include OPT as additional insureds on subcontractor policies in accordance with Paragraph 1.03.
- B. Require suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- C. Contractor is liable for all losses that would have been covered by subcontractor or supplier insurance if subcontractor or supplier fails to provide coverage.

#### 1.03 ADDITIONAL INSURED

- A. The following are to be named as an additional insured on all insurance policies, except workers' compensation insurance, builder's risk insurance, and the Contractor's professional liability insurance:
  - 1. Town of Summerfield  
Attn: Charles "Twig" Rollins, Town Manager  
P.O. Box 970  
Summerfield, NC 27385
  - 2. Guilford County  
Attn: Risk Management  
301 W. Market Street  
Greensboro, NC 27401
  - 3. Freese and Nichols  
Attn: Risk Management  
801 Cherry Street, Suite 2800  
Fort Worth, Texas 76102
- B. All insurance related notices are to be sent to the addresses listed above.
- C. Notify Owner and each additional insured if Contractor fails to purchase or maintain the insurance required by the Contract Documents.

- D. All insurance policies must include a waiver of subrogation in favor of each additional insured.
- E. Provide for an endorsement that the “other insurance” clause will not apply to OPT where OPT is an additional insured. Contractor’s insurance is primary and non-contributory with respect to any insurance or self-insurance carried by OPT for liability arising out of operations under this Contract.

#### 1.04 EVIDENCE OF INSURANCE

- A. Deliver evidence of insurance, in accordance with this Section, to the Owner with the signed Contract Documents to demonstrate that Contractor has obtained the policies, coverages, and endorsements required by the Contract.
  - 1. Continue to provide evidence Contractor is maintaining the required insurance for the duration of the Contract Times and such extended periods as required by the Contract Documents.
  - 2. Provide this evidence of insurance to Owner and each additional insured.
  - 3. Contractor may block out (redact) any confidential premium or pricing information and wording specific to a project or jurisdiction in any policy or endorsement furnished under this paragraph not applicable to this Contract.
- B. OPT’s failure to demand evidence of insurance or verify the Contractor’s full compliance with insurance requirements or failure to identify a deficiency in compliance from the evidence provided is not a waiver of the Contractor’s obligation to obtain and maintain the insurance required by the Contract Documents.
- C. Provide evidence of insurance acceptable to Owner with the executed Contract Documents. Provide the following as evidence of insurance:
  - 1. Copy of insurance policies;
  - 2. Certificates of insurance on an acceptable form;
  - 3. Full disclosure of exclusions;
  - 4. Declaration pages, riders, or endorsements to policies;
  - 5. Documentation of deductibles;
  - 6. List of named and additional insureds for each policy; and
  - 7. Evidence that waivers of subrogation are provided on applicable policies.
- D. Provide evidence of a requirement in the policy that at least 30 days’ notice will be given before cancellation, non-renewal or any material change in the policy’s terms and conditions including:
  - 1. Type of coverage provided;
  - 2. Riders or endorsements to policies;
  - 3. Policy limits of coverage;
  - 4. Change in deductible amount;
  - 5. Status of named or additional insured; or

6. Waivers of subrogation.
- E. Certificates of Insurance:
1. Submit certificates of insurance meeting the applicable requirements of the applicable state department of insurance. No requirement of this Contract may be interpreted as requiring the issuance of a certificate of insurance on a form that has not first been filed with and/or approved by the applicable state department of insurance.
  2. Include the name of the Project in the description of operations box on the certificate of insurance, and the name of each additional insured.
- F. Continuing Evidence of Coverage:
1. Provide updated, revised, or new evidence of insurance prior to the expiration of existing policies. A certificate of insurance is acceptable as evidence of renewal of insurance policies, provided no changes are made in the policy originally provided with signed Contract Documents.
  2. Provide evidence of continuation of insurance coverage at final payment and for the following 3 years.

## ARTICLE 2 – INSURANCE COVERAGE AMOUNTS AND POLICY REQUIREMENTS

### 2.01 CONTRACTOR’S INSURANCE

- A. Workers’ Compensation and Employer’s Liability Insurance:
1. Purchase and maintain workers’ compensation and employer’s liability insurance, including, as applicable, United States Longshoreman and Harbor Workers’ Compensation Act, Jones Act, stop-gap employer’s liability coverage for monopolistic states, and foreign voluntary workers’ compensation, including off-site operations.
  2. Provide the following coverage with not less than the minimum limits indicated:

| Workers’ Compensation and Related Insurance                                                 | Policy Limits |
|---------------------------------------------------------------------------------------------|---------------|
| <b>Workers’ Compensation</b>                                                                |               |
| State                                                                                       | Statutory     |
| Applicable Federal (e.g., Longshore)                                                        | Statutory     |
| Foreign Voluntary Workers’ Compensation (Employer’s Responsibility Coverage), if Applicable | Statutory     |
| <b>Employers’ Liability</b>                                                                 |               |
| Each Accident                                                                               | \$500,000     |
| Each Employee                                                                               | \$500,000     |
| Policy Limit                                                                                | \$1,000,000   |

- B. Commercial General Liability:
1. Purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:
    - a. Damages because of bodily injury, sickness or disease, or death of any person other than Contractor’s employees;
    - b. Damages insured by reasonably available personal injury liability coverage; and

- c. Damages because of injury to or destruction of tangible property wherever located, including loss of use resulting from the damage.
- 2. Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form).
  - a. Provide additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). Equivalent endorsements may be used if Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available.
  - b. Provide ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent for Design Professional additional insured.
- 3. Provide the following coverages and endorsements:
  - a. Products and completed operations coverage.
    - 1) Maintain coverage for 3 years after final payment.
    - 2) Provide Owner and each other additional insured evidence of continuation of such insurance at final payment and for 3 years thereafter.
  - b. Blanket contractual liability coverage, including coverage of Contractor's contractual indemnity obligations in the General Conditions.
  - c. Severability of interests and no insured-versus-insured or cross-liability exclusions.
  - d. Underground, explosion, and collapse coverage.
  - e. Personal injury coverage.
- 4. The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
  - a. Modifications of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
  - b. Exclusion for water intrusion or water damage.
  - c. Provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
  - d. Exclusion of coverage relating to earth subsidence or movement.
  - e. Exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than workers' compensation).
  - f. Limitations or exclusions based on the nature of Contractor's work.
  - g. Professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

5. Provide the following coverage with not less than the minimum limits indicated:

| <b>Commercial General Liability Insurance</b>       | <b>Policy Limits</b> |
|-----------------------------------------------------|----------------------|
| General Aggregate                                   | \$3,000,000          |
| Products - Completed Operations                     | \$3,000,000          |
| Personal and Advertising Injury (Limit Per Person)  | \$1,000,000          |
| Bodily Injury and Property Damage – Each Occurrence | \$1,000,000          |

C. Automobile Liability:

- Purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis. Coverage can be provided through individual limits for bodily injury and for property damage or a combined single limit covering both bodily injury and property damage.
- Provide the following coverage with not less than the minimum limits indicated:

| <b>Automobile Liability Insurance</b>                       | <b>Policy Limits</b> |
|-------------------------------------------------------------|----------------------|
| <b>Bodily Injury</b>                                        |                      |
| Each Person                                                 | \$2,000,000          |
| Each Accident                                               | \$2,000,000          |
| <b>Property Damage</b>                                      |                      |
| Each Accident                                               | \$2,000,000          |
| <b>Combined Single Limit</b>                                |                      |
| Combined Single Limit for Bodily Injury and Property Damage | \$2,000,000          |

D. Umbrella or Excess Liability:

- Purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs A through C above. The coverage afforded must be at least as broad as that of each underlying policy.
- Provide the following coverage with not less than the minimum limits indicated:

| <b>Umbrella or Excess Liability Insurance</b> | <b>Policy Limits</b> |
|-----------------------------------------------|----------------------|
| Each Occurrence                               | \$1,000,000          |
| General Aggregate                             | \$1,000,000          |

E. Contractor's Pollution Liability Insurance:

- Purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from the Contractor's operations and completed operations. This insurance must be maintained for no less than 3 years after Final Completion.
- Provide the following coverage with not less than the minimum limits indicated:

| <b>Contractor's Pollution Liability Insurance</b> | <b>Policy Limits</b> |
|---------------------------------------------------|----------------------|
| Each Occurrence                                   | \$1,000,000          |
| General Aggregate                                 | \$2,000,000          |



F. Contractor's Professional Liability Insurance:

1. Purchase and maintain applicable professional liability insurance if Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of 2 years after Substantial Completion. The policy must pre-date the commencement of furnishing services on the Project.
2. Provide the following coverage with not less than the minimum limits indicated:

| <b>Contractor's Professional Liability Insurance</b> | <b>Policy Limits</b> |
|------------------------------------------------------|----------------------|
| Each Claim                                           | \$1,000,000          |
| Annual Aggregate                                     | \$1,000,000          |

2.02 INSTALLATION FLOATER

- A. Provide and maintain installation floater insurance on a broad form or "all risk" policy providing coverage for materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work ("Covered Property"). Coverage under the Contractor's installation floater will include loss from covered "all risk" causes (perils) to Covered Property:
  1. of the Contractor, and Covered Property of others that is in the Contractor's care, custody, and control;
  2. while in transit to the Site, including while at temporary storage sites;
  3. while at the Site awaiting and during installation, erection, and testing;
  4. continuing at least until the installation or erection of the Covered Property is completed, and the Work into which it is incorporated is accepted by Owner.
- B. The installation floater coverage cannot be contingent on an external cause or risk or limited to property for which Contractor is legally liable.
- C. The installation floater coverage will be in an amount sufficient to protect the Contractor's interest in the Covered Property. The Contractor will be solely responsible for any deductible carried under this coverage.
- D. This policy will include a waiver of subrogation applicable to Owner, Contractor, Design Professional, all subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

2.03 OWNER'S LIABILITY INSURANCE

- A. Contractor is required to provide Owner's Protective Liability Insurance coverage for at least the following amounts, unless greater amounts are required by Laws and Regulations.

| <b>Owner's Liability Insurance</b>                  | <b>Policy Limits</b> |
|-----------------------------------------------------|----------------------|
| General Aggregate                                   | \$1,000,000          |
| Each Occurrence (Bodily Injury and Property Damage) | \$1,000,000          |

**END OF SECTION**

**DIVISION 01**  
**GENERAL REQUIREMENTS**

## **01 11 00 SUMMARY OF WORK**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Construct Work as described in the Contract Documents.
  - 1. Provide the materials, equipment, and incidentals required to make the Project completely and fully operable.
  - 2. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.
  - 3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation, and all other Work required for a complete and operable Project.
  - 4. Test and place the completed Project in operation.
  - 5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in the Contract Documents for the operation and maintenance of the Project.
  - 6. The Contract Documents do not indicate or describe all Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Construction Manager.
- B. Owner may pre-select or pre-purchase goods for this Project per Section 01 64 00 "Owner-Furnished Goods and Special Services." Install these goods and coordinate the performance of specified special services.

#### **1.02 DESCRIPTION OF WORK**

- A. Work is described in general, non-inclusive terms as:
  - 1. The Town of Summerfield (Town) intends to construct a fire flow system consisting of a 150,000-gallon elevated storage tank (EST) and a supply well with a minimum well yield of 200 gpm. This will support a 1,000 gpm flow for a 2 hour duration for the fire flow system.

#### **1.03 WORK UNDER OTHER CONTRACTS**

- A. Bring any discrepancies in the list to the attention of the Construction Manager. It will be deemed that the Contractor included the more expensive listing in the Contract Price if the Contractor fails to bring any discrepancies to the attention of the Construction Manager prior to executing the Agreement.
- B. Completion of the Work described in this Contract may impact the construction and testing of the items listed above.
  - 1. Coordinate construction activities through the Construction Manager.
  - 2. Pay claims for damages which result from the late completion of the Project or any specified Milestones.

1.04 WORK BY OWNER

- A. Owner has no knowledge of work, other than the Work included in this Contract that may impact construction scheduling, testing, and startup.

1.05 CONSTRUCTION OF UTILITIES

- A. Utility companies or their contractors will provide new or enhanced utilities for this Project. Coordinate with others performing Work associated with this Project.
- B. Power and Electrical Services:
  - 1. Provide permanent power connections for the Site through the power utility unless indicated otherwise in the Contract Documents.
  - 2. Pay for permits and for providing permanent power.
  - 3. Coordinate and cooperate with others performing this Work.
  - 4. Power utility will provide the construction to the property line.
  - 5. Provide conduit, conductors, pull boxes, manholes, and other appurtenances for the installation of power cable between the property line and the transformer and between the transformer and the main power switch unless the Contract Documents indicate otherwise.
  - 6. Test conductors in accordance with the Specifications and requirements of the power utility and coordinate with the power utility to energize the system when ready.
  - 7. Pay for temporary power including construction cost, meter connection, fees, and permits.
  - 8. Contractor may use the permanent power source in lieu of temporary power source when permanent power is available at the Site.
    - a. Notify Construction Manager and Owner of intent to use the permanent power source.
    - b. Arrange with the power utility and pay the charges for connections and monthly charges for use of this power.
  - 9. Pay for the power consumed until the Project has been accepted as Substantially Complete unless noted otherwise.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 23 10      ALTERNATES AND ALLOWANCES**

### **PART 1 - GENERAL**

#### **1.01      SUMMARY**

##### **A.    Alternates:**

1. This Section describes each alternate by number and describes the basic changes to be incorporated into the Work when this alternate is made a part of the Work in the Agreement.
2. The Drawings and Specifications will outline the extent of Work to be included in the alternate Contract Price.
3. Coordinate related Work and modify surrounding Work as required to properly integrate the Work under each alternate, and provide a complete and functional Project as required by the Contract Documents.
4. Alternate Bids or Proposals may be accepted or rejected at the option of the Owner.
5. Owner may incorporate these alternates in the Contract when executed, or may issue a Change Order to incorporate these alternates within 120 days of the opening of Contractor's Bid or Proposal at the prices offered in the Contractor's Bid or Proposal, unless noted otherwise. A Request for a Change Proposal may be issued after 120 days or other designated time period to negotiate a new price for incorporating the Work into the Project.

##### **B.    Allowances:**

1. Include the specified allowance amounts in the Contract Price.
2. The amount of each allowance includes:
  - a. The cost of the product to the Contractor less any applicable trade discounts;
  - b. Delivery to the Site; and
  - c. Applicable taxes.
3. Include in the Contract Price all costs for:
  - a. Handling at the Site, including unloading, uncrating, and storage per Section 01 31 00 "Project Management and Coordination."
  - b. Cost for labor and equipment for installation and finishing.
  - c. Cost for related products not specifically listed in the allowance required for installation, including consumable supplies and materials.
  - d. All overhead, profit, and related costs.
4. Assist Owner in the selection of products.
  - a. Identify qualified Suppliers.
  - b. Obtain bids or proposals from qualified Suppliers.

- c. Present available alternates to the Owner through the Construction Manager. Notify Construction Manager of:
  - 1) Any objections to a particular Supplier or product.
  - 2) Effect on the construction schedule anticipated by the selection of each option.
  - 3) Cost of each option.
- 5. Upon selection of the product:
  - a. Purchase and install the product.
  - b. Contractor's responsibilities for products will be the same as for products selected by the Contractor.
- 6. Submit a Change Proposal per Section 01 26 00 "Change Management" to adjust the Contract Price if the net cost of the product is more or less than the specified amount.
  - a. Adjust the unit cost applied to the quantities installed per the method of payment described in Section 01 29 00 "Application for Payment Procedures" for products specified as Unit Price Work.
  - b. Do not perform Work until selection of alternate has been approved by the Owner.
  - c. Provide actual invoices for the materials.

#### 1.02 DOCUMENTATION

- A. Provide documents for materials furnished as part of each alternate in accordance with Section 01 33 00 "Document Management."

#### 1.03 DESCRIPTION OF ALLOWANCES

- A. Allowance D-01 – Owner's Allowance.
  - 1. Include \$50,000 Owners Allowance in the contract price to be used at the discretion of the Owner.
- B. Allowance D-02 – Quality Control Testing by Owner Allowance
  - 1. Include \$50,000 Quality Control Testing by Owner Allowance in the contract price to be used at the discretion of the Owner.

#### 1.04 DESCRIPTION OF ALTERNATES

- A. Alternate:
  - 1. There are no Alternates for this Contract

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION (NOT USED)**

## **END OF SECTION**

## **01 26 00 CHANGE MANAGEMENT**

### **PART 1 - GENERAL**

#### **1.01 REQUESTS FOR CHANGE PROPOSAL**

- A. Construction Manager will initiate Modifications by issuing a Request for Change Proposal (RCP).
  - 1. Construction Manager and Design Professional will prepare a description of proposed Modifications.
  - 2. Construction Manager will issue the Request for Change Proposal form to Contractor. A number will be assigned to the Request for a Change Proposal when issued.
  - 3. Return a Change Proposal in accordance with Paragraph 1.02 for evaluation by the OPT.

#### **1.02 CHANGE PROPOSALS**

- A. Submit a Change Proposal (CP) to the Construction Manager for Contractor initiated changes in the Contract Documents or in response to a Request for Change Proposal. Submit the Change Proposal and attach the forms provided by the Construction Manager.
  - 1. Use the Change Proposal form provided by the Construction Manager.
  - 2. Include with the Change Proposal:
    - a. A complete description of the proposed Modification if Contractor initiated or proposed changes to the OPT's description of the proposed Modification.
    - b. The reason the Modification is requested, if not in response to a Request for a Change Proposal.
    - c. A detailed breakdown of the cost of the change if the Modification requires a change in Contract Price. The itemized breakdown is to include:
      - 1) List of materials and equipment to be installed;
      - 2) Man hours for labor by classification;
      - 3) Equipment used in construction;
      - 4) Consumable supplies, fuels, and materials;
      - 5) Royalties and patent fees;
      - 6) Bonds and insurance;
      - 7) Overhead and profit;
      - 8) Field office costs;
      - 9) Home office cost; and
      - 10) Other items of cost.
    - d. Provide the level of detail outlined in the paragraph above for each Subcontractor or Supplier actually performing the Work if Work is to be provided by a Subcontractor or Supplier. Indicate appropriate Contractor mark ups for Work



provided through Subcontractors and Suppliers. Provide the level of detail outlined in the paragraph above for self-performed Work.

- e. Submit Change Proposals that comply with the General Conditions for Cost of Work.
- f. Provide a revised schedule. Show the effect of the change on the Project Schedule and the Contract Times.
- B. Submit a Change Proposal to the Construction Manager to request a Field Order.
- C. A Change Proposal is required for all substitutions or deviations from the Contract Documents.
- D. Request changes to products in accordance with Section 01 33 02 "Shop Drawings."

#### 1.03 CONSTRUCTION MANAGER WILL EVALUATE THE REQUEST FOR A MODIFICATION

- A. Construction Manager will issue a Modification per the General Conditions if the Change Proposal is acceptable to the Owner. Construction Manager will issue a Change Order or Contract Amendment for any changes in Contract Price or Contract Times.
  - 1. Change Orders and Contract Amendments will be sent to the Contractor for execution with a copy to the Owner recommending approval. A Work Change Directive may be issued if Work needs to progress before the Change Order or Contract Amendment can be authorized by the Owner.
  - 2. Work Change Directives, Change Orders, and Contract Amendments can only be approved by the Owner.
    - a. Work performed on the Change Proposal prior to receiving a Work Change Directive or approval of the Change Order or Contract Amendment is performed at the Contractor's risk.
    - b. No payment will be made for Work on Change Orders or Contract Amendments until approved by the Owner.
- B. Contractor may be informed that the Change Proposal is not approved and construction is to proceed in accordance with the Contract Documents.

#### 1.04 EQUAL NON-SPECIFIED PRODUCTS

- A. The products of the listed manufacturers are to be furnished where the Specifications list several manufacturers and do not specifically list "or equal" or "or approved equal" products. Use of any products other than those specifically listed is a substitution. Follow the procedures in Paragraph 1.05 for a substitution.
- B. Contractor may submit other manufacturers' products that are in full compliance with the Specifications where Specifications list one or more manufacturers followed by the phrase "or equal" or "or approved equal."
  - 1. Submit a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to document that the proposed product is equal or superior to the specified product.
  - 2. Prove that the product is equal. It is not the OPT's responsibility to prove the product is not equal.

- a. Indicate on a point-by-point basis for each specified feature that the product is equal to the Contract Document requirements.
  - b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the Shop Drawing.
  - c. The decision of the Design Professional regarding the acceptability of the proposed product is final.
- 3. Provide a certification that, in furnishing the proposed product as an equal, the Contractor:
  - a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
  - b. Has determined that the product will perform in the same manner and result in the same process as the specified product.
  - c. Will provide the same warranties and/or bonds as for the product specified.
  - d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional Work which may be necessary to incorporate the product into the Project which may subsequently become apparent.
  - e. Will maintain the same time schedule as for the specified product.
- C. A Change Proposal is not required for any product that is in full compliance with the Contract Documents. If the product is not in full compliance, it may be offered as a Substitution.

#### 1.05 SUBSTITUTIONS

- A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product. Submit a Change Proposal per Paragraph 1.02 along with documents required for a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to request approval of a substitution.
- B. Prove that the product is acceptable as a substitute. It is not the Design Professional's responsibility to prove the product is not acceptable as a substitute.
  - 1. Indicate on a point-by-point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
  - 2. Make a direct comparison with the specified Suppliers published data sheets and available information. Provide this printed material with the Shop Drawing.
  - 3. The decision of the Design Professional regarding the acceptability of the proposed substitute product is final.
- C. Provide a certification that, in making the substitution request, the Contractor:
  - 1. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product;
  - 2. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the manufacturer of the specified product;

3. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the Project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent; and
  4. Will maintain the same time schedule as for the specified product.
- D. Pay for review of substitutions in accordance with Section 01 33 02 "Shop Drawings."

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 29 00 APPLICATION FOR PAYMENT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Submit Applications for Payment for completed Work and for materials and equipment in accordance with the General Conditions, the Supplementary Conditions, the Agreement, and this Section. The Contract Price is to include costs for:
  1. Providing the Work in accordance with the Contract Documents;
  2. Installing Owner furnished equipment and materials, if any;
  3. Providing Work for alternates and allowances, if any;
  4. Providing Work for extra work items, if any and if authorized
  5. Commissioning, startup, training, and initial maintenance and operation;
  6. Acceptance testing at the manufacturer's facilities or at the Site;
  7. All home office overhead costs and expenses, including profit made directly or indirectly from the Project;
  8. Project management, contract administration, and field office and field operations staff including supervision, clerical support, and technology system support;
  9. Professional services including design fees, legal fees, and other professional services;
  10. Bonds and insurance;
  11. Permits, licenses, patent fees, and royalties;
  12. Taxes;
  13. Providing all documentation and Samples required by the Contract Documents;
  14. Facilities and equipment at the Site including:
    - a. Field offices, office furnishings, and all related office supplies, software, and equipment,
    - b. Storage facilities for Contractor's use and storage facilities for stored materials and equipment including spare parts storage,
    - c. Shops, physical plant, construction equipment, small tools, vehicles, and technology and telecommunications equipment,
    - d. Safety equipment and facilities to provide safe access and working conditions for workers and for others working at the Site,
    - e. Temporary facilities for power and communications,
    - f. Potable water and sanitation facilities, and
    - g. Mobilization and demobilization for all these facilities and equipment.
  15. Products, materials, and equipment stored at the Site or other suitable location in accordance with Section 01 31 00 "Project Management and Coordination";

16. Products, materials, and equipment permanently incorporated into the Project;
  17. Temporary facilities for managing water including facilities for pumping, storage, and treatment as required for construction and protection of the environment;
  18. Temporary facilities for managing environmental conditions and Constituents of Concern;
  19. Temporary facilities such as sheeting, shoring, bracing, formwork, embankments, storage facilities, working areas, and other facilities required for construction of the Project;
  20. Temporary and permanent facilities for protection of all overhead, surface, or underground structures or features;
  21. Temporary and permanent facilities for removal, relocation, or replacement of any overhead, surface, or underground structures or features;
  22. Products, materials, and equipment consumed during the construction of the Project;
  23. Contractor labor and supervision to complete the Project including that provided through Subcontractors or Suppliers;
  24. Correcting Defective Work during the Contract Times, during the Correction Period, or as required to meet any warranty provision of the Contract Documents;
  25. Risk associated with weather and environmental conditions, startup, and initial operation of facilities including equipment, processes, and systems;
  26. Contractor safety programs, including management, administration, and training;
  27. Maintenance of facilities including equipment, processes, and systems until operation is transferred to Owner;
  28. Warranties, extended or special warranties, or extended service agreements;
  29. Cleanup and disposal of any and all surplus materials; and
  30. Demobilization of all physical, temporary facilities not incorporated into the Project.
- B. Include the cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price.
  - C. Provide written approval of the surety company providing performance and payment bonds for the Schedule of Values, Application for Payment form, and method of payment prior to submitting the first Application for Payment. Submit approval using the "Consent of Surety Company to Payment Procedures" form provided by the Construction Manager. Payment will not be made without this approval.
  - D. Construction Manager may withhold processing the Applications for Payment if any of the following processes or documentation is not up to date:
    1. Progress Schedule per Section 01 33 05 "Construction Progress Schedule."
    2. Project videos and photographs per Section 01 33 06 "Graphic Documentation."
    3. Record Documents per Section 01 31 13 "Project Administration."

## 1.02 SCHEDULE OF VALUES

- A. Divide the Contract Price into an adequate number of line items to allow more accurate determination of the earned value for each line item when evaluating progress payments. Submit a detailed Schedule of Values for the Project at least 10 days prior to submitting the first Application for Payment using forms provided by the Construction Manager.
- B. Do not apply for payment until the Schedule of Values has been approved by the Construction Manager.
- C. Divide the cost associated with each line item in the Schedule of Values into installation and materials components.
  1. Installation cost is to include all cost associated with the line item except materials cost.
  2. Materials cost is the direct cost (as verified by invoice values) for products, materials, and equipment to be permanently incorporated into the Project associated with the line item.
  3. Installation cost is to include all direct costs and a proportionate amount of the indirect costs for the Work associated with each line item. Include costs not specifically set forth as an individual payment item but required to provide a complete and functional system.
  4. The sum of materials and installation costs for all line items must equal the Contract Price.
- D. Use each unit price line item in the Agreement as a line item in the Schedule of Values. The sum of materials and installation costs for each line item for unit price contracts must equal the value of the line item in the Agreement. In addition to the installation cost described in Paragraph 1.02.C.3, installation costs for unit price items are to include costs for waste and overages.
  1. Installation and materials cost may be left as a single installation component if:
    - a. Contractor does not intend to request payment for stored materials for that line item; or
    - b. Work in the line item will be completed within a single payment period.
  2. Provide adequate detail to allow a more accurate determination of the earned value for installation costs, expressed as a decimal fraction of Work completed, for each line item.
  3. Installation cost line items may not exceed \$50,000.00. Items that are not subdivided into smaller units may only be included in the Application for Payment when Work on the entire unit is complete.
  4. Lump sum items may be divided into an estimated number of units to estimate earned value. The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
  5. Include Contractor's overhead and profit in the installation costs each line item in proportion to the value of the line item to the Contract Price.
  6. Include cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price for each item.

7. Line items may be used to establish the value of Work to be added or deleted from the Project.
- E. Include a breakdown of both mobilization and demobilization costs in the Schedule of Values. The total cost for both mobilization and demobilization may not exceed five percent of the total Contract Price. Payment for mobilization and demobilization will be based on the earned value of Work completed. Payment for these costs will only be made for Work completed for the following:
1. Bonds and insurance;
  2. Transportation and setup for equipment;
  3. Transportation and/or erection of all field offices, sheds, and storage facilities;
  4. Salaries for preparation of documents required before the first Application for Payment; and
  5. Salaries for field personnel directly related to the mobilization of the Project.

#### 1.03 SCHEDULE OF ANTICIPATED PAYMENTS

- A. Submit a schedule of the anticipated Application for Payments showing the anticipated application numbers, submission dates, and the amount to be requested for each Application for Payment on the form provided by the Construction Manager.
- B. Update the schedule of anticipated payments as necessary to provide a reasonably accurate indication of the funds required to make payments each month to the Contractor for Work performed.

#### 1.04 ALTERNATES, ALLOWANCES, AND EXTRA WORK ITEMS

- A. Include line items and amounts for specified alternate Work and allowances for Work in the Agreement, if any, and as described in Section 01 23 10 "Alternates and Allowances."
- B. Include line items and amounts for Extra Work items in the Agreement, if any, and as described in Section 01 29 01 "Measurement and Basis for Payment."

#### 1.05 RETAINAGE AND SET-OFFS

- A. Retainage will be withheld from each Application for Payment per the Agreement.
- B. Reduce payments for set-offs per the General Conditions as directed by the Construction Manager.

#### 1.06 PROCEDURES FOR SUBMITTING AN APPLICATION FOR PAYMENT

- A. Submit a draft Application for Payment to the Construction Manager each month at least **[20]** days before the date established in the Agreement for Owner to make progress payments. Do not submit Applications for Payment more often than monthly. Review the draft Application for Payment with the Construction Manager to determine concurrence with:
  1. Values requested for materials and equipment, stored or incorporated into the Project as documented by invoices;

2. The earned value for installation costs for each line item in the Application for Payment form expressed as a percent complete for that line item;
  3. The quantity of Work completed for each unit price item;
  4. Amount of retainage to be withheld; and
  5. Set-offs included in the Application for Payment.
- B. Submit Applications for Payment to the Construction Manager after agreement has been reached on the draft Application for Payment with the Construction Manager.
- C. Provide all information requested in the Application for Payment form. Do not leave any blanks incomplete. If information is not applicable, enter "N/A" in the space provided.
1. Number each application sequentially and include the dates for the application period.
  2. Complete the "Contract Time Summary" section on the Application for Payment form. If the Final Completion date shows the Project is more than 30 days behind schedule, revise the Schedule of Anticipated Payments to correspond to the updated schedule required per Section 01 33 05 "Construction Progress Schedule."
  3. Complete the "Summary of Earned Value and Set-offs" section on the Application for Payment form. Show the total amounts for earned value of original Contract performed, earned value for Work on approved Contract Amendments and Change Orders, retainage and set-offs.
  4. Sign and date the Contractor's Certification on the Application for Payment form that all Work, including materials, covered by this Application for Payment have been completed or delivered and stored in accordance with the Contract Documents, that all amounts have been paid for Work, materials, and equipment for which previous Payment has been made by the Owner, and that the current payment amount shown in this Application for Payment is now due.
  5. Include "Attachment A - Tabulation of Earned Value of Original Contract Performed" to show the value of materials stored and successfully incorporated into the Project and the earned value for installation of the Work for each line item in the Application for Payment for Work. Attachment A includes Work on the original Contract Price and on approved Contract Amendments and Change Orders.
  6. Include "Attachment B - Tabulation of Values for Materials and Equipment" to track invoices used to support amounts requested as materials in Attachment A. Enter materials to show the amount of the invoice assigned to each item in Attachment A if an invoice includes materials used on several line items.
  7. Include "Attachment C - Summary of Set-offs" to document set-offs made per the Contract Documents. Show each set-off as it is applied. Show a corresponding line item to reduce the set-off amount if a payment held by a set-off is released for payment.
  8. Include "Attachment D - Retainage Calculation" to show method for calculating retainage. The amount of retainage with respect to progress payments is stipulated in the Agreement. Any request for a reduction in retainage must be accompanied by a Consent of Surety to Reduction or Partial Release of Retainage.
  9. Include "Attachment E - EVA Calculation" and the EVA Chart showing the anticipated and actual total earned value of fees, Work, and materials. Create a graphic



representation (curve) of the anticipated progress on the Project each month. Compare the anticipated cumulative total earned value of fees, Work, and materials to the actual total earned value of fees, Work, and materials to determine performance on budget and schedule. Adjust the table and curve to incorporate Modifications.

- D. Submit attachments in Portable Document Format (PDF).
  - 1. Generate attachments to the Application for Payment using the Excel spreadsheet provided by the Construction Manager.
  - 2. Submit PDF documents with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.

#### 1.07 ADJUSTMENTS TO THE SCHEDULE OF VALUES IN THE APPLICATION FOR PAYMENT

- A. Submit a Change Proposal to request any changes to the Schedule of Values incorporated into the Application for Payment once approved. A Field Order will be issued by the Construction Manager to modify the Application for Payment form if approved.
- B. Payment for materials and equipment shown in the Application for Payment will be made for the total of associated invoice amounts, up to the value shown for materials in the Application for Payment for that line item.
  - 1. If the total amount for invoices for materials and equipment for a line item are less than the amount shown for the materials component of that line item in the Application for Payment, and it can be demonstrated that no additional materials or equipment are required to complete Work described in that item, the difference between the total invoice for materials and equipment and the materials component for that line item can be added to the installation component of that Work item.
  - 2. Costs for material and equipment in excess of the value shown in the Schedule of Values may not be paid for under other line items.

#### 1.08 CONSTRUCTION MANAGER'S RESPONSIBILITY

- A. Construction Manager will review each draft Application for Payment with Contractor to reach an agreement on the amount to be recommended to Owner for payment. Contractor is to revise the Application for Payment to incorporate changes, if any, resulting from this review process.
- B. Construction Manager will review the Application for Payment to determine that the Application for Payment has been properly submitted and is in accordance with the agreed to draft Application for Payment.
- C. Construction Manager will either recommend payment of the Application for Payment to Owner or notify the Contractor of the reasons for not recommending payment. Contractor may make necessary corrections and resubmit the Application for Payment. Construction Manager will review resubmitted Application for Payment and reject or recommend payment of the Application for Payment to Owner as appropriate.

- D. Construction Manager's recommendation of the Application for Payment constitutes a representation that based on its experience and the information available:
  - 1. The Work has progressed to the point indicated;
  - 2. The quality of the Work is generally in accordance with the Contract Documents; and
  - 3. Requirements prerequisite to payment have been met.
- E. This representation is subject to:
  - 1. Further evaluation of the Work as a functioning whole;
  - 2. The results of subsequent tests called for in the Contract Documents; or
  - 3. Any other qualifications stated in the recommendation.
- F. Construction Manager does not represent by recommending payment that:
  - 1. Inspections made to check the quality or the quantity of the Work as it was performed were exhaustive or extended to every aspect of the Work in progress; or
  - 2. Other matters or issues that might entitle Contractor to additional compensation or entitle Owner to withhold payment to Contractor exist.
- G. Neither Construction Manager's review of Contractor's Work for the purposes of recommending payments nor Construction Manager's recommendation of payment imposes responsibility on the Construction Manager or Owner:
  - 1. To supervise, direct, or control the Work;
  - 2. For the means, methods, techniques, sequences, or procedures of construction, or safety precautions and programs;
  - 3. For Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
  - 4. To make examinations to ascertain how or for what purposes Contractor has used the monies paid on account of the Contract Price; or
  - 5. To determine that title to the Work, materials, or equipment has passed to Owner free and clear of Liens.

#### 1.09 FINAL APPLICATION FOR PAYMENT

- A. Include adjustments to the Contract Price in the final Application for Payment for:
  - 1. Approved Change Orders and Contract Amendments;
  - 2. Allowances not previously adjusted by Change Order;
  - 3. Deductions for Defective Work that have been accepted by the Owner;
  - 4. Penalties and bonuses;
  - 5. Deduction for all final set-offs; and
  - 6. Other adjustments if needed.

- B. Construction Manager will prepare a final Change Order reflecting the approved adjustments to the Contract Price which have not been covered by previously approved Change Orders and, if necessary, to reconcile estimated unit price quantities with actual quantities.
- C. Submit the final Application for Payment per the General Conditions, including the final Change Order. Provide the following with the final Application for Payment:
  - 1. Evidence of payment or release of Liens on the forms provided by the Construction Manager and as required by the General Conditions.
  - 2. Consent from surety to final payment.
- D. Final payment will also require additional procedures and documentation per Section 01 70 00 "Execution and Closeout Requirements."

1.10 PAYMENT BY OWNER

- A. Owner is to pay the amount recommended for monthly payments within 30 days after receipt of the Construction Manager's recommended Application for Payment.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 29 01 MEASUREMENT AND BASIS FOR PAYMENT**

### **PART 1 - GENERAL**

#### **1.01 PAYMENT FOR MATERIALS AND EQUIPMENT**

- A. Payment will be made for materials and equipment materials properly stored and successfully incorporated into the Project less the specified retainage.
- B. Provide a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of Liens. Provide documentation of payment for materials and equipment with the next Application for Payment. Remove items from the tabulation of materials and equipment if this documentation is not provided with the next Application for Payment.
- C. Provide evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest.
- D. The Work covered by progress payments becomes the property of the Owner at the time of payment. The Contractor's obligations with regard to proper care and maintenance, insurance, and other requirements are not changed by this transfer of ownership until final acceptance in accordance with the General Conditions.
- E. Payment for materials and equipment does not constitute acceptance of the product.

#### **1.02 MEASUREMENT AND BASIS FOR PAYMENTS ON LUMP SUM ITEMS**

- A. Measurement for progress payments is the invoice value for stored materials and the earned value for all other cost for constructing each item. Earned value is expressed as the value of the Work completed divided by the total value of installation cost. The total amount paid will be equal to the total lump sum amount for that item.

#### **1.03 MEASUREMENT AND BASIS FOR PAYMENTS ON UNIT PRICE ITEMS**

- A. Measure the Work using the unit of measure indicated in this Section for each unit price line item. Payment will be made only for the actual measured unit and/or computed length, area, solid contents, number, and weight unless other provisions are made in the Contract Documents. Payment on a unit price basis will not be made for Work outside dimensions shown in the Contract Documents.
- B. Payment will be made for the actual quantity of Work completed and for materials and equipment stored during the payment period. Payment amount is the Work quantity measured per Paragraph A above multiplied by the unit price for that line item in the Agreement.

#### **1.04 MEASUREMENT AND BASIS FOR PAYMENT FOR BASE ITEMS**

- A. Item A-01 - Mobilization:
  - 1. Measurement and payment for mobilization shall be on a lump sum basis at the unit price allowed with a maximum of 5% of total amount bid. The amount shown in the proposal is the amount allowed to assist the Contractor in defraying the initial cost of operations. Partial payment for mobilization will be made as follows:

- a. Fifty (50%) percent of the lump sum amount is payable when bonds are furnished; the contract is executed; the certificate of insurance and insurance policies are provided; and the notice to proceed is issued.
    - b. One hundred (100%) percent of the lump sum amount is payable upon completion of the above and; the Contractor has set up his field office; mobilized all equipment to the site necessary to begin construction; and submitted schedules and all required shop drawings.
  2. It is not intended that the lump sum amount allowed will cover all costs for bonds, insurance, mobilization, utility investigations, and other costs associated with project start-up.
- B. Item A-02- 150,000 Gallon EST, Foundation and Appurtenances:
1. Measurement for the 150,000-gallon multi-leg EST, foundation, and appurtenances shall be on a lump sum basis.
  2. Payment for the 150,000-gallon multi-leg EST, foundation, and appurtenances shall be made at the lump sum price bid and shall be full compensation for supplying all labor, equipment, and materials for furnishing and installing the multi-leg EST and related appurtenances including, but not limited to valves, piping, fittings, mixing system, coatings, logo(s), hatches, vents, guardrails, landings, ladders, access ladder with safety system, platforms, doors, tank foundation and pedestal, all components within the tank area including the splash pad, excavation and unsuitable material removal, disposal and replacement, supervision, and any incidental work and materials related to items required for construction.
- C. Item A-03 – Water Well & Appurtenances
1. Measurement for the water well and appurtenances shall be on a lump sum basis.
  2. Payment for the water well and appurtenances shall be made at the lump sum price bid and shall be full compensation for supplying all labor, equipment, and materials for constructing and installing the water well, related appurtenances, and yard piping required to connect to proposed 12" water line including, but not limited to drilling and logging of a pilot hole; construction, development and testing of the well screen; furnishing and installing the well pump; and furnishing and installing an electric well motor. No progress payments shall be made for any part of the well until all the work on the well is completed and initial performance guarantees are shown to have been met. This provision applies to the well, permanent pump, permanent pump motor, discharge piping, 4" yard piping, other above-ground installations, and all other products and work that are not included in any other unit price item. Payment also includes providing all pipe, bedding and backfill, valves and fittings, taps, pressure gauges, and other specials including: all piping and fittings, mega-lugs, restrained couplings, mechanical joints, and all associated labor and materials. Any items not specifically listed in the bid form shall be included in the cost of the well. All costs for testing and disinfection are included in this item.
- D. Item A-04 – 12" Ductile Iron Water Line
1. Measurement for 12-Inch DI water line shall be per linear foot installed and complete in place.

2. Payment for the 12-Inch DI pipe shall be for providing all pipe, bedding and backfill, fittings, and other specials including: all piping and fittings, restrained couplings, and all associated labor and materials. Any items not specifically listed in the bid form shall be included in the cost of the pipe. All costs for testing and disinfection are included in this item.
- E. Item A-05 – Fire Hydrant
1. Measurement for fire hydrant assemblies shall be per each installed in place.
  2. Payment for fire hydrant assemblies shall be made at the unit price bid per each and shall be full compensation for supplying all labor, equipment, and materials including, but not limited to installation of fire hydrant, hydrant lead, valve, blocking, and all other items associated with the fire hydrant assembly.
- F. Item A-06 – 12” Gate Valve
1. Measurement for 12” gate valve shall be per each installed and complete in place.
  2. Payment for 12” gate valves shall be made at the unit price bid per each and shall be full compensation for furnishing and installing 12-Inch Gate Valves as indicated on the Contract Drawings and in accordance with the Project Specifications, including valves, valve box pad, operators, valve risers, stems, boxes, backfill, and all other items required for installation.
- G. Item A-07 – Trench Safety
1. Measurement for trench safety shall be per linear foot installed.
  2. Payment for trench safety shall be made at the unit price bid per linear foot installed and shall be full compensation for trench safety as outlined in the Contract Documents. The quantity included in the Bid Proposal is a minimum quantity to be bid.
- H. Item A-08 – Traffic Control
1. Measurement for traffic control shall be on a lump sum basis.
  2. Payment for traffic control shall be made at the lump sum price bid and shall include all materials necessary for providing and maintaining traffic control around construction and providing a traffic control plan to meet all Union County and NCDOT standards. The lump sum bid price shall include temporary paving, cones, signs, barricades, flag men, temporary signal modifications, temporary striping and buttons, and any other items required to provide for the safe movement of traffic.
- I. Item A-09 – 6” Thick Concrete Driveway
1. Measurement for 6” thick concrete driveway shall be per square yard installed.
  2. Payment for the concrete driveway shall be made at the unit price bid per square yard and shall be full compensation for furnishing and installing the concrete driveway to the limits shown in the Contract Drawings, including special backfill, soil amendments and all other items required in accordance with the Contract Documents.
- J. Item A-10 – Concrete Well Pad
1. Measurement for the concrete well pad shall be per square yard installed.

2. Payment for the concrete well pad shall be made at the unit price bid per square yard and shall be full compensation for furnishing and installing the concrete well pad as shown in the Contract Drawings, including special backfill, soil amendments and all other items required in accordance with the Contract Documents.
- K. Item A-11 – 2' Concrete Valley Gutter
1. Measurement for 2' concrete valley gutter shall be per linear foot installed.
  2. Payment for 2' concrete valley gutter shall be made at the unit price bid per linear foot and shall be full compensation for furnishing and installing the gutter as shown in the Contract Drawings, including all labor, equipment, materials, and any other items required.
- L. Item A-12 – Gravel Construction Entrance
1. Measurement for the gravel construction entrance shall be per each installed.
  2. Payment for the gravel construction entrance shall be made at the unit price bid per each installed and shall be full compensation for furnishing and installing the gravel construction entrance as shown on the Contract Drawings, including all labor, equipment, and materials that may be required.
- M. Item A-13 – Class B Rock Riprap
1. Measurement for Class B rock riprap shall be per cubic yard installed.
  2. Payment for Class B rock riprap shall be made at the unit price bid per cubic yard installed and shall be full compensation for furnishing and installing Class B rock riprap as indicated on the Contract Drawings, including all labor, equipment, and materials that may be required.
- N. Item A-14 – Filter Fabric
1. Measurement for filter fabric shall be per square yard installed.
  2. Payment for filter fabric shall be made at the unit price bid per square yard installed and shall be full compensation for furnishing and installing filter fabric as indicated on the Contract Drawings, including all labor, equipment, and materials that may be required.
- O. Item A-15 - 45° Wingwall
1. Measurement for 45° Wingwalls shall be per each installed.
  2. Payment for 45° Wingwalls shall be made at the unit price bid per each installed and shall be full compensation for furnishing and installing the wingwalls as indicated on the Contract Drawings, including all labor, equipment, and materials that may be required.
- P. Item A-16 – 18" RCP Driveway Culvert
1. Measurement for 18" RCP driveway culverts shall be per linear foot installed.
  2. Payment for 18" RCP driveway culverts shall be made at the unit price bid per linear foot installed and shall be full compensation for furnishing and installing the driveway culverts as indicated on the Contract Drawings, including all labor, equipment, and materials that may be required.

Q. Item A-17 – Clearing and Grubbing

1. Measurement for clearing and grubbing shall be on a lump sum basis.
2. Payment for clearing and grubbing shall be made at the lump sum price bid and shall be full compensation for supplying all labor, equipment, tools, and incidentals necessary to complete the specified work, including refilling of depressions. No payment will be made for clearing or grubbing in the borrow or waste disposal areas, and all costs thereof shall be included in the appropriate bid price of the type of work involved. The amount bid for clearing grubbing shall not exceed 1% of the total amount bid, excluding amounts for “Mobilization” and “Clearing and Grubbing”.

R. Item A-18 – Grading and Erosion Control

1. Measurement for grading and erosion control shall be on a lump sum basis.
2. Payment for grading and erosion control shall be made at the lump sum price bid and shall be full compensation for all proposed grading and erosion control measures as shown on the plans.

S. Item A-19 – Chain Link Fencing

1. Measurement for payment for chain link fences and gates shall be based on the linear feet of fencing and gates installed.
2. Payment for all chain link fencing, including gates, shall be made at the contract unit price bid per linear foot for the Item, “Chain Link Fencing.” This price shall be full compensation for furnishing labor, materials, and equipment for installing the chain link fencing, including gates, as shown on the Drawings. No separate payment shall be made for restoring adjacent areas to preconstruction conditions.

T. Item A-20 – Seeding and Hydromulch

1. Measurement for seeding and hydromulch shall be per acre.
2. Payment for seeding and hydromulch shall be made at the unit price bid per acre and shall be full compensation for, but not limited to, reestablishing grass, seeding, fertilizing, watering, and maintenance of grass.

U. Item A-21 – Storm Water Pollution Prevention

1. Measurement for Storm Water Pollution Prevention Plan Implementation shall be on a lump sum basis.
2. Payment for Storm Water Pollution Prevention Plan Implementation shall be made at the lump sum price bid and shall be full compensation for design, implementation, and removal of the plan for the duration of the project. Plan shall be prepared in accordance with Section 01 57 00 – Temporary Controls of the project specifications.

V. Item A-22 – Slide Gate

1. Measurement for the slide gate shall be per each installed and complete in place.
2. Payment for slide gate shall be made at the unit price bid per each installed and shall include all required materials, labor and equipment required for furnishing, site preparation and installation of the manual slide gate as shown in the Contract Drawings.



W. Item A-23 – Instrumentation

1. Measurement for instrumentation shall be on a lump sum basis.
2. Payment for instrumentation shall be made at the lump sum price bid and shall be full compensation for supplying all labor, equipment, and materials, and installing instrumentation for the elevated storage tank including, but not limited to, float switches, pressure transmitters, propeller flow meter, and all system modifications required for a complete and operational system.

X. Item A-24 – Tank and Site Electrical

1. Measurement for tank and site electrical shall be on a lump sum basis.
2. Payment for tank and site electrical shall be made at the lump sum price bid and shall be full compensation for supplying all labor, equipment, and materials and installing all electrical improvements on the site, tank exterior, and tank interior including but not limited to conduit, duct banks, conductors, grounding, lightning protection, instrumentation, instrumentation conductors, panel board, cable trays, lighting poles and foundations, light fixtures, UPS system, obstruction lights and control panel, start-up and testing, lighting contactor, and all miscellaneous electrical items for a complete and operational system. All effort and coordination required to establish permanent power to the site shall be included in this item.

1.05 MEASUREMENT AND BASIS FOR PAYMENT FOR ALLOWANCES

A. Item D-01 - Owner's Allowance :

1. There will be no unit of measure for this payment.
2. The owner's allowance item shall be the amount shown on the bid proposal and is an allowance that may only be used at the discretion of the Owner. This item may be used in full, part, or not at all during construction

B. Item D-02 – Quality Control Testing by Owner Allowance

1. There will be no unit of measure for this payment.
2. The quality control testing allowance item shall be the amount shown on the bid proposal and is an allowance that may only be used at the discretion of the Owner for testing of materials and work performed during the construction process. This item may be used in full, part, or not at all during construction.

1.06 MEASUREMENT AND BASIS FOR PAYMENT FOR ALTERNATES

1. None.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 31 00 PROJECT MANAGEMENT AND COORDINATION**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Furnish resources required to complete the Project in accordance with the Contract Documents and within the Contract Times.
- B. Construct Project in accordance with current safety practices.
- C. Manage Site to allow access to Site and control construction operations.
- D. Construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- E. Provide temporary controls for pollution, management of water, and management of excess earth as required in Section 01 57 00 "Temporary Controls."

#### **1.02 STANDARDS**

- A. Perform Work to comply with:
  - 1. Requirements of the Contract Documents;
  - 2. Laws and Regulations; and
  - 3. Specified industry standards.

#### **1.03 DOCUMENTATION**

- A. Provide documents in accordance with Section 01 33 00 "Document Management."
- B. Provide copies of Supplier's printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation.
- C. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings per Section 01 31 13 "Project Administration."

#### **1.04 PERMITS**

- A. Obtain building permits for the Project from the local authorities having jurisdiction. Pay building permit fees and include these costs in the Contract Price.
- B. Obtain environmental permits required for construction at the Site.
- C. Provide required permits for transporting heavy or oversized loads.
- D. Provide other permits required to conduct any part of the Work.
- E. Arrange for inspections and certification by agencies having jurisdiction over the Work and include the cost for these inspections and certifications in the Contract Price.
- F. Make arrangements with private utility companies and pay fees associated with obtaining services or inspections.
- G. Retain copies of permits and licenses at the Site and comply with all regulations and conditions of the permit or license.

#### 1.05 SAFETY REQUIREMENTS

- A. Manage safety to protect the safety and welfare of persons at the Site.
- B. Provide safe access to move through the Site. Provide protective devices to warn and protect from hazards at the Site.
- C. Provide safe access for those performing tests and inspections.
- D. Maintain a supply of personal protective equipment for visitors to the Site.
- E. Comply with latest provisions of the Occupational Health and Safety Administration (OSHA) and other Laws and Regulations.
- F. Cooperate with accident investigations. Provide two copies of all reports, including insurance company reports, prepared concerning accidents, injuries, or deaths related to the Project to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

#### 1.06 ACCESS TO THE SITE

- A. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe access for normal operations during construction.
- B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding, and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.
- C. Use roadways for construction traffic only with written approval of the appropriate representatives of each entity. Roadways may not be approved for construction traffic. Obtain written approval to use roads to deliver heavy or oversized loads to the Site. Furnish copies of the written approvals to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

#### 1.07 CONTRACTOR'S USE OF THE SITE

- A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Construction Manager. Coordinate the use of the Site with the Construction Manager.
- B. Provide security at the Site as necessary to protect against vandalism and loss by theft.
- C. Park construction equipment in designated areas only and provide spill control measures as discussed in Section 01 57 00 "Temporary Controls."
- D. Park employees' vehicles in designated areas only.
- E. Obtain written permission of the property owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.
- F. Cooperate with public and private agencies with facilities operating within the limits of the Project. Provide 48 hours' notice to any applicable agency when Work is anticipated to proceed in the vicinity of any facility by using NC-811 (1-800-632-4949).

G. Conduct of Contractor's or Subcontractor's Employees:

1. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.
2. Do not allow the use of offensive language or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.
3. Require workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, or any exceedingly torn, ripped, or soiled clothing to be worn on the Site.
4. Do not allow the use, possession, concealment, transportation, promotion, or sale of the following prohibited items anywhere on the Site:
  - a. Firearms (including air rifles and pistols and BB or pellet guns) and ammunition;
  - b. Bows, crossbows, arrows, bolts, or any other projectile weapons;
  - c. Explosives of any kind, including fireworks;
  - d. Illegal knives;
  - e. Other weapons prohibited by state Laws and Regulations; and
  - f. Any other item that has been designed or intended to be used as a weapon.

No exceptions will be made for the possession of a firearm by a person that has a valid state-issued license to carry a firearm. Remove any of the prohibited items listed above from the Site immediately and permanently. Any person found to be in possession of any prohibited item must also be removed from the Site and may be reported to local law enforcement.

1.08 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Examine the Site and review the available information concerning the Site. Locate utilities, underground facilities, and existing structures. Verify the elevations of the structures adjacent to excavations. Report any discrepancies from information in the Contract Documents to the Construction Manager before beginning construction.
- B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Prepare a Plan of Action per Section 01 31 13 "Project Administration." Coordinate Work with local utility company and others for the relocation or replacement.
- C. Protect utilities, underground facilities and existing structures unless they are shown to be replaced or relocated on the Drawings. Restore damaged items to the satisfaction of the Owner and utility or property owner.
- D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless required by the Contract Documents or

approved by the Construction Manager. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines, or other obstructions.

- E. Protect existing trees and landscaping at the Site. Mark trees that may be removed during construction and review with the Construction Manager for approval before removing. Protect trees to remain from damage limiting activity, including stockpiling of materials within the drip line of the tree.
- F. Protect buildings from damage when handling material or equipment. Protect finished surfaces, including floors, doors, and jambs. Remove doors and install temporary wood protective coverings over jambs, if needed.

#### 1.09 DISRUPTION TO SERVICES/CONTINUED OPERATIONS

- A. Owner's facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities. Keep disruptions to existing utilities, piping, process piping, or electrical services to a minimum.
  - 1. Do not restrict access to critical valves, operators, or electrical panels.
  - 2. Do not store material or products inside structures unless authorized by the Construction Manager.
  - 3. Limit operations to the minimum amount of space needed to complete the specified Work.
  - 4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the Work in a manner that flow is not restricted.
- B. Provide a Plan of Action in accordance with Section 01 35 00 "Special Procedures" if facilities must be taken out of operation.

#### 1.10 FIELD VERIFICATION

- A. Perform complete field measurements prior to purchasing products or beginning construction for products required to fit existing conditions.
- B. Verify property lines, control lines, grades, and levels indicated on the Drawings.
- C. Verify pipe class, equipment capacities, existing electrical systems, and power sources for existing conditions.
- D. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.
- E. Include field measurements in Record Documents as required in Section 01 31 13 "Project Administration."

#### 1.11 REFERENCE DATA AND CONTROL POINTS

- A. Construction Manager will provide the following control points:
  - 1. Base line or grid reference points for horizontal control.
  - 2. Benchmarks for vertical control.

- B. Locate and protect control points prior to starting the Work and preserve permanent reference points during construction. Designated control points may be on an existing structure or monument. Do not change or relocate points without prior approval of the Construction Manager. Notify Construction Manager when a reference point is lost, destroyed, or requires relocation. Replace Project control points on the basis of the original survey. Control points or benchmarks damaged, disturbed or destroyed as a result of the Contractor's negligence will be restored by the Construction Manager. Owner will impose a set-off as compensation for the effort required.
- C. Provide complete engineering layout of the Work needed for construction.
  - 1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.
  - 2. Provide surveying with accuracy meeting the requirements established for +/-0.01 inch.
  - 3. Provide Record Data per Section 01 31 13 "Project Administration" and measurements per standards.

#### 1.12 DELIVERY AND STORAGE

- A. Deliver products and materials to the Site in time to prevent delays in construction.
- B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store properly until used. Leave products in original packages or other containers until installed. If original packages or containers are damaged, repackage in containers and include packing slips, labels and other information from the original packaging.
- C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs or pallets.
- D. Assume full responsibility for the protection and safekeeping of products stored at the Site.
- E. Store products at locations acceptable to the Construction Manager and to allow Owner access to maintain and operate existing facilities.
- F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.
- G. Provide additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control, and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.
- H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work.
- I. Provide adequate exterior storage for products that may be stored out-of-doors.

1. Provide substantial platforms, blocking, or skids to support materials and products above ground which has been sloped to provide drainage. Protect products from soiling or staining.
  2. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.
  3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter.
  4. Provide surface drainage to prevent erosion and ponding of water.
  5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
  6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.
  7. Store products to prevent wind damage.
- J. Protect and maintain mechanical and electrical equipment in storage.
1. Provide Supplier's service instructions on the exterior of the package.
  2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data per Section 01 31 13 "Project Administration" when Owner assumes responsibility for maintenance and operation.
  3. Provide power to and energize space heaters for all equipment for which these devices are provided.
  4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.
- K. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:
1. Storage facilities continue to meet specified requirements;
  2. Supplier's required environmental conditions are continually maintained; and
  3. Products that can be damaged by exposure to the elements are not adversely affected.
- L. Replace any stored item damaged by inadequate protection or environmental controls.
- M. Payment may be withheld for any products not properly stored.

#### 1.13 CLEANING DURING CONSTRUCTION

- A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from discharging into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.
- B. Clean the Site as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers at the Site for waste collection. Do

not allow waste materials or debris to blow around or off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.

- C. Comply with Laws and Regulations. Do not burn or bury waste materials. Remove waste materials, rubbish, and debris from the Site and legally dispose of these at public or private disposal facilities.

#### 1.14 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

- A. Maintain roads and streets in a manner that is suitable for safe operations of public vehicle during all phases of construction unless the Owner approves a street closing. Do not close public roads overnight. Coordinate and arrange for emergency vehicle access when streets are to be closed.
- B. Submit a Notification by Contractor for Owner's approval of a street closing. The request must state:
  - 1. The reason for closing the street.
  - 2. How long the street will remain closed.
  - 3. Procedures to be taken to maintain the flow of traffic.
- C. Obtain permits and permissions of the entity that owns the road prior to any Work and provide a copy of the permit or permission Record Data per Section 01 31 13 "Project Administration."
- D. Construct temporary detours, including by-pass roads around construction, with adequately clear width to maintain the free flow of traffic at all times. Maintain barricades, signs, and safety features around the detour and excavations. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).
- E. Assume responsibility for any damage resulting from construction along roads or drives.

#### 1.15 BLASTING

- A. Blasting is not allowed for any purpose.

#### 1.16 ARCHAEOLOGICAL REQUIREMENTS

- A. Cease operations immediately and contact the Owner for instructions if historical or archaeological artifacts are found during construction.
- B. Conduct all construction activities to avoid adverse impact of the sites where significant historical or archaeological artifacts are found or identified as an area where other artifacts could be found.
  - 1. Obtain details for working in these areas from regulatory agencies.
  - 2. Maintain confidentiality regarding the site(s) of artifacts.
  - 3. Adhere to the requirements of applicable local, state, and federal Laws and Regulations.
  - 4. Notify the Construction Manager and any local, state, or federal agency as required by applicable Laws and Regulations.



- C. Do not disturb archaeological sites.
  - 1. Obtain the services of a qualified archaeological specialist to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.
  - 2. Coordinate activities to permit archaeological work to take place within the area.
    - a. Attempt to archaeologically clear areas needed for construction as soon as possible.
    - b. Provide a determination of priority for such areas.
- D. Assume responsibility for any unauthorized destruction that might result to such sites by construction personnel, and pay all penalties assessed by state or federal agencies for non-compliance with these requirements.
- E. Contract Times will be modified to compensate for delays caused by such archaeological finds. No additional compensation will be paid for delays.

#### 1.17 ENDANGERED SPECIES RESOURCES

- A. Do not perform any activity that is likely to destroy or adversely modify the habitat or jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA) or applicable state Laws and Regulations.
- B. Cease Work immediately in the area of the encounter and notify the Construction Manager if a threatened or endangered species is encountered during construction. Construction Manager will implement actions in accordance with the ESA and applicable state statutes. Resume construction in the area of the encounter when authorized to do so by the Construction Manager.

#### 1.18 OCCUPANCY

- A. Owner has the right to occupy or operate any portion of the Project that is ready for use after notifying the Contractor of its intent to do so.
- B. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.
- C. Owner may accept the facility for continued use after startup and testing at the option of the Owner. If acceptance is delayed at the option of the Owner, shut down facilities per approved operation and maintenance procedures.
- D. The execution of bonds is understood to indicate the consent of the surety to these provisions for occupancy of the structures and use of equipment.
- E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.
- F. Conduct operations to ensure the least inconvenience to the Owner and general public.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 31 13 PROJECT ADMINISTRATION**

### **PART 1 - GENERAL**

#### **1.01 WORK INCLUDED**

- A. Administer contract requirements to construct the Project. Provide documentation per the requirements of this Section. Provide information as requested by the OPT.

#### **1.02 DOCUMENTATION**

- A. Provide documents in accordance with Section 01 33 00 "Document Management."

#### **1.03 COMMUNICATION DURING THE PROJECT**

- A. Construction Manager is to be the first point of contact for all parties on matters concerning this Project.
- B. Construction Manager will coordinate correspondence concerning:
  - 1. Contract administration;
  - 2. Clarification and interpretation of the Contract Documents;
  - 3. Contract modifications;
  - 4. Observation of Work and testing; and
  - 5. Claims.
- C. Construction Manager will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.
- D. Direct written communications to the Construction Manager at the address indicated at the pre-construction conference. Include the following with communications as a minimum:
  - 1. Name of the Owner;
  - 2. Project name;
  - 3. Contract title;
  - 4. Project number;
  - 5. Date; and
  - 6. A reference statement.
- E. Submit communications on the forms referenced in this Section or in Section 01 33 00 "Document Management."

#### **1.04 PROJECT MEETINGS**

- A. Pre-Construction Conference:
  - 1. Attend a pre-construction conference;
  - 2. The location of the conference will be determined by the Construction Manager;

3. The time of the conference will be determined by the Construction Manager, but will be after the Notice of Award is issued and not later than 15 days after the Notice to Proceed is issued;
  4. OPT, Contractor's project manager and superintendent, representatives of utility companies, and representatives from major Subcontractors and Suppliers may attend the conference; and
  5. Provide and be prepared to discuss:
    - a. Preliminary construction schedule per Section 01 33 05 "Construction Progress Schedule";
    - b. Preliminary Schedule of Documents per Section 01 33 00 "Document Management";
    - c. Schedule of Values and anticipated schedule of payments per Section 01 29 00 "Application for Payment Procedures";
    - d. List of Subcontractors and Suppliers;
    - e. Contractor's organizational chart as it relates to this Project; and
    - f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications, and payment requests.
- B. Progress Meetings:
1. Attend meetings with the Construction Manager, Design Professional, and Owner.
    - a. Meet monthly or as requested by the Construction Manager to discuss the Project.
    - b. Meet at the Site or other location as designated by the Construction Manager.
    - c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
    - d. Notify the Construction Manager of any specific items to be discussed a minimum of 1 week prior to the meeting.
  2. Provide information as requested by the Construction Manager, Design Professional or Owner concerning this Project. Prepare to discuss:
    - a. Status of overall project schedule;
    - b. Contractor's detailed schedule for the next month;
    - c. Anticipated delivery dates for equipment;
    - d. Coordination with the Owner;
    - e. Status of documents;
    - f. Information or clarification of the Contract Documents;
    - g. Claims and proposed modifications to the Contract;
    - h. Field observations, problems, or conflicts; and
    - i. Maintenance of quality standards.

3. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- C. Pre-Documentation and Pre-Installation Meetings:
1. Conduct pre-documentation and pre-installation meetings as required in the individual technical Specifications or as determined necessary by the Construction Manager (for example, instrumentation, roofing, concrete mix design, etc.).
  2. Set the time and location of the meetings when ready to proceed with the associated Work. Submit a Notification by Contractor in accordance with Paragraph 1.07 for the meeting 2 weeks before the meeting. OPT must approve of the proposed time and location.
  3. Attend the meeting and require the participation of appropriate Subcontractors and Suppliers in the meeting.
  4. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- D. Weekly Coordination Meetings: Meet on a weekly basis with the Construction Manager or designated on-site representative of the OPT to discuss Work planned for the following week, review coordination issues, testing required, or other issues. Records of these meetings are not required.

#### 1.05 REQUESTS FOR INFORMATION

- A. Submit a Request for Information to the Construction Manager to obtain additional information or clarification of the Contract Documents.
1. Submit a separate Request for Information for each item on the form provided by the Construction Manager.
  2. Attach adequate information to permit a response without further clarification. Construction Manager will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple reviews due to inadequate information.
  3. A response will be made when adequate information is provided. The response will be made on the Request for Information form provided by the Construction Manager.
- B. Response to a Request for Information is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.
1. Submit a Change Proposal per Section 01 26 00 "Change Management" if a contract modification is suggested or required.

- C. Use the Decision Register to document decisions made at meetings and actions to be taken in accordance with Paragraph 1.06.
- D. Use the Action Item Register to document assignments for actions to be taken in accordance with Paragraph 1.06.

#### 1.06 DECISION AND ACTION ITEM REGISTER

- A. Construction Manager will maintain a Decision Register to document key decisions made during meetings, telephone conversations, or visits to the Site using the format provided by the Construction Manager:
  - 1. Review the Decision Register prior to each regular meeting.
  - 2. Report any discrepancies to the Construction Manager for correction or discussion at the next monthly meeting.
- B. Construction Manager will maintain an Action Item Register in conjunction with the Decision Register to track assignments made during meetings, telephone conversations or visits to the Site using the format provided by the Construction Manager:
  - 1. Review the Action Item Register prior to each regular meeting.
  - 2. Report actions taken after the previous progress meeting on items in the register assigned to the Contractor or through the Contractor to a Subcontractor or Supplier to the Construction Manager. Report on status of progress 1 week prior to each progress meeting established in Paragraph 1.04 to allow Construction Manager to update the register prior to the Progress Meetings.
  - 3. Be prepared to discuss the status at each meeting.
- C. Decisions or action items in the register that require a change in the Contract Documents will have the preparation of a Modification as an action items if appropriate. The Contract Documents can only be changed by a Modification.

#### 1.07 NOTIFICATION BY CONTRACTOR

- A. Notify the Construction Manager of:
  - 1. Need for testing;
  - 2. Intent to work outside regular working hours;
  - 3. Request to shut down facilities or utilities;
  - 4. Proposed utility connections;
  - 5. Required observation by Construction Manager, Engineer, or inspection agencies prior to covering Work; and
  - 6. Training.
- B. Provide notification a minimum of 2 weeks in advance to allow OPT time to respond appropriately to the notification.
- C. Use the Notification by Contractor form provided by the Construction Manager.

1.08 REQUESTS FOR MODIFICATIONS

- A. Submit requests for Modifications per Section 01 26 00 "Change Management."

1.09 RECORD DATA

- A. Submit information required by the Contract Documents that is not related to a product as Record Data using the form provided by the Construction Manager.

1.10 RECORD DOCUMENTS

- A. Maintain one complete set of printed Record Documents at the Site including:
  - 1. Drawings;
  - 2. Specifications;
  - 3. Addenda;
  - 4. Modifications;
  - 5. Product Data and approved Shop Drawings;
  - 6. Construction photographs;
  - 7. Test Reports;
  - 8. Clarifications and other information provided in Request for Information responses; and
  - 9. Reference standards.
- B. Store printed Record Documents and Samples in the Contractor's field office.
  - 1. Record Documents are to remain separate from documents used for construction.
  - 2. Provide files and racks for the storage of Record Documents.
  - 3. Provide a secure storage space for the storage of Samples.
  - 4. Maintain Record Documents in clean, dry, legible conditions, and in good order.
  - 5. Make Record Documents and Samples available at all times for inspection by the OPT.
- C. Maintain an electronic record of Specifications and Addenda to identify products provided in PDF format.
  - 1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
  - 2. Reference Modifications by type and number for all changes.
- D. Maintain an electronic record of Drawings in PDF format.
  - 1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
  - 2. Reference Modifications by type and number for all changes.
  - 3. Record information as construction is being performed. Do not conceal any Work until the required information is recorded.
  - 4. Mark drawings to record actual construction.

- a. Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
  - b. Horizontal and vertical locations of underground utilities and appurtenances constructed, and existing utilities encountered during construction.
  - c. Location of utilities and appurtenances concealed in the Work. Refer measurements to permanent structures on the surface. Include the following equipment:
    - 1) Piping;
    - 2) Ductwork;
    - 3) Equipment and control devices requiring periodic maintenance or repair;
    - 4) Valves, unions, traps, and tanks;
    - 5) Services entrance;
    - 6) Feeders; and
    - 7) Outlets.
  - d. Changes of dimension and detail.
  - e. Changes by Modifications.
  - f. Information in Requests for Information or included in the Decision Register.
  - g. Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to Requests for Information.
5. Mark Drawings with the following colors:
- a. Highlight references to other documents, including Modifications in blue.
  - b. Highlight mark ups for new or revised Work (lines added) in yellow.
  - c. Highlight items deleted or not installed (lines to be removed) in red.
  - d. Highlight items constructed per the Contract Documents in green.
6. Submit Record Documents to Construction Manager for review and acceptance 30 days prior to Final Completion of the Project.
- E. Applications for Payment will not be recommended for payment if Record Documents are found to be incomplete or not in order. Final payment will not be recommended without complete Record Documents.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**



## **01 33 00      DOCUMENT MANAGEMENT**

### **PART 1 - GENERAL**

#### **1.01      SUMMARY**

- A. Submit documentation as required by the Contract Documents and as requested by the Construction Manager.
- B. Use the Project Management Information System (PMIS) provided by the Construction Manager. Software for the PMIS is FNiManager which has the following system requirements:
  - 1. Operating Systems: Windows 7 or later and OS X v10.8 or later.
  - 2. Supported Internet Browsers: Internet Explorer 11.0 or later, Google Chrome 70.0 or later, Firefox 63.0 or later, Safari 11.0 or later, and Microsoft Edge 17.0 or later.
  - 3. Screen Resolution: The recommended screen resolution is 1280 x 1024 or higher. The minimum screen resolution required to support all features is 1024 x 768.

#### **1.02      QUALITY ASSURANCE**

- A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Documents not meeting these criteria will be returned without review as “Not Approved.”

#### **1.03      CONTRACTOR’S RESPONSIBILITIES**

- A. Review documents prior to submission. Make certifications as required by the Contract Documents and as indicated on Construction Manager provided forms.
- B. Provide a Schedule of Documents to list the documents that are to be submitted and the dates on which documents are to be sent to the Construction Manager for review. Use the form provided by the Construction Manager for this list.
- C. Incorporate the dates for processing documents into the Progress Schedule required by Section 01 33 05 “Construction Progress Schedule.”
  - 1. Provide documents in accordance with the schedule so construction of the Project is not delayed.
  - 2. Allow a reasonable time for the review of documents when preparing the Progress Schedule. Assume a 14-day review cycle for each document unless a longer period of time is indicated in the Contract Documents or agreed to by Construction Manager and Contractor.
  - 3. Schedule delivery of review documents to provide all information for interrelated Work at one time.
  - 4. Allow adequate time for processing documents so construction of the Project is not delayed.

#### 1.04 FORMS AND WORKFLOWS

- A. Use the forms or workflow process provided by the Construction Manager for project documentation.

#### 1.05 DOCUMENT PREPARATION AND DELIVERY PROCEDURES

- A. Deliver documents in electronic format as directed by the Construction Manager.
  - 1. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
  - 2. Deliver all documents in Portable Document Format (PDF).
    - a. Create PDF document using Bluebeam Revu software.
    - b. Create PDF documents from native format files unless files are only available from scanned documents.
    - c. Rotate pages so that the top of each document appears at the top of the monitor screen when opened in PDF viewing software.
    - d. Provide PDF document with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.
    - e. Submit color PDF documents where color is required to interpret the document.
    - f. Create or convert documents to allow text to be selected for comments or searched using text search features. Run scanned documents through Optical Character Recognition (OCR) software if necessary.
    - g. Flatten markups in documents to prevent markups made by Contractor from being moved or deleted. Flatten documents to allow markup recovery.
    - h. Use Bluebeam Revu software to reduce file size using default settings except the option for "Drop Metadata". Uncheck the "Drop Metadata" box when reducing file size.
    - i. Add footers to each document with the name of the Project.

#### 1.06 DOCUMENTATION

- A. Furnish documents as indicated in the individual Specification Sections. Submit documents per the procedures described in the Contract Documents.
- B. Submit documents per the Specification Sections shown in the following table:

| Document Type                 | Specification Section                                                  |
|-------------------------------|------------------------------------------------------------------------|
| Application for Payment       | 01 29 00                                                               |
| Certified Test Report         | 01 33 02 for approval of product<br>01 40 00 to demonstrate compliance |
| Change Management             | 01 26 00                                                               |
| Equipment Installation Report | 01 75 00                                                               |
| Graphic Documentation         | 01 33 06                                                               |

| Document Type                   | Specification Section |
|---------------------------------|-----------------------|
| Notification by Contractor      | 01 31 13              |
| Operation & Maintenance Manuals | 01 33 04              |
| Product Data                    | 01 33 03              |
| Progress Schedules              | 01 33 05              |
| Record Data                     | 01 31 13              |
| Request for Information         | 01 31 13              |
| Schedule of Values              | 01 29 00              |
| Shop Drawing                    | 01 33 02              |
| Substitutions                   | 01 26 00              |
| Suppliers and Subcontractors    | 01 31 13<br>01 33 03  |

#### 1.07 Electronic Documents Protocol

- A. The parties shall follow the provisions in this Section, referred to as the Electronic Documents Protocol ("EDP"), for exchange of electronic transmittals.
- B. Basic Requirements:
  1. Except as otherwise stated elsewhere in the Contract Documents, the OPT and Contractor will send and accept Electronic Documents sent by Electronic Means using the protocols provided in this Section.
  2. The contents of the information in any Electronic Document will be the responsibility of the transmitting party. Electronic Documents may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, and are subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
  3. Provisions of this Contract regarding Electronic Documents must be incorporated into other agreements or subcontracts on the Project. Nothing in this paragraph reduces or eliminates requirements:
    - a. to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations;
    - b. to comply with any applicable Law or Regulation governing the signing and sealing of design documents and related Modifications or the signing and electronic transmission of any other documents; or
    - c. to comply with the notice requirements.
  4. When sending Electronic Documents by Electronic Means the sending party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or sending Electronic Documents.

C. System Infrastructure for Electronic Document Exchange:

1. Contractor will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost. System Infrastructure must comply with these requirements.
2. The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 10 MB. Attachments larger than that may be exchanged in parts or by using large file transfer functions or physical media.
3. Contractor assumes full and complete responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software.
4. Contractor is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.
5. Contractor will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems that are intended to protect others from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. Contractor will not be liable to others for any breach of system security to the extent that Contractor maintains and operates required security software and systems.
6. In the case of disputes, conflicts, or modifications to the use of Electronic Documents required to address issues affecting System Infrastructure, Contractor and OPT will cooperatively resolve the issues; but, failing resolution, OPT is authorized to make and require reasonable and necessary changes meet its original intent. Contractor may submit a Change Proposal if the changes cause additional cost or time to Contractor that could not have reasonably been anticipated.
7. Contractor and OPT are both responsible for their own back-up and archive of documents sent and received during the term of the contract. Contractor and OPT remain solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract as each party deems necessary for its own purposes.
8. If a Contractor or OPT receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.
9. OPT will operate a project information management system (Project Website) for use of OPT and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this Contract, use of

the Project Website will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information.

**D. Software Requirements:**

1. OPT and Contractor will each acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the following software formats:

| <b>Document</b>                                                                        | <b>Document Format</b>                                                                                  |
|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Email                                                                                  | .htm, .rtf, or .txt without formatting that impair legibility of content on screen or in printed copies |
| Submittals                                                                             | Bluebeam PDF                                                                                            |
| Applications for Payment                                                               | Bluebeam PDF and Microsoft® Excel                                                                       |
| Progress Schedules                                                                     | PDF and Schedule in Schedule in Native Format                                                           |
| Layouts and drawings to be submitted to Owner for future use and modification          | Autodesk® AutoCAD .dwg format                                                                           |
| Document submitted to OPT for future word processing use and modification              | Microsoft® Word                                                                                         |
| Spreadsheets and data submitted to OPT for future data processing use and modification | Microsoft® Excel                                                                                        |
| Photographs                                                                            | .jpg or .jpeg                                                                                           |
| Videos                                                                                 | .mp4, .mpeg, or .avi                                                                                    |

2. Software will be the version currently published at the time Contract is signed, unless a specific software version is listed in the Supplementary Conditions. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or convert to comply with this Section.
3. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 33 02 SHOP DRAWINGS**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection, or installation of the product without additional detailed information from the Supplier.
- B. Submit Shop Drawings as required by the Contract Documents and as reasonably requested by the Construction Manager to:
  - 1. Record the products incorporated into the Project;
  - 2. Provide detailed information for the products proposed for the Project regarding their fabrication, installation, commissioning, and testing; and
  - 3. Allow the Design Professional to advise the Owner if products proposed for the Project by the Contractor conform, in general, to the design concepts of the Contract Documents.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Shop Drawings, Samples, or mockups.
- D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be approved by Change Order or Field Order.

#### **1.02 QUALITY ASSURANCE**

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Shop Drawings not meeting these criteria will not be approved.
- B. Demonstrate that the proposed products are in full compliance with the design criteria and requirements of the Contract Documents, or will be if deviations requested per Paragraph [1.11] are approved.
- C. Furnish and install products that fully comply with the information included in the Shop Drawings.

#### **1.03 CONTRACTOR'S RESPONSIBILITIES**

- A. Furnish Shop Drawings for products as indicated in the individual Specification Sections.
- B. Include Shop Drawings in the Document Register required by Section 01 33 00 "Document Management" to indicate the Shop Drawings to be submitted, the dates on which Shop Drawings are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Incorporate the dates for processing Shop Drawings into the Progress Schedule required by Section 01 33 05 "Construction Progress Schedule."

1. Submit Shop Drawings in accordance with the schedule so construction of the Project is not delayed.
  2. Submit Shop Drawings for interrelated Work at one time.
  3. Allow adequate time for ordering, fabricating, delivering, and installing products so construction of the Project is not delayed.
- D. Complete the following before submitting a Shop Drawing or Sample:
1. Prepare and review the Shop Drawing or Sample. Coordinate the Shop Drawing or Sample with other Shop Drawings and Samples, with the requirements of the Work, and the Contract Documents;
  2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to Shop Drawings and Samples;
  3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
  4. Determine and verify information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- E. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Shop Drawing and are accurate;
  2. Location of existing structures, utilities, and equipment related to the Shop Drawing have been shown and conflicts between the products, existing structures, utilities, and equipment have been identified;
  3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
  4. Shop Drawing is complete for its intended purpose; and
  5. Conflicts between the Shop Drawing related to the various Subcontractors and Suppliers have been resolved.
- F. Review Shop Drawings prior to submitting to the Construction Manager. Certify that all Shop Drawings have been reviewed by the Contractor and are in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Shop Drawings except for deviations specifically brought to the Construction Manager's attention on an attached Shop Drawing Deviation Request form in accordance with Paragraph 1.09.
- G. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Defective products may be rejected at the Owner's option.
- H. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Construction Manager and Design Professional.

#### 1.04 DOCUMENTATION

- A. Provide adequate information in Shop Drawings and with Samples so the Design Professional can:
  - 1. Assist the Owner in selecting colors, textures, or other aesthetic features.
  - 2. Compare the proposed features of the product with the specified features and advise Owner that the product does, in general, conform to the Contract Documents.
  - 3. Compare the performance features of the proposed product with those specified and advise the Owner that the product does, in general, conform to the performance criteria specified in the Contract Documents.
  - 4. Review required certifications, guarantees, warranties, and service agreements for compliance with the Contract Documents.
- B. Include a complete description of the material or equipment to be furnished, including:
  - 1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;
  - 2. Weights, gauges, materials of construction, external connections, anchors, and supports required;
  - 3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;
  - 4. All applicable standards;
  - 5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
  - 6. Wiring and piping diagrams and related controls;
  - 7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and
  - 8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.
- C. Submit Shop Drawings that require coordination with other Shop Drawings for fabrication at the same time. Shop Drawings requiring coordination with other Shop Drawings will not be approved until a complete package is submitted, unless approved by the Construction Manager.
- D. Submit information for all of the components and related equipment required for a complete and operational system in one Submittal.
  - 1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.
  - 2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.



## 1.05 SPECIAL CERTIFICATIONS AND REPORTS

- A. Provide all required special certifications, reports, and other documentation with the Shop Drawings as specified in the individual Specification Sections which may include:
  - 1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product, when installed, will meet the requirements of the Contract Documents and is part of the Shop Drawing. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Shop Drawing.
  - 2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.
  - 3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
  - 4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

## 1.06 WARRANTIES AND SERVICE AGREEMENTS

- A. Provide warranties and service agreements per Section 01 78 36 "Warranties and Service Agreements."

## 1.07 SHOP DRAWING SUBMITTAL PROCEDURES

- A. Submit Shop Drawings to the Construction Manager. Send all documents in digital format for processing.
  - 1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
  - 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Shop Drawing. Provide Samples and color charts per Paragraph 1.08.
  - 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Shop Drawings for more than one independent system in the same Submittal.
  - 4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.

5. Define abbreviations and symbols used in Shop Drawings.
  - a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.
  - b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
  - c. Provide a legend for symbols used on Shop Drawings.
6. Mark Shop Drawings to reference:
  - a. Related Specification Sections;
  - b. Drawing number and detail designation;
  - c. Equipment designation or name;
  - d. Schedule references;
  - e. System into which the product is incorporated; and
  - f. Location where the product is incorporated into the Project.
- B. Use the following conventions to markup Shop Drawings for review:
  1. Make comments and corrections in the color blue. Add explanatory comments to the markup.
  2. Highlight items in black (redact) that are not being furnished when the Supplier's standard drawings or information sheets are provided so that only the products to be provided are in their original color.
  3. Make comments in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action requested of the Design Professional.
  4. Make comments in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Include explanatory comments in the Shop Drawing Deviation Request form.
  5. Mark dimensions with the prefix "FD" to indicate field verified dimensions on the Shop Drawings.
- C. Designate a document as requiring priority treatment to place the review of the Shop Drawing ahead of other Shop Drawings previously delivered. Shop Drawings are typically reviewed in the order received, unless Contractor requests that a different priority be assigned. Priority Shop Drawings will be reviewed before other Shop Drawings already received but not yet reviewed. Use of this priority designation for Shop Drawings may delay the review of Shop Drawings previously submitted. Contractor is responsible for delays resulting from the use of the priority designation status on Shop Drawings.
- D. Complete the certification required by Paragraph 1.03.G.

#### 1.08 SAMPLE AND MOCKUP SUBMITTAL PROCEDURES

- A. Submit color charts and Samples for every product requiring color, texture, or finish selection.

1. Submit color charts and Samples only after Shop Drawings for the products have been approved.
  2. Deliver all color charts and Samples at one time.
  3. Provide Samples of adequate size to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
  4. Indicate the full range of color, texture, and patterns.
  5. Deliver color charts and Samples to the field office and store for the duration of the Project.
  6. Notify the Construction Manager that color charts and Samples have been delivered for approval using the Notification by Contractor form.
  7. Submit color charts and Samples not less than 30 days prior to when these products are to be ordered or released for fabrication to comply with the Project schedule.
  8. Remove Samples that have not been approved. Submit new Samples following the same process as for the initial Sample until Samples are approved.
  9. Dispose of Samples when related Work has been completed and approved and disposal is approved by the Construction Manager. At Owner's option, Samples will become the property of the Owner.
- B. Construct mockups for comparison with the Work being performed.
1. Construct mockups from the actual products to be used in construction per the detailed specifications.
  2. Construct mockups of the size and in the area indicated in the Contract Documents.
  3. Construct mockups complete with texture and finish to represent the finished product.
  4. Notify the Construction Manager that mockups have been constructed and are ready for approval using the Notification by Contractor form. Allow 2 weeks for Construction Manager to approve of the mockup before beginning the Work represented by the mockup.
  5. Remove mockups that have not been approved. Construct new mockups following the same process as for the initial mockup until mockup is approved.
  6. Protect mockups until Work has been completed and accepted by the Construction Manager.
  7. Dispose of mockups when related Work has been completed and disposal is approved by the Construction Manager.

#### 1.09 REQUESTS FOR DEVIATION

- A. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures.
- B. Provide a Shop Drawing with the Change Proposal that clearly identifies deviations for any product or component of the product that does not fully comply with the Contract

Documents using the Shop Drawing Deviation Request form provided by the Construction Manager. Mark deviations on the Shop Drawing per Paragraph 1.07.B.

- C. Include a description of why the deviation is required and the impact on Contract Price or Contract Times. Include the amount of any cost savings to the Owner for deviations that result in a reduction in cost.
- D. Identify each deviation request as a separate item. Include all requested deviations that must be approved as a group together and identify them as a single item.
- E. Construction Manager will issue a Field Order or Change Order to approve acceptable deviations. Approval of a requested Shop Drawing deviation by the Design Professional on the Shop Drawings Deviation Request form indicates approval of the requested deviation only on its technical merits as generally conforming to the Contract Documents. Deviations from the Contract Documents can only be approved by a Modification issued by the Construction Manager.

#### 1.10 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Shop Drawings will be received by the Construction Manager. Construction Manager will log the documents and forward to the Design Professional for review per this Section for general conformance with the Contract Documents.
  - 1. Design Professional's review and approval will be only to determine if the products described in the Shop Drawing or Sample will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
  - 2. Design Professional's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
  - 3. Design Professional's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- B. Comments will be made on items called to the attention of the Design Professional for review and comment. Any marks made by the Design Professional do not constitute a blanket review of the document or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
  - 1. Design Professional will respond to Contractor's markups by either making markups directly in the Shop Drawing file using the color red or by attaching a Document Review Comments form with review comments keyed to the Drawings or Shop Drawing Deviation Request.
  - 2. Shop Drawings that are reviewed will be returned with one or more of the following status designations:
    - a. Approved: Shop Drawing is found to be acceptable as submitted.
    - b. Approved as Noted: Shop Drawing is approved so long as corrections or notations made by Design Professional are incorporated into the Shop Drawing.
    - c. Not Approved: Shop Drawing or products described are not acceptable.

- d. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.
- 3. Shop Drawings will also be designated for one of the following actions:
  - a. Documents Filed: Shop Drawing is acceptable without further action and has been filed as a record document.
  - b. Shop Drawing Not Required: A Shop Drawing was not required by the Contract Documents. Resubmit the document per Section 01 33 03 "Product Data."
  - c. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.
  - d. Revise and Resubmit: Shop Drawing has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.

Actions "a" through "c" will close out the Shop Drawing review process and no further action is required as a Shop Drawing. Action "d" requires follow up action to close out the review process.

- 4. Drawings with a significant or substantial number of markings by the Contractor may be marked "Approved as Noted." These drawings are to be revised to provide a clean record of the document. Proceed with ordering products as the documents are revised.
- 5. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as "At Variance With" (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with the Contract Documents.
- C. Bring deviations to the Shop Drawings to the attention of the Design Professional for approval by using the Shop Drawing Deviation Request form. Use a single line for each requested deviation so the Status and Action for each deviation can be determined for that requested deviation. If approval or rejection of a requested deviation will impact other requested deviation, then all related deviations should be included in that requested deviation line so the status and action can be determined on the requested deviation as a whole.
- D. Requested deviations will be reviewed as a possible Modification to the Contract Documents.
  - 1. A requested deviation will be marked as "Not Approved" if the requested deviation is unacceptable. Contractor is to revise and resubmit the Shop Drawing with corrections for approval.
  - 2. A Field Order will be issued by the Construction Manager for deviations approved by the Design Professional if the requested deviation is acceptable and if the requested deviation will not result in a change in Contract Price or Contract Times. Requested deviations from the Contract Documents may only be approved by Field Order.
  - 3. A requested deviation will not be approved if the requested deviation is acceptable but the requested deviation will or should result in a change in Contract Price or Contract Times. Submit any requested deviation that requires a change in Contract Price or

Contract Times as a Change Proposal for approval prior to resubmitting the Shop Drawing.

- E. Contractor is to resubmit a complete Shop Drawing incorporating revisions until it is acceptable and marked “Approved” or “Approved as Noted” and is assigned an action per Paragraph 1.10.B.3 that indicates that the Shop Drawing process is closed.
- F. Information that is submitted as a Shop Drawing that should be submitted as Product Data or other type of document, or is not required may be returned without review, or may be deleted. No further action is required and the Shop Drawing process for this document will be closed.

#### 1.11 RESUBMISSION REQUIREMENTS

- A. Make all corrections or changes required by the Design Professional in the document and resubmit to the Construction Manager until approved.
- B. Resubmit a complete Shop Drawing for each resubmittal. The last approved Shop Drawing must not rely on previous submissions. The final Shop Drawing is to provide a complete record for the Owner’s records.
- C. Revise initial drawings or data and resubmit as specified for the reviewed document.
  - 1. Highlight or cloud in green those revisions which have been made in response to the previous reviews by the Design Professional. This will include changes previously highlighted or clouded in yellow to direct attention to Design Professional to items requiring selections, decisions by the Design Professional or highlighted or clouded in orange for a requested deviation from the Contract Documents, or comments in red made by the Construction Manager.
  - 2. Highlight and cloud new items in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action to be taken by the Design Professional.
  - 3. Highlight and cloud new items in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Numbering for these new items is to start with the next number following the last Shop Drawing deviation requested. Include explanatory comments in the Shop Drawing Deviation Request form.
- D. Pay for excessive review of Shop Drawings.
  - 1. Excessive review of Shop Drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.
  - 2. Review of Shop Drawings or Samples will be an additional service requiring payment by the Contractor if the Contractor submits a substitution for a product for which a Shop Drawing or Sample has previously been approved, unless the need for such change is beyond the control of Contractor.

3. Cost for additional review time will be billed to the Owner by the Design Professional for the actual hours required for the review of Shop Drawings by Design Professional and in accordance with the rates listed in Section 00 73 00 "Supplementary Conditions."
4. A set-off will be included in each Application for Payment to pay the cost for the additional review. The set-off will be based on invoices submitted to the Owner for these services.
5. Need for more than one resubmission or any other delay in obtaining Design Professional's approval of Shop Drawings will not entitle the Contractor to an adjustment in Contract Price or an extension of Contract Times.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 33 03 PRODUCT DATA**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Submit Product Data as required by the Contract Documents and as reasonably requested by the Construction Manager. Provide Product Data for all products unless a Shop Drawing is required for the same item.
- B. Submit Product Data to provide documents that allow the Owner to:
  - 1. Record the products incorporated into the Project;
  - 2. Record detailed information about products regarding their fabrication, installation, commissioning, and testing; and
  - 3. Provide replacement or repair of products at some future date.
- C. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the receipt or cursory review of Product Data.
- D. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be made by an approved Change Order or Field Order.

#### **1.02 QUALITY ASSURANCE**

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Product Data not meeting these criteria will not be accepted and must be resubmitted.

#### **1.03 CONTRACTOR'S RESPONSIBILITIES**

- A. Furnish Product Data for products as indicated in the individual Specification Sections.
- B. Include Product Data in the Document Register required by Section 01 33 00 "Document Management" to indicate the Product Data to be submitted, the dates on which documents are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Complete the following before submitting Product Data:
  - 1. Prepare Product Data and coordinate with Shop Drawings, Samples, Product Data for related products, and with the requirements of the Contract Documents;
  - 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information;
  - 3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and



4. Determine and verify information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- D. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Product Data and are accurate;
  2. Location of existing structures, utilities, and equipment related to the Product Data have been shown and conflicts between the products, existing structures, utilities, and equipment have been brought to the attention of the Construction Manager;
  3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
  4. Product Data is complete for its intended purpose; and
  5. Conflicts between the Product Data related to the various Subcontractors and Suppliers have been resolved.
- E. Review Product Data prior to submitting to the Construction Manager. Certify that all Product Data has been reviewed by the Contractor and is in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Product Data.

#### 1.04 DOCUMENTATION

- A. Include a complete description of the material or equipment to be furnished, including:
1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;
  2. Weights, gauges, materials of construction, external connections, anchors, and supports required;
  3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;
  4. All applicable standards;
  5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
  6. Wiring and piping diagrams and related controls;
  7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and
  8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.
- B. Submit information for all components and related equipment required for a complete and operational system in one submittal.
1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.

2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.

#### 1.05 SPECIAL CERTIFICATIONS AND REPORTS

- A. Provide all required certifications with the Product Data as specified in the individual Specification Sections:
  1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product when installed will meet the requirements of the Contract Documents and is part of the Product Data. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Product Data.
  2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.
  3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
  4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

#### 1.06 WARRANTIES AND SERVICE AGREEMENTS

- A. Provide warranties and service agreements per Section 01 78 36 "Warranties and Service Agreements."

#### 1.07 PRODUCT DATA SUBMITTAL PROCEDURES

- A. Submit Product Data to the Construction Manager. Send all documents in digital format for processing.
  1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
  2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Product Data.
  3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Product Data for more than one system in the same Submittal.

4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
5. Define abbreviations and symbols used in Product Data.
  - a. Use terms and symbols in Product Data consistent with the Contract Drawings.
  - b. Provide a list of abbreviations and their meaning as used in the Product Data.
  - c. Provide a legend for symbols used on Product Data.
6. Mark Product Data to reference:
  - a. Related Specification Sections;
  - b. Drawing number and detail designation;
  - c. Equipment designation or name;
  - d. Schedule references;
  - e. System into which the product is incorporated; and
  - f. Location where the product is incorporated into the Project.
- B. Complete the certification required by Paragraph 1.03.F.

#### 1.08 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Product Data will be received by the Construction Manager, logged, and provided to Owner as the Project record.
  1. Product Data may be reviewed to see that the information provided is adequate for the purpose intended. Product Data not meeting the requirements of Paragraph 1.02 may not be approved.
  2. Product Data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
  3. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Product Data. Contract modifications can only be approved by a Change Order or Field Order.
- B. Construction Manager may take the following action in processing Product Data:
  1. File Product Data as received if the cursory review indicates that the document meets the requirements of Paragraph 1.02. Document will be marked "Filed as Received" and "Documents Filed." No further action is required on that Product Data.
  2. Not approve the Product Data for one of the following reasons:
    - a. The documentation requirements of the Contract Documents indicate that the document submitted as Product Data should have been submitted as a Shop Drawing. The Product Data will be marked "Not Approved" and "Submit as Shop Drawing." No further action is required on this document as Product Data and the Product Data process will be closed. Resubmit the document as a Shop Drawing per Section 01 33 02 "Shop Drawings."

- b. The cursory review indicates that the document does not meet the requirements of Paragraph 1.02. The Product Data will be marked “Not Approved” and “Revise and Resubmit.” Contractor is to resubmit the Product Data until it is acceptable and marked “Filed as Received.” When Product Data is filed, no further action is required and the Product Data process will be closed.
  - c. The Product Data is not required by the Contract Documents nor is applicable to the Project. The Product Data will be marked “Not Approved” and “Cancelled.” No further action is required and the Product Data process will be closed.
- C. Contractor is to resubmit the Product Data until it is acceptable and marked “Filed as Received.”

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 33 04 OPERATION AND MAINTENANCE DATA**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Prepare a complete and detailed operation and maintenance manual (manual) for each type and model of equipment or product furnished and installed under this Contract.
- B. Prepare manuals in the form of an instruction manual for the Owner.
- C. Provide complete and detailed information specifically for the products or systems provided for this Project. Include the information required to operate and maintain the product or system.
- D. Manuals are to be provided in addition to any information packed with or attached to the product when delivered. Remove information packed with or attached to the product and include this information as an attachment to the manual.
- E. Include cost for manuals provided by Suppliers and Subcontractors as described in this Section in the Cost of Work for that equipment item.

#### **1.02 DOCUMENTATION**

- A. Submit manuals in accordance with Section 01 33 00 "Document Management." Attach a copy of the Operation and Maintenance Manual Review Report form provided by the Construction Manager to each manual with pertinent information completed.
- B. Provide one preliminary electronic copy of the manual to the Construction Manager for review within 15 days after review of any equipment submittal by the OPT.
- C. Provide one electronic copy and three printed copies of the final manual after:
  - 1. Preliminary manuals have been approved;
  - 2. Field test records have been incorporated into the manual; and
  - 3. Record Documents per Section 01 31 13 "Project Administration" have been approved and have been incorporated in the final manual.
- D. Provide copies of the manufacturer's warranties, guarantees, or service agreements in accordance with Section 01 70 00 "Execution and Closeout Requirements."

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Provide digital files for each manual as specified in Paragraph 2.02.
  - 1. Use filenames that correspond to the equipment designation shown in the Contract Documents or other equipment designations provided by the OPT.
  - 2. Submit a preliminary version of the electronic manual for review. Provide a final version of the manual incorporating OPT's comments.
- B. Provide printed copies of each manual as specified in Paragraph 2.03.

## 2.02 ELECTRONIC MANUAL FORMAT

- A. Manual contents are to be submitted in electronic format to the Construction Manager.
- B. Provide individual electronic files for each manual.
  - 1. Maximum file size is 75 MB. If manual is greater than maximum allowable file size, provide individual files for each major section of manual.
  - 2. Acceptable file types for written documents are Portable Document File (PDF) or provide manual text in Microsoft Word. Provide drawings in native format and PDF format. All files must be compatible with the latest software version available.
  - 3. Filename must identify the equipment location, equipment manufacturer, and date equipment placed in service, e.g. JCC1-Pump Room-Manufacturer-200503.pdf.
  - 4. Each electronic file must contain a table of contents at the beginning of the file which includes hypertext links or bookmarks to navigate the file contents per section/chapter.
  - 5. Scanned images of written documents are not acceptable. Document must allow character selection. Text within a file must be transferable to other documents.
  - 6. Drawing files must have the ability to turn on/off drawing layers within the file.

## 2.03 PRINTED MANUAL FORMAT

- A. Printed copies of each manual are to be submitted as follows:
  - 1. Print manuals on heavy, first quality 8-1/2 x 11 paper.
    - a. Reduce drawings and diagrams to 8-1/2 x 11 paper size.
    - b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for three-ring binder use. Provide a typed identification label on each sheet protector.
    - c. Punch paper for standard three-ring binders.
  - 2. Place manuals in heavy duty presentation, d-ring binders with clear front, back, and spine covers.
  - 3. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:
    - a. Name of Owner;
    - b. Project name;
    - c. Volume number; and
    - d. Table of contents.
  - 4. Insert the name of the Project and volume number into the spine covers.
  - 5. Sheet lifters are to be provided.
  - 6. Minimum size is 2-inch capacity. Maximum size is 3-inch capacity. Fill binders to only three-fourths of its indicated capacity to allow for addition of materials to each binder by the Owner.

7. Provide index tabs for each section of the manual. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.
8. Manuals for several products or systems may be provided in the same binder. Correlate the data into related groups when multiple products or systems are included in the same binder.
  - a. Sections for each product or system must be included in the same binder.
  - b. Sections must be in numerical order from volume to volume.

### **PART 3 - EXECUTION**

#### **3.01 MANUAL ORGANIZATION AND CONTENTS**

- A. Provide a table of contents listing each section of the manual for each product or system.
  1. Assign a number and letter to each section in the manual.
    - a. The number is to correspond to the Owner's equipment numbering system or other system designated in the Contract Documents.
    - b. The letter assigned will represent the part of the manual, consistent with the manual contents as required by this Section.
  2. Identify each product or system using the nomenclature shown in the Contract Documents. Provide a cross reference to the Owner's numbering system and designations for equipment indicated in the Contract Documents if these are different.
- B. Include only the information that pertains to the product described. Annotate each sheet to:
  1. Clearly identify the specific product or component installed;
  2. Clearly identify the data applicable to the installation; and
  3. Delete or strike through references to inapplicable information.
- C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.
- D. Manuals for several products or systems may be provided in the same binder.
- E. Fill binders to only three-fourths of its indicated capacity to allow for addition of information by the Owner.

#### **3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT**

- A. Provide the following information in the first tabbed section of each manual:
  1. A description of the unit and component parts and how it functions.
  2. Operating instructions for pre-startup, startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.
  3. The sequence of operation by the controls manufacturer. Provide control diagrams by the manufacturer, modified to reflect the as-built, as-installed condition.

4. Include general assembly contract drawings, sections, and photographic views as necessary to completely depict and properly identify the equipment. Indicate the dimensions, weight, capacity, and design conditions for the equipment.
- B. Include detailed information to allow for the proper installation, calibration, testing, preventative, and corrective maintenance procedures in the second section of the manual or of each section of the manual information if the manual covers a multi-component equipment system. This information should include the following:
1. Maintenance instructions including assembly, installation, alignment, clearances, tolerances, and interfacing equipment requirements, adjustment, and checking instructions. Include any special rigging required to place the equipment into place, and any special test equipment required to place the equipment in service.
  2. A safety subsection which addresses all safety and tag-out procedures necessary to safely operate and maintain the equipment.
  3. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.
  4. Troubleshooting guide.
  5. A table showing the schedule of routine maintenance requirements and seasonal work which is not performed at a set frequency. Preventative maintenance tasking must address:
    - a. Daily/weekly inspections performed by operations personnel;
    - b. Routine preventative maintenance scheduled weekly, monthly, quarterly, semi-annually, or annually through major overhauls by maintenance personnel; and
    - c. Predictive maintenance work such as alignment, analysis of the equipment, vibration, flow, oil sampling, etc.
  6. Description of sequence of operation by the control manufacturer.
  7. Warnings for detrimental maintenance practices.
  8. Detailed corrective maintenance procedures including:
    - a. Detail equipment for complete disassembly and assembly;
    - b. Cross-sectional drawings or exploded views with all parts numbered to correspond with the numbers in the parts list to permit identification of the various parts;
    - c. A table of normal clearances, diameters, thickness of new parts, and limits permissible for wearing parts; and
    - d. List torque settings for nuts, bolts, and fasteners when critical to the equipment's performance.
- C. Include all necessary diagrammatic piping and wiring diagrams and miscellaneous contract drawings and equipment in the third section of the manual or of each section of the manual if the manual covers a multi-component equipment system.
- D. Provide spare parts information in the fourth section of the manual including:
1. Part numbers for ordering new parts;



2. Assembly illustrations showing an exploded view of the complex parts of the product;
  3. Predicted life of parts subject to wear;
  4. List of the manufacturer's recommended spare parts, current prices with effective date, and number of parts recommended for storage;
  5. Directory of a local source of supply for parts with company name, address, and telephone number;
  6. Complete nomenclature and list of commercial replacement parts; and
  7. Complete list of spare parts, spare equipment, tools, and materials that are turned over to the Owner.
- E. Provide statistical information from the original equipment manufacturer as to performance such as pump curves, flow charts insulation resistance, calibration, or test data sheets in the fifth section of the manual, including all field testing records used to verify actual performance.
  - F. Provide equipment name plate data installed on equipment and valves and equipment data sheets as required and furnished by the Owner in the sixth section of the manual.
  - G. Provide a copy of warranties and the date the warranty expires for equipment in the seventh section of the manual.

### 3.03 ELECTRICAL AND ELECTRONICS SYSTEMS MANUAL

- A. Provide all of the information listed in Paragraph 3.02 as appropriate and include the following information:
  1. Control schematics and point to point wiring diagrams prepared for field installation;
  2. Circuit directories of panel boards and terminal strips and as installed color coded wiring diagrams; and
  3. Other information as may be required by the individual Specification Sections.

### 3.04 ARCHITECTURAL PRODUCTS MANUAL

- A. Provide the following information:
  1. Information required for ordering replacement products;
  2. Instructions for care and maintenance;
  3. List of the manufacturer's recommended lubricants;
  4. The manufacturer's recommendations for types of cleaning agents and methods;
  5. Cautions against cleaning agents and methods that are detrimental to the product; and
  6. Recommended maintenance and cleaning schedule.
- B. Final balancing reports for mechanical systems.
- C. Other information as may be required by the individual Specification Sections.

3.05 LIST OF SERVICE ORGANIZATIONS

- A. Provide a directory of authorized service organizations with company name, address, telephone number, email address, and the contact person for warranty repair.

**END OF SECTION**

## **01 33 05 CONSTRUCTION PROGRESS SCHEDULE**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Prepare and submit a Progress Schedule for the Work and update the schedule on a monthly basis for the duration of the Project.
- B. Provide Progress Schedule in adequate detail to allow Owner to monitor progress and to relate submittal processing to sequential activities of the Work.
- C. Incorporate Contract Milestones into the schedule and show activities leading to achievement of these milestones.
- D. Assume complete responsibility for maintaining the progress of the Work per the Progress Schedule submitted.

#### **1.02 DOCUMENTATION**

- A. Submit the schedules to the Construction Manager. Send all documents in digital format for processing.
- B. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
- C. Provide schedules, schedule updates and revisions to the Construction Manager in electronic format in its originating software and in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management."
- D. Submit a preliminary Progress Schedule at the pre-construction conference.
- E. Submit a detailed Progress Schedule at least 10 days prior to the first payment request.
- F. Submit Progress Schedule updates monthly within 10 days after submitting Applications for Payment to indicate the progress made on the Project to the closing date for the Application for Payment. Failure to submit Progress Schedules will cause delay in the review and approval of subsequent Applications for Payment.

#### **1.03 PROGRESS SCHEDULE REQUIREMENTS**

- A. Progress Schedule is to be in adequate detail to:
  - 1. Ensure adequate planning, scheduling, and reporting during the execution of the Work;
  - 2. Ensure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers;
  - 3. Monitor the progress of the Work; and
  - 4. Evaluate the impact of proposed changes to the Contract Times and Project Schedule.
- B. Provide personnel with 5 years' minimum experience in scheduling construction work comparable to this Project. Prepare the Progress Schedule using acceptable scheduling software.

- C. Provide the Progress Schedule in the form of a computer-generated critical path schedule which includes Work to be performed on the Project. It is intended that the Progress Schedule accomplish the following:
  - 1. Give early warning of delays in time for correction.
  - 2. Provide detailed plans for the execution of the Work in the form of future activities and events in sequential relationships.
  - 3. Establish relationships of significant planned Work activities and provide a logical sequence for planned Work activities.
  - 4. Provide continuous current status information.
  - 5. Allow analysis of the Contractor's program for the completion of the Project.
  - 6. Permit schedules to be revised when the existing schedule is not achievable.
  - 7. Log the progress of the Work as it actually occurs.
- D. Provide a time-scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The chart is to indicate:
  - 1. Complete sequence of construction by activity;
  - 2. Identification of the activity by structure, location, and type of Work;
  - 3. Chronological order of the start of each item of Work;
  - 4. The activity start and stop dates;
  - 5. The activity duration; and production rates used to determine the duration;
  - 6. Successor and predecessor relationships for each activity;
  - 7. A clearly indicated single critical path; and
  - 8. Projected percentage of completion, based on dollar value of the Work included in each activity as of the first day of each month.
- E. Provide a Progress Schedule for Submittals:
  - 1. Indicate the specific dates each document is to be delivered to the Construction Manager.
  - 2. Allow a reasonable time to review each document, taking into consideration the size and complexity of the document, other documents being processed, and other factors that may affect review time.
  - 3. Include time for making revisions to the Shop Drawings and resubmitting the Shop Drawing for at least a second review.
  - 4. Assume a 14-day review cycle for each time a Shop Drawing is submitted for review unless a longer period is indicated in the Contract Documents or provided by the Construction Manager.
  - 5. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous documents and for time lost when documents are submitted for products that do not meet specification requirements.

#### 1.04 PROGRESS SCHEDULE REVISIONS

- A. Revise the Progress Schedule if it appears that the schedule no longer represents the actual progress of the Work.
  - 1. Submit a Plan of Action for schedule recovery if the Progress Schedule or earned value analysis indicates that the Project is more than 30 days behind schedule. The report is to include:
    - a. Number of days behind schedule;
    - b. Narrative description of the steps to be taken to bring the Project back on schedule; and
    - c. Anticipated time required to bring the Project back on schedule.
  - 2. Submit a revised Progress Schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.
- B. Revise the Progress Schedule to indicate any adjustments in Contract Times approved by a Modification.
  - 1. Include a revised Progress Schedule with Change Proposals if a change in Contract Times is requested.
  - 2. Construction Manager will deem any Change Proposal that does not have a revised Progress Schedule and request for a change in Contract Times as having no impact on the ability of the Contractor to complete the Project within the Contract Times.
- C. Updating the Progress Schedule to reflect actual progress is not considered a revision to the schedule.
- D. Applications for Payment will not be recommended for payment without a revised Progress Schedule and if required, the report indicating the Contractor's plan for bringing the Project back on schedule.

#### 1.05 FLOAT TIME

- A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.
- B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.
- C. Where several subsystems each have a critical path, the subsystem with the longest time of completion is the critical path and float time is to be assigned to other subsystems.
- D. Schedule completion date must be the same as the Contract completion date. Time between the end of construction and the Contract completion date is float time.

#### 1.06 MODIFICATION OF CONTRACT TIMES

- A. Contract Times cannot be changed by the submission of a Progress Schedule. Contract Times can only be modified by a Change Order or Contract Amendment.
- B. Submit a Change Proposal for any proposed change in Contract Times, and include justification for the change in accordance with the provisions of the Contract Documents.

#### 1.07 NEAR-TERM LOOK AHEAD SCHEDULES

- A. Provide a near-term look ahead schedule (NTLA Schedule) every 30 days, typically at periodic coordination meetings, using the form provided by the Construction Manager which shows the days of planned activity for the following:
  - 1. Submittals to be provided and day of anticipated return;
  - 2. Equipment and material deliveries;
  - 3. Arrival and departure of key construction equipment; and
  - 4. Activities for the Contractor and each Subcontractor.
- B. Coordinate NTLA Schedule with Project Schedule. Submit a report with each NTLA Schedule identifying deviations from the Project Schedule.
- C. Submit a report of near-term work planned in the previous NTLA Schedule that was delayed or not executed by marking actual activity on the previous near term look ahead schedule. Provide explanation of why planned work was not executed and plan to execute in the future and regain time lost.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

## **01 33 06 GRAPHIC DOCUMENTATION**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Furnish an adequate number of photographs of the Site to clearly depict the completed Project.
  - 1. Provide aerial photographs of the completed Project from an angle and height to include the entire Site.
  - 2. Provide a minimum of four different views.
  - 3. Photograph a panoramic view of the entire Site.
  - 4. Photograph all significant areas of completed construction.
  - 5. Do not take completion photographs until all construction trailers, excess materials, trash, and debris have been removed.
  - 6. Employ a professional photographer approved by the Construction Manager to photograph the Project.
- B. Provide video recordings of the Site.
  - 1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including streets, curb and gutter, utilities, driveways, fencing, landscaping, etc., prior the beginning of construction. Provide one copy of the dated and labeled recording to the Construction Manager before the start of construction. Provide additional recording as directed by the Construction Manager if the recording provided is not considered suitable for the purpose of recording pre-existing conditions.
  - 2. Provide a video recording of the Site after the Project is complete and all construction trailers, excess materials, trash, and debris have been removed. Provide a 360-degree view of the Project from a consistent height and angle.
  - 3. Format must allow photographic still shots to be extracted from the video recording.
- C. All photographs and video recordings are to become the property of the Owner. Photographs or recordings may not be used for public or private publication or display without the written consent of the Owner.
- D. Unmanned Aerial Vehicles used for aerial photography must be registered and piloted by licensed individuals in accordance with Laws and Regulations.

#### **1.02 DOCUMENTATION**

- A. Submit photographic documentation in accordance with Section 01 33 00 "Document Management."

#### **1.03 QUALITY ASSURANCE**

- A. Provide clear photographs and video recordings taken with proper exposure. View photographs and video recordings in the field and take new photographs or video recordings immediately if photos of an adequate print quality cannot be produced or video quality is

not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

## **PART 2 - PRODUCTS**

### **2.01 PHOTOGRAPHS**

- A. Provide photographs in digital format with a minimum resolution of 1280x960, accomplished without a digital zoom.
- B. Take photographs at locations acceptable to the Construction Manager.
- C. Provide a digital copy of each photograph taken.
- D. Identify each photograph with:
  - 1. Name of the Project.
  - 2. Date, time, location, and orientation of the exposure.
  - 3. Description of the subject of photograph.

### **2.02 VIDEO RECORDING**

- A. Provide video recordings in digital format that can be played with Windows Media Player in full screen mode without loss of resolution.
- B. Identify Project on video by audio or visual means.
- C. Provide video with file size that does not exceed 1 GB.
- D. Provide video resolution of at least 1080p.
- E. The quality of the video must be adequate to determine the existing conditions of the construction area. Camera panning must be performed while at rest; do not pan the camera while walking or driving. Camera pans should be performed at intervals to clearly view the entire construction area.
- F. Construction stationing is to be annotated in the video.
- G. The entire construction area recording must be submitted at once. Sections submitted separately will not be accepted.
- H. Site components must be video recorded in an organized sequential order with major components identified.

## **PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**



## 01 40 00 QUALITY MANAGEMENT

### PART 1 - GENERAL

#### 1.01 OVERVIEW

- A. Quality management refers to the overall process of delivering a completed Project to the Owner that complies with the requirements of the Contract Documents. Quality management applies to documentation, products, services, and the Work.
- B. Contractor is responsible for the quality of documentation, products, services, and the Work provided.
  - 1. Contractor is to integrate quality control procedures into the execution of the Work that are adequate to produce a Project that meets the requirements of the Contract Documents, while minimizing loss of time and increased costs. Contractor is solely responsible for time and cost impacts of correcting Defective Work.
  - 2. Contractor is to provide all testing and inspection required to control the quality of the Work in progress to determine that completed Work will comply with the requirements of the Contract Documents.
  - 3. Contractor is to provide verification or acceptance testing as required by the Contract Documents to demonstrate that the completed Work complies with the requirements of the Contract Documents, except for those test that the Owner has determined are to be conducted independent of the Contractor and identified as Owner testing in the Owner's Quality Management Plan.

#### 1.02 STANDARDS

- A. Provide testing laboratories that comply with the American Council of Independent Laboratories (ACIL) "Recommended Requirements for Independent Laboratory Qualifications."
- B. Perform testing in accordance with the published standards and procedures for testing listed in the Specifications and applicable Laws and Regulations.

#### 1.03 DOCUMENTATION

- A. Provide documentation which includes:
  - 1. Contractor's Quality Management Plan that establishes the methods of ensuring compliance with the Contract Documents. Submit this plan as Product Data per Section 01 31 13 "Project Administration."
  - 2. A statement of qualifications for any proposed testing laboratory that includes a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list of tests that can be performed, equipment used with date of last certification, and a list of recent projects for which testing has been performed with references for those projects.
  - 3. Certified Test Reports for products to be incorporated into the Project. Provide reports to indicate that the proposed products comply with the Contract Documents or indicate that the proposed products do not comply with the Contract Documents and why those

products do not comply. Submit Certified Test Reports as part of a Shop Drawing submitted per Section 01 33 02 "Shop Drawings."

4. Certified Test Reports for inspections and testing required in this Section and in other Sections of the Specifications. Provide reports to indicate that the Work complies with the Contract Documents or indicate that the Work does not comply with the Contract Documents and why the Work does not comply. Submit these test reports on forms provided by the Construction Manager per Section 01 33 00 "Document Management."
5. Certified Test Reports of Defective Work and Certified Test Reports documenting that successful corrective action has produced Work that complies with the Contract Documents. Maintain a register listing Defective Work and record when corrective action has produced Work that complies with the Contract Documents. Present this Defective Work register as part of the Quality Report at progress meetings as described in Paragraph 1.04.E. Incorporate this register in the closeout documentation per Section 01 70 00 "Execution and Closeout Requirements" to demonstrate that all Defective Work has been corrected.

#### 1.04 CONTRACTOR'S RESPONSIBILITIES

- A. Review the OQMP and provide a Contractor's Quality Control Plan (CQCP) outlining testing to be provided by the Contractor per Paragraph 1.06.
- B. Implement the CQCP to provide Work that complies with the requirements of the Contract Documents.
  1. Provide quality documents meeting the requirements of the Contract Documents.
  2. Provide services meeting the requirements of the Contract Documents.
  3. Provide the services of a Construction Materials Inspection and Testing (CMIT) provider meeting the requirements of this Section to provide testing required by the Contract Documents to demonstrate that products proposed for the Project in Shop Drawings and Product Data fully comply with the Contract Documents.
  4. Inspect and test products to be incorporated into the Project to identify defects before installing them. Do not install Defective products. Conspicuously mark Defective products and remove from the Site. If products are installed before the defect is recognized, remove the Defective products, mark them as Defective and remove them from the Site when the defect is recognized.
  5. Integrate production quality control measures into construction activities to produce Work meeting the requirements of the Contract Documents. Inspect self-performed Work and the Work of Subcontractors and Suppliers to identify defects. Correct or replace Defective Work.
  6. Provide facilities, equipment, and Samples required for inspections and tests.
    - a. Give the Construction Manager adequate notice before proceeding with Work that would interfere with inspections or testing.
    - b. Notify the Construction Manager and CMIT provider prior to the time that testing is required, providing adequate lead time to allow arrangements for inspections or testing to be performed.

- c. Do not proceed with Work that would impact the ability to correct defects, or with Work that would require that it be removed to correct defects, until testing is complete, and test results indicate that the corrected Work is acceptable.
  - d. Provide safe access for all CMIT activities, including those to be conducted as part of the Owner's Quality Management Program.
  - e. Cooperate fully with the performance of sampling, inspection, and testing. Provide personnel to assist with sampling or to assist in making inspections and field tests.
  - f. Provide Samples and products in adequate quantities for testing at the Site or at the production source of the product for testing.
  - g. Provide facilities required to store and cure test Samples.
  - h. Provide calibrated scales and measuring devices for OPT's use in performing inspections and testing.
  - i. Provide adequate lighting to allow OPT observations.
  - j. Make Contract Documents available to testing agencies when requested.
- C. Perform tests as indicated in Contract Documents. All verification testing is to be observed by the Construction Manager or its designated representative.
  - D. Submit test reports to the Construction Manager.
  - E. Provide an update on quality control activities performed the previous month and planned for the coming month at monthly progress meetings required by Section 01 31 13 "Project Administration."
  - F. Determine testing or inspections required to implement the CQCP. Include costs for additional testing and inspections required to meet the Contractor's quality control obligations in the Contract Price.

#### 1.05 CONTRACTOR'S QUALITY CONTROL MANAGER

- A. Provide a Quality Control Manager for the Project. Quality Control Manager must have authority to reject Defective Work, redirect the efforts of the Contractor, Subcontractor and Suppliers to correct Defective Work, and implement steps to prevent future Defective Work.
- B. The resident superintendent or an approved assistant can serve as Quality Control Manager, provided other duties will allow adequate time to serve in this capacity.

#### 1.06 CONTRACTOR'S QUALITY CONTROL PLAN

- A. Provide a CQCP that describes testing and inspections for Work performed at the Site and at remote locations. Include Work by Subcontractors and Suppliers. The CQCP is to include:
  - 1. A description of the quality control organization, including an organization chart showing lines of authority to control the quality of Work.
  - 2. Documentation describing name, qualifications (in resume format), duties, responsibilities, and level of authority of the Quality Control Manager.
  - 3. The name, qualifications (in resume format), duties, responsibilities, and authorities of other persons assigned a quality control function.

4. Procedures for scheduling, reviewing, certifying, and managing documentation including documentation provided by Subcontractors and Suppliers.
  5. Control, verification, and acceptance testing procedures for each specific test. Include:
    - a. Name of tests to be performed;
    - b. Specification paragraph requiring test;
    - c. Parameters of Work to be tested;
    - d. Test frequency;
    - e. Persons responsible for each test; and
    - f. Applicable industry testing standards and laboratory facilities to be used for the test.
  6. Incorporate the testing specified in the OQMP into the CQCP, specifically identifying the tests or inspections that will be provided by the OQMP;
  7. Procedures for tracking and documenting quality management efforts per Paragraph 1.03.
  8. Reporting procedures which incorporate the use of forms provided by the Construction Manager.
  9. The name of the proposed testing laboratories along with documentation of qualifications per Paragraph 1.03.
- B. Use the Contractor's Quality Control Plan Checklist provided by the Construction Manager to review the CQCP before submitting and include a copy of the completed checklist with the CQCP. Do not begin Work until the CQCP is accepted. Submit an interim plan covering only the portion of Work to be performed if the Contractor plans to begin Work prior to submitting the complete CQCP for the Project. Do not begin Work on other parts of the Project until the complete CQCP is accepted.
  - C. Meet with the OPT 7 days after CQCP is submitted and before start of construction to discuss the CQCP.
  - D. Notify the Construction Manager of any changes to the CQCP or quality control personnel.

#### 1.07 CONTRACTOR'S USE OF OWNER'S TEST REPORTS

- A. Contractor will receive copies of all test reports documenting the Owner's verification tests. Contractor is entitled to rely on the accuracy of these tests results and use these as part of its quality control efforts.
- B. Contractor may submit a Change Proposal if the Owner's testing program deviates significantly from the OQMP. Contractor must demonstrate that actual testing and inspection costs were incurred implementing the CQCP as a result of Owner's decision to not provide testing described in the OQMP.

#### 1.08 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

- A. The testing laboratory representatives are limited to providing testing services and interpreting the results of the test performed.

- B. The testing laboratory is not authorized to:
  - 1. Alter the requirements of the Contract Documents;
  - 2. Accept or reject any portion of the Work;
  - 3. Perform any of the duties of the Contractor; or
  - 4. Direct or stop the Work.

#### 1.09 TEST REPORTS

- A. Certified Test Reports are to be prepared for all tests.
  - 1. Tests performed by testing laboratories may be submitted on their standard test report forms if acceptable to the Owner using the process directed by the Construction Manager. These reports must include the following:
    - a. Name of the Owner, Project title and number, and name of the Contractor;
    - b. Name, address, and telephone number of the laboratory;
    - c. Name and signature of the laboratory personnel performing the test;
    - d. Description of the product being sampled or tested;
    - e. Date and time of sampling, inspection, and testing;
    - f. Date the report was issued;
    - g. Description of the test performed;
    - h. Weather conditions and temperature at time of test or sampling;
    - i. Location at the Site or structure where the test was taken;
    - j. Standard or test procedure used in making the test;
    - k. A description of the results of the test;
    - l. Statement of compliance or non-compliance with the Contract Documents; and
    - m. Interpretations of test results, if appropriate.
  - 2. Submit reports on tests performed by the Contractor, Subcontractors, or Suppliers as directed by the Construction Manager.
  - 3. OPT will prepare test reports on tests performed by the OPT.
- B. Submit test reports as directed by the Construction Manager within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention. Notify the Construction Manager, using acceptable means other than the test report, immediately of any test that fails to comply with the Contract Documents.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures. Provide facilities for storing, curing, and processing test specimens as required by test standards to maintain the integrity of Samples. Transport test specimens in a manner to prevent damage to specimens while in transit.

## **PART 2 - PRODUCTS**

### **2.01 TESTING APPARATUS**

- A. Furnish testing apparatus and related accessories necessary to perform the tests.

### **2.02 SAMPLE PRODUCTS**

- A. Provide Samples of products in adequate quantity for testing.

## **PART 3 - EXECUTION**

### **3.01 IMPLEMENTING CONTRACTOR'S QUALITY CONTROL PLAN**

- A. Perform quality control observations and testing as required in each Section of the Specifications and where indicated on the Drawings.
- B. Include the phases listed below for each definable work task. A definable work task is one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be work by the same trade in a different environment.
  - 1. Planning Phase: Perform the following before beginning each definable work task:
    - a. Review the Contract Documents.
    - b. Review documents the Contractor will submit and determine that they are complete in accordance with the Contract Documents.
    - c. Check to ensure that all materials and/or equipment have been tested, submitted, and approved.
    - d. Examine the work area to ensure that all required preliminary Work has been completed and complies with the Contract Documents.
    - e. Examine required materials, equipment, and sample Work to ensure that they are on hand, conform to Contract Documents, Shop Drawings and Product Data, and are properly stored.
    - f. Review requirements for quality control inspection and testing.
    - g. Discuss procedures for controlling quality of the Work. Document construction tolerances and workmanship standards for the work task.
    - h. Check that the portion of the plan for the Work to be performed incorporates document review comments.
    - i. Discuss results of planning phase with the Construction Manager. Conduct a meeting attended by the Construction Manager, Quality Control Manager, superintendent, other quality control personnel as applicable, and the foreman responsible for the work task. Instruct applicable workers as to the acceptable level of workmanship required to meet the requirements of the Contract Documents. Document the results of the planning phase actions by separate meeting minutes prepared by the Quality Control Manager and attached to the quality control report.

- j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.
- 2. Work Phase: Complete this phase after the planning phase.
  - a. Notify the Construction Manager at least 1 week in advance of beginning the Work and discuss the review of the planning phase effort to indicate that requirements have been met.
  - b. Check the Work to ensure that it is in full compliance with the Contract Documents.
  - c. Verify adequacy of controls to ensure full compliance with the Contract Documents. Verify required control inspection and testing is performed.
  - d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required Sample panels as appropriate.
  - e. Repeat the work phase for each new crew to work on-site, or any time acceptable specified quality standards are not being met.
- 3. Follow-Up Phase: Perform daily checks to ensure control activities, including control testing, are providing continued compliance with contract requirements.
  - a. Make checks daily and record observations in the quality control documentation.
  - b. Conduct follow-up checks and correct all defects prior to the start of additional work tasks that may be affected by the Defective Work. Do not build upon nor conceal Defective Work.
  - c. Conduct a review of the Work at least 1 month prior to the expiration of the correction period prescribed in the General Conditions with the OPT. Correct defects as noted during the review.
- C. Conduct additional planning and work phases if:
  - 1. The quality of on-going Work is unacceptable;
  - 2. Changes are made in applicable quality control staff, on-site production supervision, or crews;
  - 3. Work on a task is resumed after a substantial period of inactivity; or
  - 4. Other quality problems develop.

### 3.02 DEFECTIVE WORK

- A. Immediately correct any Defective Work or notify the Construction Manager why the Work is not to be corrected immediately and when corrective action will be completed.
- B. Work performed that is connected or adjacent to Defective Work or Work that would have to be removed to correct Defective Work is also considered to be Defective. Contractor is responsible for all costs associated with replacing any acceptable Work that must be removed, or might be damaged by corrective actions.
- C. Document Defective Work, corrective actions taken to correct defects, and that corrected Work complies with the Contract Documents.
- D. Implement countermeasures to prevent future Defective Work.

- E. No payment will be made for Defective Work. Remove Work from the Application for Payment if Work paid for on a previous Application for Payment is found to be Defective.
- F. Owner will withhold payment for Defective Work or Work that has not been tested or inspected in accordance with the CQCP, OQCP, or the Contract Documents.

**3.03 VERIFICATION TESTING FOR CORRECTED DEFECTS**

- A. Provide verification testing on corrected Work when corrective action is complete to demonstrate that the corrected Work complies with the Contract Documents. Conduct the same tests or inspections used to determine that the original Work was Defective. Different tests or methods may be used if approved by the Owner. Document that Defective Work has been corrected with the Construction Manager.
- B. Pay for verification testing until Work meets quality requirement set forth in the Contract Documents. OPT may perform verification testing as part of the Owner's Quality Management Program and impose a set-off to recover the cost for this testing.

**END OF SECTION**



## **01 50 00      TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 - GENERAL**

#### **1.01      SUMMARY**

- A. Provide temporary facilities, including OPT's field office, Contractor's field offices, storage sheds, workshops, and other facilities needed to complete the Work.
- B. Provide temporary utilities needed to support the operation of the facilities and construction activities.
- C. Provide and maintain temporary project identification signs for Owner and Funding Agency.
- D. Provide temporary informational signs to identify key elements of construction and direct the flow of traffic.
- E. Provide a weatherproof kiosk for display of permits and other notices required by Laws and Regulations.

#### **1.02      DOCUMENTATION**

- A. Submit Shop Drawings in accordance with Section 01 33 02 "Shop Drawings" for the following:
  - 1. Project identification sign.
  - 2. Office Floor Plan: Provide a scaled floor plan prior to installation of OPT's field office. Include details for:
    - a. Telephone equipment;
    - b. Internet equipment;
    - c. Computer equipment;
    - d. Security/alarm systems; and
    - e. Office furniture and appliances.

#### **1.03      QUALITY ASSURANCE**

- A. Inspect and test each utility before using facilities. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use of facilities.

#### **1.04      DELIVERY, STORAGE, AND HANDLING**

- A. Transport, unload, and set up all temporary buildings and utilities.

#### **1.05      JOB CONDITIONS**

- A. Locate buildings and sheds at the Site as indicated or as approved by the OPT.
- B. Prepare the Site by removing trees, brush, or debris and performing demolition or grubbing needed to clear a space adequate for the structures.

- C. Provide Contractor's temporary facilities and utilities in time to avoid delays in the performance of the Work.
- D. Provide OPT's field office, complete and ready for occupancy, and use no later than 7 days after the Notice to Proceed. Applications for Payment will not be processed until OPT's field office facilities are completed and approved.
- E. Provide and maintain temporary facilities and utilities.
- F. Operate temporary facilities in a safe and efficient manner.
  - 1. Restrict loads on utilities to operate within their designed or designated capacities.
  - 2. Provide sanitary conditions. Prevent public nuisance or hazardous conditions from developing or existing at the Site.
  - 3. Prevent freezing of pipes, flooding, or the contamination of water.
  - 4. Maintain site security and protection of the facilities.
- G. Remove temporary facilities and utilities when construction is complete and removal is approved by the Construction Manager.

## **PART 2 - PRODUCTS**

### **2.01 SIGN MATERIALS**

- A. Provide wood or metal signs in sound condition, structurally adequate to withstand wind and weather.
- B. Provide 3/4-inch exterior grade A/D face veneer plywood with medium density overlay for sign surface.
- C. Provide galvanized or stainless steel bolts, brackets, fasteners, and other hardware.
- D. Provide exterior quality coatings.

### **2.02 CONTRACTOR'S FIELD OFFICE**

- A. Furnish a field office of adequate size for Contractor's use.
- B. Subcontractors may provide their own field offices only when space is available on the Site and the OPT agrees to its size, condition, and location.

### **2.03 TEMPORARY STORAGE BUILDINGS**

- A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the Site that might be affected by weather.

### **2.04 TEMPORARY SANITARY FACILITIES**

- A. Provide sanitary facilities at the Site for the entire duration of the Project. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority. On large sites, provide portable toilets at such locations so that no point at the Site will be more than 600 feet from a toilet.

- B. Use these sanitary facilities. Do not use restrooms within existing or Owner-occupied buildings.

#### 2.05 TEMPORARY HEAT

- A. Provide heating devices needed to protect buildings during construction. Provide fuel needed to operate the heating devices and attend the heating devices at all times they are in operation, including overnight operations.

#### 2.06 TEMPORARY UTILITIES

- A. Provide the temporary utilities for administration, construction, testing, disinfection, and startup of the Work, including electrical power, water, and telephone. Pay all costs associated with furnishing temporary utilities.
  - 1. Provide a source of temporary electrical power of adequate size for construction procedures.
    - a. Use existing power systems where spare capacity is available. Provide temporary power connections that do not adversely affect the existing power supply. Submit connections to the Construction Manager for approval prior to installation.
    - b. Provide electrical pole and service connections that comply with Laws and Regulations and the requirements of the power company.
  - 2. Provide temporary water. Potable water is not available at the site.
  - 3. Provide telephone service to the Site and install telephones inside the Contractor's and OPT's field offices.
- B. Provide power for construction and storage. Provide power to energize space heaters for stored electrical equipment.

#### 2.07 WATER FOR CONSTRUCTION

- A. Provide temporary water. Water is not available at the site. Non-potable water may be used for hydraulic testing of non-potable basins or pipelines. Include the cost of water in the Contract Price.

### **PART 3 - EXECUTION**

#### 3.01 LOCATION OF TEMPORARY FACILITIES

- A. Locate temporary facilities in areas approved by the Construction Manager. Construct and install signs at locations approved by the Construction Manager. Install informational signs so they are clearly visible.

#### 3.02 PROJECT IDENTIFICATION SIGNS

- A. Arrange for a professional sign painter to paint and erect a sign for the Site in accordance with the sign information provided in the Contract Documents or provided by Owner and Funding Agencies. Sign will include identification of the OPT and Contractor (including appropriate logos, as required) and other Project information as determined by the Construction Manager. Paint sign on a 4-foot by 8-foot by 3/4-inch exterior grade plywood

board. Frame plywood with 2 x 4 wood frame and mount on not less than two 4 x 4 posts. House plywood board in a channel routed 1/2 inch deep in the 2 x 4 frame. Shoulder, glue, and screw corners.

### 3.03 TEMPORARY LIGHTING

- A. Provide temporary lighting inside buildings once buildings are weatherproof.
- B. Provide exterior security lighting.
- C. Provide lighting that is adequate to perform Work within any space. Temporary lights may be removed once the permanent lighting is in service.
- D. Provide portable flood lights at any time that Work will be performed outside the structure at night. Provide adequate lighting at any location Work is being performed.

### 3.04 DRINKING WATER

- A. Provide all field offices with potable water. Provide a dispenser and cooling apparatus if bottled drinking water is provided.
- B. Pay for water services and maintain daily.

### 3.05 CONSTRUCTION FENCE

- A. Install and maintain a chain-link construction fence around the Site and off-site storage yards. Fence must be a minimum 6 feet high. Provide gates with padlocks.

### 3.06 REMOVAL OF TEMPORARY FACILITIES

- A. Remove temporary buildings, sheds, and utilities at the conclusion of the Project and restore the Site to original condition or finished condition in accordance with the Drawings.
- B. Remove informational signs upon completion of construction.
- C. Remove project identification signs, framing, supports, and foundations upon completion of the Project.

### 3.07 MAINTENANCE AND JANITORIAL SERVICE

- A. Provide janitorial service for the OPT's field office on a weekly basis or as requested. Empty trash receptacles daily or as needed.
- B. Maintain signs and supports in a neat, clean condition. Repair damage to structures, framings, or signs.
- C. Repair any damage to Work caused by placement or removal of temporary signage.
- D. Service, maintain, and replace, if necessary, the field office computer equipment throughout the Project as required by the OPT including replacement cartridges for all office equipment.

## END OF SECTION

## **01 57 00 TEMPORARY CONTROLS**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Provide labor, materials, equipment, and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- B. Construct temporary impounding works, channels, diversions, furnishing, and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

#### **1.02 DOCUMENTATION**

- A. Provide Shop Drawings in accordance with Section 01 33 02 "Shop Drawings."
- B. Provide copies of notices, records, and reports required by the Contract Documents or Laws and Regulations as Product Data in accordance with Section 01 31 13 "Project Administration."

#### **1.03 QUALITY ASSURANCE**

- A. Construct and maintain temporary controls with adequate workmanship using durable materials to provide effective environmental management systems meeting the requirements of the Contract Documents and Laws and Regulations. Use materials that require minimal maintenance to prevent disruption of construction activities while providing adequate protection of the environment.
- B. Periodically inspect systems to determine that they are meeting the requirements of the Contract Documents.

#### **1.04 POLLUTION CONTROL**

- A. Prevent the contamination of soil, water, or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.
- B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.
  - 1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-site locations in an acceptable manner.
  - 2. Excavate contaminated soil and dispose at an off-site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.
  - 3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal site.

4. Comply with Laws and Regulations regarding the disposal of pollutants.
- C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or contaminated soil is considered contaminated. Do not allow contaminated water to enter streams or water courses, leave the Site in a non-contained form, or enter non-contaminated areas of the Site.
  1. Construct temporary holding ponds or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.
  2. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

#### 1.05 EARTH CONTROL

- A. Remove excess soil, spoil materials, and other earth not required for backfill. Control stockpiled materials to eliminate interference with Contractor and Owner's operations.
- B. Dispose of excess earth off the Site. Provide written approval from the property owner for soils deposited on private property as Product Data per Section 01 31 13 "Project Administration." Obtain approval of the OPT if this disposal impacts the use of Site or other easements.

#### 1.06 AIR POLLUTION CONTROL

- A. Air Pollution Watch Days:
  1. Air Pollution Watch Days (APWD) may occur in the following times:
    - a. Typical Ozone Season: May 1 through October 31.
    - b. Critical Emission Time: 6:00 a.m. to 10:00 a.m.
  2. Watch Days:
    - a. State or local environmental regulatory agencies, in coordination with the National Weather Service, may designate the following day as an APWD by 3:00 p.m. on the prior afternoon.
    - b. Begin work after 10:00 a.m. on designated APWD if work requires the use of heavy construction equipment for run times in excess of 1 hour prior to 10:00 a.m. Heavy construction equipment may be used prior to 10:00 a.m. if equipment is certified by EPA as "Low Emitting" or equipment burns Ultra Low Sulfur Diesel (ULSD), diesel emulsions, or alternative fuels such as CNG.
- B. Obtain air permit for construction activities per requirements of Laws and Regulations.

#### 1.07 TEMPORARY STORMWATER POLLUTION CONTROL

- A. Provide temporary stormwater pollution control per Section 01 57 23 "Temporary Stormwater Pollution Control."

## 1.08 MANAGEMENT OF WATER

- A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.
- B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.
- C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.
- D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.
- E. Remove the temporary construction and restore the Site in a manner acceptable to the Construction Manager and to match surrounding material at the conclusion of the Work.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Provide materials that comply with Laws and Regulations.

## PART 3 - EXECUTION

### 3.01 CONSTRUCTING, MAINTAINING, AND REMOVING TEMPORARY CONTROLS

- A. Construct temporary controls in accordance with Laws and Regulations.
- B. Maintain controls in accordance with regulatory requirements where applicable or in accordance with the requirements of the Contract Documents.
- C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls while they are still required.

**END OF SECTION**

## **01 57 23      TEMPORARY STORMWATER POLLUTION CONTROL**

### **PART 1 - GENERAL**

#### **1.01      SUMMARY**

- A. Furnish labor, materials, equipment, and incidentals necessary to provide stormwater pollution prevention for the duration of the construction period including furnishing, installing, and maintaining erosion and sediment control structures and procedures and properly removing the features when no longer required.
- B. Develop, implement, and maintain a stormwater pollution prevention plan (SWPPP) in compliance with local, state, and federal Laws and Regulations. Provide preventive measures to keep sediment and other pollutants from the construction activity from entering any stormwater system, including open channels.
- C. Comply with the North Carolina Department of Environmental Quality General Permit, NCG010000, (General Permit) to discharge stormwater under the National Pollutant Discharge Elimination System for construction activities that are also subject to the North Carolina Sedimentation Pollution Control Act of 1973.
- D. File all required legal notices and obtain required permits prior to beginning any construction activity.
- E. This Section provides guidelines and Best Management Practices information for the Contractor to use in adhering to all local, state, and federal environmental Laws and Regulations with respect to stormwater pollution prevention during construction activities.

#### **1.02      DOCUMENTATION**

- A. Documentation must be provided in accordance with Section 01 33 00 "Document Management."
- B. Submit copies of required notices and reports to the Construction Manager as Product Data in accordance with Section 01 33 03 "Product Data." Retain copies of these documents at the Site for review and inspection by the OPT or regulatory agencies at all times.
- C. Submit copies of required notices to local, state, and federal authorities and any other entity as required by the General Permit and applicable Laws and Regulations.
- D. Post a copy of required notices at the Site in a location where it is readily available for viewing by the general public and local, state, and federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.
- E. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the SWPPP required under the General Permit.
- F. Provide schedules in accordance with Paragraph 3.05.

#### **1.03      QUALITY ASSURANCE**

- A. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Drawings are not intended to be prescriptive but rather to convey



the intent to provide complete slope protection, erosion control, and stormwater pollution prevention for both the Owner's property and adjacent properties.

- B. Perform Work to comply with "Best Practices" as established by the General Permit or the local agency of jurisdiction.
- C. Contractor must develop and implement a SWPPP in accordance with the General Permit prior to the beginning of construction activity.
- D. Contractor assumes sole responsibility for implementing, updating, and modifying the General Permit per Laws and Regulations for the SWPPP and Best Management Practices.
- E. Stormwater pollution prevention measures must be established prior to the beginning of construction and maintained during the entire length of construction until final stabilization has been achieved for the area protected.
- F. All land-disturbing activities must be planned and conducted to minimize the area to be exposed at any one time as well as time of exposure, off-site erosion, sedimentation, and adverse water quality impacts.
- G. Surface water runoff originating upgrade of an exposed area must be managed to minimize erosion and sediment loss during the period of exposure.
- H. Install measures to control both the velocity and rate of release so as to minimize erosion and sedimentation of the receiving water body (i.e. , ditch, channel, stream) in accordance with regulatory requirements and as directed by the OPT.
- I. Periodically clean out and dispose of all sediment and other pollutants as necessary to maintain adequate treatment capacity of each pollution control feature. Clean out and properly dispose of all sediment and other stormwater pollutants at the time of completion of the Work.

#### 1.04 JOB CONDITIONS, CODES AND ORDINANCES

- A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional stormwater pollution prevention measures during construction beyond those required by state and federal Laws and Regulations, the Contractor must provide such measures at no additional cost.

#### 1.05 STANDARDS

- A. The applicable provisions of the following standards apply as if written here in their entirety:
  - 1. ASTM International (ASTM):

|            |                                                                                                                            |
|------------|----------------------------------------------------------------------------------------------------------------------------|
| ASTM D4632 | Standard Test Method for Grab Breaking Load and Elongation of Geotextiles, 90 pounds                                       |
| ASTM D4833 | Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 60 pounds           |
| ASTM D3786 | Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 280 psi |
| ASTM D4751 | Standard Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 70 (max) to No. 100 (min)       |

|            |                                                                                                                             |
|------------|-----------------------------------------------------------------------------------------------------------------------------|
| ASTM D4355 | Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus |
| ASTM D4318 | Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils                                        |
| ASTM D698  | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort                               |

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. All materials used for stormwater pollution prevention must meet the minimum design and specification requirements identified below for commonly used sediment loss prevention NCDEQ Stormwater Design Manual. The Contractor must use appropriate control devices to protect against stormwater pollution from construction site activities.
- B. Erosion control blankets (ECBs) to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following design criteria:
  1. The type and class of erosion control mat must be specified as appropriate for the slope of the area to be protected, the flow rate (sheet flow on cut/fill slopes) or velocity (concentrated flow in swales) of stormwater runoff in contact with the ECB, and the anticipated length of service.
  2. Erosion control blankets must meet the applicable NCDEQ Minimum Performance Standards as provided in its Erosion and Sediment Control Planning and Design Manual.
- C. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following design criteria:
  1. If 50 percent or less soil by weight passes the U.S. Standard sieve No. 200, select the apparent opening size (A.O.S.) to retain 85 percent of the soil.
  2. If 85 percent or more of soil by weight passes the U.S. Standard sieve No. 200, silt fences must not be used unless the soil mass is evaluated and deemed suitable by a soil scientist or geotechnical engineer concerning the erodibility of the soil mass, dispersive characteristics, and the potential grain-size characteristics of the material that is likely to be eroded.
  3. Silt fence fabric must meet the following minimum criteria:
    - a. Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 90 pounds.
    - b. Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 60 pounds.
    - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 280 psi.
    - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 70 (max) to No. 100 (min).

- e. Ultraviolet Resistance, ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus. Minimum 70 percent.
4. Filter stone for an overflow structure must be 1-1/2-inch washed stone containing no fine material. Angular shaped stone is preferable to rounded shaped stone.
5. Fence posts must be galvanized steel or equivalent and may be T-section or L-section, 1.3 pounds per linear foot minimum, and 4 feet in length minimum. Wood posts may be used depending on anticipated length of service and provided they are 4 feet in length minimum and have a nominal cross-section of 2 inches by 4 inches for pine or 2 inches by 2 inches for hardwoods.
6. Silt fence must be supported by galvanized steel wire fence fabric as follows:
  - a. 4-inch by 4-inch mesh size, W1.4/1.4, minimum 14-gauge wire fence fabric;
  - b. Hog wire, 12-gauge wire, small openings installed at bottom of silt fence;
  - c. Standard 2-inch by 2-inch chain link fence fabric; or
  - d. Other welded or woven steel fabrics consisting of equal or smaller spacing as that listed herein and appropriate gauge wire to provide support.
- D. Inlet protection used in new developments that include new inlets or roads with new curb inlets or during repairs to existing roadways are subject to the following design criteria:
  1. Filter fabric protection must be designed and maintained in a manner similar to a silt fence.
  2. Where applicable, filter fabric, posts, and wire backing must meet the material requirements specified in Paragraph 2.01.C.
  3. Filter gravel must be 3/4-inch washed stone containing no fines. Angular shaped stone is preferable to rounded shapes.
  4. Concrete blocks must be standard 8-inch by 8-inch by 16-inch concrete masonry units.
  5. When organic filter tubes are used, the designer must specify the type of material to be used (or excluded) on a particular site:
    - a. Straw filter material must be Certified Weed Free Forage. The straw must be in good condition, air-dried, and not rotten or moldy.
    - b. Compost must conform to the requirements for Erosion Control Compost in NCDEQ Erosion and Sediment Control Planning and Design Manual . Compost may provide some oil and grease removal; however, the large percentage of fines in compost will result in less filtering and more ponding of stormwater.
    - c. Wood chips must be 100 percent untreated chips and free of inorganic debris, such as plastic, glass, metal, etc. Wood chip size must not be smaller than 1 inch and must not exceed 3 inches in diameter. Shavings must not be more than 5 percent of the total mass.
  6. Bags used to secure inlet protection devices on pavement must be filled with aggregate, filter stone, or crushed rock that is less likely than sand to be washed into an inlet if the bag is broken. Filled bags must be 24 to 30 inches long, 16 to 18 inches

wide, and 6 to 8 inches thick. Bags must be polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 ounces per square yard and meet the following criteria:

- a. Greater than 300 psi Mullen Burst Strength using ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.
  - b. Greater than 70 percent UV Stability using ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus.
- E. Stone outlet sediment traps (bermed or excavated) used in situations where flows are concentrated in a drainage swale or channel are subject to the following design criteria:
1. The embankment must be placed on geotextile fabric meeting the following minimum criteria:
    - a. Tensile Strength, ASTM D4632 Text Method for Grab Breaking Load and Elongation of Geotextiles, 250 pounds.
    - b. Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 135 pounds.
    - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 420 psi.
    - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 20 (max).
  2. Fill placed to constrict the swale for construction of the excavated stone outlet sediment trap and fill placed for the berm in the bermed stone outlet sediment trap must consist of clay material, minimum Plasticity Index of 30, using ASTM D4318 Standard Test for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  3. The embankment must be comprised of well graded stone riprap with a size range of 6 to 12 inches in diameter.
- F. Sediment basins used as treatment devices for sites with disturbed areas of 10 acres and larger that are part of a common drainage area are subject to the following design criteria:
1. The embankment must be constructed with clay soil, minimum Plasticity Index of 30 using ASTM D4318 Standard Test for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  2. If the size of the detention basin meets or exceeds the above applicability, the design must be in accordance with state criteria, and the final construction Drawings and Specifications must be submitted to the NCDEQ for review and approval.
- G. Check dams used for long drainage swales or ditches to reduce erosive velocities are subject to the following design criteria:
1. Use geotextile filter fabric under check dams exceeding 12 inches in height. The fabric must meet the material specified for the Stone Outlet Sediment Trap discussed above.
  2. Loose, unconfined soil, wood chips, compost, and other material that can float or be transported by runoff must not be used to construct check dams.

3. Sand bags must not be used for check dams, due to their propensity to break and release sand that is transported by the concentrated flow in the drainage swale or ditch.
4. Rock Check Dams:
  - a. Stone must be well graded with stone size ranging from 3 to 6 inches in diameter for a check dam height of 24 inches or less.
  - b. The stone size range for check dams greater than 24 inches is 4 to 8 inches in diameter.
5. Rock Bag Check Dams Bags:
  - a. Fill material should be pea gravel, filter stone or aggregate that is clean and free of deleterious material.
  - b. Bag material must comply with the requirements of Inlet Protection above.
6. Sack Gabion Check Dams:
  - a. Sack gabions must be wrapped in galvanized steel, woven wire mesh. The wire must be 20 gauge with 1-inch diameter, hexagonal openings.
  - b. Stone must be well graded with a minimum size range from 3 to 6 inches in diameter.
7. Organic Filter Tube Check Dams:
  - a. Filter material used within tubes to construct check dams must be limited to coir, straw, aspen fiber and other organic material with high cellulose content.
  - b. The material should be slow to decay or leach nutrients in standing water and comply with the requirements for Inlet Protection above.
- H. Stabilized construction exits used for sites in which significant truck traffic occurs on a daily basis are subject to the following design criteria:
  1. The construction exit material must be a minimum thickness of 6 inches. The stone or recycled concrete used must be 3 to 5 inches in size with little or no fines.
  2. The geotextile fabric must meet the following minimum criteria:
    - a. Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 300 pounds.
    - b. Puncture Strength, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 120 pounds.
    - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 600 psi.
    - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 40 (max).

- I. Alternative pollution prevention measures selected by the Contractor must be identified from one or more of the following reference sources, as appropriate for the region of the construction activity:
  1. NCDEQ Erosion and Sediment Control Planning and Design Manual.
  2. Guilford County Unified Development Ordinance (UDO).
  3. Town of Summerfield Unified Development Ordinance (UDO).

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Prepare a SWPPP in accordance with applicable permit requirements for construction activity. Develop the SWPPP in conformance with the General Permit and any applicable local requirements.
- B. Prepare and implement the SWPPP prior to the beginning of construction activity in accordance with local, state, and federal Laws and Regulations.
- C. OPT may require Contractor to install stormwater pollution prevention devices and/or practices during construction in addition to those required under the approved SWPPP. Contractor must remain solely responsible for complying with all local, state, and federal Laws and Regulations.

#### **3.02 INSTALLATION**

- A. Erosion control blankets to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following installation criteria:
  1. Prior to the installation of any erosion control matting, all rocks, dirt clods, stumps, roots, trash, and any other obstructions that would prevent the mat from lying in direct contact with the soil must be removed.
  2. Anchor trenching must be located along the entire perimeter of the installation area, except for small areas with less than 2 percent slope.
  3. Installation and anchoring must conform to the recommendations shown within the manufacturer's published literature for the erosion control blanket.
  4. Anchors (staples) must be a minimum of 6 inches in length and 1 inch wide. They must be made of 11-gauge wire, or equivalent, unless the ECB is intended to remain in place with final stabilization and biodegrade.
  5. Particular attention must be paid to joints and overlapping material. Overlap along the sides and at the ends of ECBs should be per the manufacturer's recommendations for site conditions and the type of ECB being installed. At a minimum, the end of each roll of ECB must overlap the next roll by 3 feet and the sides of rolls must overlap 4 inches.
  6. After installation, check blankets for uniform contact with the soil, security of the lap joints, and flushness of the staples with the ground.

- B. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following installation criteria:
  1. Construct fences along a line of constant elevation (along a contour line if possible).
  2. Maximum drainage area must be 0.25 acres per 100 linear feet of silt fence.
  3. Maximum flow to any 20-foot section of silt fence must be 1 cfs.
  4. Maximum distance of flow to silt fence must be 200 feet or less. If the slope exceeds 10 percent, the flow distance must be less than 50 feet.
  5. Maximum slope adjacent to the fence must be 2:1.
  6. Stone overflow structures or other outlet control devices must be installed at all low points along the fence or spaced at approximately 300 feet if there is no apparent low point.
  7. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel to prevent bypass of runoff under the fence. Fabric must overlap at abutting ends a minimum of 3 feet and must be joined such that no leakage or bypass occurs. If soil conditions prevent a minimum toe-in depth of 6 inches or installation of support post to depth of 12 inches, silt fences must not be used.
  8. Sufficient room for the operation of sediment removal equipment must be provided between the silt fence and other obstructions in order to properly maintain the fence.
  9. The last 10 feet (or more) at the ends of a line of silt fence must be turned upslope to prevent bypass of stormwater. Additional upslope runs of silt fence may be needed every 200 to 400 linear feet, depending on the traverse slope along the line of silt fence.
- C. Inlet protection for new developments that include new inlets or roads with new curb inlets or during repairs to existing roadways are subject to the following installation criteria:
  1. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD), when installing inlet protection on publicly traveled streets or in developed areas. Ensure that inlet protection is properly designed, installed, and maintained to avoid flooding of the roadway or adjacent properties and structures.
  2. Maximum depth of flow must be 8 inches or less.
  3. A 2-inch overflow gap or weir is required on all curb inlet protection devices.
  4. Positive drainage is critical in the design of inlet protection. If overflow is not provided for at the inlet, excess flows must be routed through established swales, streets, or other watercourses to minimize damage due to flooding.
  5. Filter Fabric Protection:
    - a. Filter fabric protection is appropriate where the drainage area is less than 1 acre and the basin slope is less than 5 percent.
    - b. Filter fabric, posts, and wire mesh must meet the material requirements specified in Paragraph 2.01.C.

- c. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel. This entrenchment prevents any bypass of runoff under the fence.
  - d. Stone overflow structures must be installed where flow to the inlet is concentrated and more than 1 cfs according to the criteria in Paragraph 2.01.
- 6. Block and Gravel Protection (Curb and Drop Inlets):
  - a. Concrete blocks are to be placed on their sides in a single row around the perimeter of the inlet, with ends abutting.
  - b. Openings in the blocks should face outward, not upward. 1/2-inch by 1/2-inch wire mesh must then be placed over the outside face of the blocks covering the holes.
  - c. Filter stone must then be piled against the wire mesh to the top of the blocks with the base of the stone being a minimum of 18 inches from the blocks.
  - d. Alternatively, where loose stone is a concern (streets, etc.), the filter stone may be placed in appropriately sized geotextile fabric bags.
- 7. Excavated Impoundment Protection:
  - a. Excavated impoundment protection is only applicable to drop inlets.
  - b. It should not be applied to Y inlets because it will undermine the concrete pad surrounding the inlet opening. Nor can it be used for inlets on pavement.
  - c. With this protection method, it is necessary to install weep holes to allow the impoundment to drain completely.
  - d. The impoundment must be sized such that the volume of excavation is equal to or exceeds the runoff volume from the temporary control design storm (2-year, 24-hour) for the inlet's drainage area.
  - e. The trap must have a minimum depth of 1 foot and a maximum depth of 2 feet as measured from the top of the inlet and must have side slopes of 2:1 or flatter.
- 8. Organic Filter Tube Protection (Curb and Drop Inlets):
  - a. Organic filter tubes may be used on paved or unpaved surfaces. On paved surfaces, tubes must be secured in place by rock bags. On unpaved surfaces, the tubes must be embedded in the ground a minimum of 3 inches and staked at 4-foot spacing.
  - b. Designer must provide calculations and specify the diameter of tube to be used based on the inlet's drainage area and the flow rate of runoff to the inlet.
  - c. The minimum allowable diameter is 12 inches.
  - d. For curb protection, the diameter of the tube must be at least 2 inches less than the height of the inlet opening. The tube should not be allowed to block the entire opening, since it will clog.
  - e. The tube must be placed on 4-inch by 4-inch or 2-inch by 4-inch wire mesh to prevent the tube from sagging into the inlet. The tube should be long enough to extend a minimum of 12 inches past the curb opening on each side of the inlet.



- D. Stone outlet sediment traps (excavated or bermed) for situations where flows are concentrated in a drainage swale or channel are subject to the following installation criteria:
  1. The maximum drainage area contributing to the trap must be less than 10 acres for the excavated trap, and 5 acres or less for the bermed trap. For larger drainage areas a sediment basin must be used.
  2. The minimum storage volume must be the volume of runoff from the temporary control design storm (2-year, 24-hour) for the sediment trap's drainage area.
  3. The surface area of the design storage must be 1 percent of the area draining to the device.
  4. The maximum embankment height must be 6 feet as measured from the toe of the slope on the downstream side.
  5. Minimum width of the embankment at the top must be 2 feet.
  6. Embankment slope must be 1:5:1 or flatter.
  7. The embankment must have a depressed area to serve as the outlet with a minimum width of 4 feet.
  8. A 6-inch minimum thickness layer of 1-1/2-inch filter stone must be placed on the upstream face of the embankment when stormwater runoff contains fine silt and clay particles.
  9. The embankment must consist of stone riprap or a combination of compacted fill with stone riprap. The stone may be enclosed in wire mesh or a gabion basket and anchored to the channel bottom to prevent washing away.
  10. Fill must be placed in 8-inch loose lifts (maximum) and compacted to 95 percent Standard Proctor Density at optimum moisture content using ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
  11. Geotextile fabric, covered with a layer of stone, must extend past the base of the embankment on the downstream side a minimum of 2 feet.
  12. The outlet must be designed to have a minimum freeboard of 6 inches at design flow.
- E. Sediment basins for treatment devices for sites with disturbed areas of 10 acres and larger that are part of a common drainage area are subject to the following installation criteria:
  1. Design of the sediment basin should be coordinated with design of the permanent drainage infrastructure for the development. Sediment basin sizing and discharge volumes should be calculated using the NCDEQ Erosion and Sediment Control Planning and Design Manual or similar technical manual in accordance with the design criteria of the locality where the basin is constructed.
  2. Minimum capacity of the basin must be the calculated volume of runoff from a 2-year, 24-hour duration storm event plus sediment storage capacity of at least 1000 cubic feet.
  3. The basin must be laid out such that the effective flow length to width ratio of the basin is a minimum of 4:1. The effectiveness of sediment basins may be increased by using baffles to prevent short-circuiting of flow through the basin.

4. Top width of the embankment must be determined by the Design Professional based on the total height of the embankment as measured from the toe of the slope on the downstream side.
  5. Embankment side slopes must be 3:1 or flatter.
  6. Clay soil for the embankment must be placed in 8-inch lifts and compacted to 95 percent Standard Proctor Density at optimum moisture content using ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
  7. The primary outlet must have a minimum design dewatering time of 36 hours for the temporary control design storm (2-year, 24-hour).
  8. Whenever possible, the outlet must be designed to drain the basin in less than 72 hours to minimize the potential for breeding mosquitoes.
  9. The basin's primary outlet and spillway must be sized to pass the difference between the conveyance storm (25-year, 24-hour) and the temporary control design storm without causing damage to the embankment and structures.
  10. Unless infeasible, the primary outlet structure should withdraw water from the surface of the impounded water. Outlet structures that do this include surface skimmers, solid risers (non-perforated), flashboard risers, and weirs.
  11. The outlet of the outfall pipe (barrel) must be stabilized with riprap or other materials designed using the conveyance storm flow rate and velocity. Velocity dissipation measures must be used to reduce outfall velocities in excess of 5 feet per second.
  12. The outfall pipe through the embankment must be provided with anti-seep collars connected to the exterior of the pipe section or at a normal joint of the pipe material. The anti-seep collar material must be compatible with the pipe material used and must have a watertight bond to the exterior of the pipe section. The size and number of collars must be selected by the designer in accordance with the NCDEQ Erosion and Sediment Control Planning and Design Manual or similar technical manual in accordance with the design criteria of the locality where the basin is constructed.
  13. Risers used to discharge high flows must be equipped with an anti-vortex device and trash rack.
  14. Spillways must be constructed in undisturbed soil material (not fill) and must not be placed on the embankment that forms the basin.
- F. Check dams for long drainage swales or ditches to reduce erosive velocities are subject to the following installation criteria:
1. Typically, the dam height should be between 9 inches and 36 inches, depending on the material of which they are made. The height of the check dam must always be less than one-third the depth of the channel.
  2. Dams should be spaced such that the top of the downstream dam is at the same elevation as the toe of the upstream dam. On channel grades flatter than 0.4 percent, check dams should be placed at a distance that allows small pools to form between each check dam.

3. The top of the side of the check dam must be a minimum of 12 inches higher than the middle of the dam. In addition, the side of the dams must be embedded a minimum of 18 inches into the side of the drainage ditch, swale or channel to minimize the potential for flows to erode around the side of the dam.
4. Larger flows (greater than 2-year, 24-hour design storm) must pass the check dam without causing excessive upstream flooding.
5. Check dams should be used in conjunction with other sediment reduction techniques prior to releasing flow off-site.
6. Rock Check Dams: Rock check dams must have a minimum top width of 2 feet with side slopes of 2:1 or flatter.
7. Rock Bag Check Dams:
  - a. Rock bag check dams should have a minimum top width of 16 inches.
  - b. Bag length must be 24 to 30 inches, width must be 16 to 18 inches, and thickness must be 6 to 8 inches and having a minimum weight of 40 pounds.
  - c. Minimum rock bag dam height of 12 inches would consist of one row of bags stacked on top of two rows of bag. The dam must always be one more row wide than it is high, stacked pyramid fashion.
  - d. PVC pipes may be installed through the dam to allow for controlled flow through the dam. Pipe should be schedule 40 or heavier polyvinyl chloride (PVC) having a nominal internal diameter of 2 inches.
8. Sack Gabion Check Dams:
  - a. Sack gabion check dams may be used in channels with a contributing drainage area of 5 acres or less.
  - b. Wire mesh must be one piece, wrapped around the rock, and secured to itself on the downstream side using wire ties or hog rings.
  - c. Sack gabions must be staked with 3/4-inch rebar at a maximum spacing of 3 feet. Each wire sack must have a minimum of two stakes.
9. Organic Filter Tube Check Dams:
  - a. Organic filter tubes may be used as check dams in channels with a contributing drainage area of 5 acres or less.
  - b. Organic filter tubes must be a minimum of 12 inches in diameter.
  - c. Staking of filter tubes must be at a maximum of 4-foot spacing and must alternate through the tube and on the downstream face of the tube.
- G. Stabilized construction exits for sites in which significant truck traffic occurs on a daily basis are subject to the following installation criteria:
  1. Limit site access to one route during construction, if possible; two routes for linear and larger projects.

2. Prevent traffic from avoiding or shortcutting the full length of the construction exit by installing barriers. Barriers may consist of silt fence, construction safety fencing, or similar barriers.
3. Design the access point(s) to be at the upslope side of the construction site. Do not place construction access at the lowest point on the construction site.
4. Stabilized Construction Exits are to be constructed such that drainage across the entrance is directed to a controlled, stabilized outlet on-site with provisions for storage, proper filtration, and removal of wash water.
5. The exit must be sloped away from the paved surface so that stormwater is not allowed to leave the Site onto roadways.
6. Minimum width of exit must be 15 feet.
7. Vehicles must not be permitted to track or drop sediment onto paved roads, streets, or parking lots. When necessary, vehicles must be cleaned to remove sediment prior to exit onto paved areas. When washing is required, it must be done on a constructed wheel wash facility that drains into an approved sediment trap or sediment basin or other sedimentation/filtration device.
8. Minimum dimensions for the exit must be as follows:

| Tract Area            | Min. Width of Exit | Min. Length of Exit |
|-----------------------|--------------------|---------------------|
| <1 Acre               | 15 feet            | 20 feet             |
| ≥ 1 acre but <5 Acres | 25 feet            | 50 feet             |
| ≥5 Acres              | 30 feet            | 50 feet             |

- H. Install pollution control devices in a manner consistent with their designed intent.

### 3.03 MAINTENANCE

- A. Maintain pollution prevention control structures and procedures in full working order at all times during construction. This must include any necessary repair or replacement of items which have become damaged or ineffective. Remove sediment and other pollutants which accumulate in pollution control devices as necessary to maintain the intended design efficiency for the pollution prevention measure.
- B. Dispose properly of trash, debris, and other pollutants.
- C. Place sediment material in approved earth spoil areas or return the sediment material to the area from which it eroded.
- D. Maintain pollution prevention structures and procedures until construction is complete for the area protected and until the Site achieves final stabilization. Unless more stringently defined by local, state, or federal requirements, final stabilization is defined as achieving 70 percent of background vegetative cover or placement of permanent cover, such as concrete or asphalt.
- E. Upon completion of construction and achievement of final stabilization, properly remove the temporary pollutant control structures and complete the area as indicated. Pollution control devices made of organic materials designed to degrade naturally in place will not require removal, unless specifically required by the OPT.

- F. Erosion control blankets must be inspected regularly (at least as often as required by the General Permit) for bare spots caused by weather related events. Missing or loosened blankets must be replaced or re-anchored. Also check for excess sediment deposited from runoff. Remove sediment and/or replace blanket as necessary. In addition, determine the source of excess sediment and implement appropriate Best Management Practices to control the erosion.
- G. Silt fences must be inspected regularly (at least as often as required by the General Permit) for buildup of excess sediment, undercutting, sags, and other failures. Sediment should be removed when it reaches approximately one-half the height of the fence. In addition, determine the source of excess sediment and implement appropriate Best Management Practices to control the erosion. If the fabric becomes damaged or clogged, it must be repaired or replaced as necessary.
- H. Inlet protection must be inspected regularly (at least as often as required by the General Permit). Floatable debris and other trash caught by the inlet protection should be removed after each storm event. Sediment should also be removed from curb inlet protection after each storm event because of the limited storage area associated with curb inlets. Sediment collected at inlet protection should be removed before it reaches half the height of the protection device. Sediment should be removed from inlets with excavated impoundment protection before the volume of the excavation is reduced by 50 percent. In addition, the weep holes should be checked and kept clear of blockage. Concrete blocks, 2-inch by 4-inch boards, stakes, and other materials used to construct inlet protection should be checked for damaged and repaired or replaced if damaged. When filter fabric or organic filter tubes are used, they should be cleaned or replaced when the material becomes clogged. For systems using filter stone, when the filter stone becomes clogged with sediment, the stones must be pulled away from the inlet and cleaned or replaced. Because of the potential for inlet protection to divert runoff or cause localized flooding, remove inlet protection as soon as the drainage area contributing runoff to the inlet is stabilized. Ensure that all inlet protection devices are removed at the end of the construction.
- I. The stone outlet sediment trap should be inspected regularly (at least as often as required by the General Permit) to check for clogging of the void spaces between stones. If the filter stone appears to be clogged, such that the basin will not completely drain, then the filter stone will require maintenance. If the filter stone is not completely clogged it may be raked with a garden rake to allow the water to release from the basin. If filter stone is completely clogged with mud and sediment, then the filter stone will have to be removed and replaced. Failure to keep the filter stone material properly maintained will lead to clogging of the stone riprap embankment. When this occurs, the entire stone rip-rap structure will need to be replaced. If the aggregate appears to be silted in such that efficiency is diminished, the stone should be replaced. Trash and debris should be removed from the trap after each storm event to prevent it from plugging the rock. Deposited sediment must be removed before the storage capacity is decreased by one-third, or sediment has reached a depth of 1 foot, whichever is less. The removed sediment must be stockpiled or redistributed in areas that are protected with erosion and sediment controls.
- J. Sediment basins should be inspected regularly (at least as often as required by the General Permit) to check for damage and to ensure that obstructions are not diminishing the effectiveness of the structure. Sediment must be removed and the basin must be re-graded to its original dimensions when the sediment storage capacity of the impoundment has

been reduced by 20 percent. The removed sediment may be stockpiled or redistributed on-site in areas that are protected by erosion and sediment controls. Inspect temporary stabilization of the embankment and graded basin and the velocity dissipaters at the outlet and spillway for signs of erosion. Repair any eroded areas that are found. Install additional erosion controls if erosion is frequently evident.

- K. Check dams should be inspected regularly (at least as often as required by the General Permit). Silt must be removed when it reaches approximately one-third the height of the dam or 12 inches, whichever is less. Inspectors should monitor the edges of the dam where it meets the sides of the drainage ditch, swale, or channel for evidence of erosion due to bypass or high flows. Eroded areas must be repaired. If erosion continues to be a problem, modifications to the check dam or additional controls are needed. Care must be used when taking out rock check dams in order to remove as much rock as possible. Loose rock can create an extreme hazard during mowing operations once the area has been stabilized.
- L. Stabilized construction exits should be inspected regularly (at least as often as required by the General Permit). The stabilized construction exit must be maintained in a condition that prevents tracking or flow of sediment onto paved surfaces. Periodic re-grading and top dressing with additional stone must be done to keep the efficiency of the exit from diminishing. The rock must be re-graded when ruts appear. Additional rock must be added when soil is showing through the rock surface. Additional controls are needed if inspections reveal a properly installed and maintained exit, but tracking of soil outside the construction area is still evident. Additional controls may be daily sweeping of all soil spilled, dropped, or tracked onto public rights-of-way or the installation of a wheel cleaning system.

#### 3.04 FIELD QUALITY CONTROL

- A. In the event of conflict between the specified requirements and stormwater pollution control laws, rules, or regulations or other local, state, or federal agencies, the more restrictive laws, rules, or regulations will apply.

#### 3.05 SCHEDULES

- A. Prior to start of construction, submit schedules to the OPT for accomplishment of temporary and permanent erosion control work in connection with required clearing and grubbing, grading, construction, and paving. Include a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials in the submittal.

### END OF SECTION

## **01 60 00      PRODUCT REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.01      SUMMARY**

- A. Provide products for this Project that comply with the requirements of this Section. Specific requirements of the detailed equipment specifications govern in the case of a conflict with the requirements of this Section.
- B. Comply with applicable specifications and standards.

#### **1.02      DOCUMENTATION**

- A. Provide documents in accordance with the Contract Documents.

#### **1.03      QUALITY ASSURANCE**

##### **A. Design Criteria:**

1. Provide products designed for structural stability and operational capability.
2. Provide members designed to withstand all loads imposed by installation, erection, and operation of the product without deformation, failure, or adversely affecting the operational requirements of the product. Size and strength of materials for structural members are specified as minimums only.
3. Design mechanical and electrical components for all loads, currents, stresses, and wear imposed by startup and normal operations of the equipment without deformation, failure, or adversely affecting the operation of the unit. Mechanical and electrical components specified for equipment are specified as the minimum acceptable for the equipment.

##### **B. Coordination:**

1. Provide coordination of the entire Project, including verification that structures, piping, and equipment components to be furnished and installed for this Project are compatible.
2. Determine that the equipment furnished for this Project is compatible with the requirements of the Contract Documents and with the equipment and materials furnished by others.
3. Provide electrical components for equipment that comply with all provisions of the Contract Documents.
4. Apply protective coatings and paints to equipment in the shop that are fully compatible with the final coatings to be field applied in accordance with the Contract Documents.

##### **C. Adapting Substitute Products:**

1. The Drawings and Specifications are prepared for the specified products. Make modifications to incorporate the products into the Project if a substitution is requested for a product is and approved in accordance with Section 01 26 00 "Change Management."

2. Do not provide a product with a physical size that exceeds the available space. Consideration may be given to the acceptance of these products or equipment if the Contractor assumes all costs necessary to incorporate the item and the OPT approves such revisions.
3. Coordinate electrical requirements for the products to be installed in the Project, including revisions in electrical equipment components wiring and other elements necessary to incorporate the component.

#### 1.04 STANDARDS

- A. The applicable industry standards referenced in the Specifications apply as if written here in their entirety.
- B. Provide equipment manufactured using structural and miscellaneous fabricated steel conforming to the standards of the American Institute of Steel Construction, except where indicated otherwise.

#### 1.05 WARRANTIES AND GUARANTEES

- A. Normal warranty provisions are as stated in the General Conditions and Section 01 78 36 "Warranties and Service Agreements."
- B. Correct Defective Work under the provisions of the General Conditions.
- C. Provide warranties and guarantees for periods as defined in the Contract Documents. Individual Sections of the Specifications may have more stringent warranty requirements than stated in the General Conditions. The most stringent warranty will apply in the event of conflicts within the Contract Documents.
- D. The Contract Documents may require special warranties that guarantee performance at a specified capacity, power consumption, efficiency, or other operating parameter. Correct defects that prevent products from meeting the specified performance parameters. The requirements of the special warranty that guarantee performance will be satisfied when the specified performance parameters have been met for a period of 1 calendar year of operation, unless Owner elects to accept Defective Work under the provisions of the General Conditions.
- E. The Contract Documents may require special warranties for periods extending beyond the one-year correction period specified in the General Conditions. The full warranty provisions and requirements for correction of Defective Work stated in the General Conditions apply throughout the extended warranty period.
- F. Provide a warranty bond to provide the same protection as the Contractor's performance bond for extended special warranties. The warranty bond will become effective on the day the performance bond expires which is 1 year after the date of final payment per the General Conditions. The warranty bond will remain in effect until the extended warranty period has expired.
- G. In the event that products are repaired, modified, or replaced under the warranty bond, then the warranty period will continue on the date of completion of these repairs for a period of 6 months or until the end of the original warranty period, whichever is later. In no event will



the warranty period extend more than 6 months beyond the end of the original warranty period.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Provide products according to normally accepted engineering and shop practices, except where a higher standard of quality is required by the Contract Documents.
- B. Manufacture like parts of duplicate units to standard sizes and gages that are interchangeable.
- C. Two or more items of the same kind are to be identical and made by the same Supplier.
- D. Provide products suitable for the intended service.
- E. Adhere to the equipment capacities, sizes, and dimensions indicated in the Contract Documents.
- F. Do not use products for any purpose other than that for which they were designed.
- G. Provide new products. Do not provide equipment that has been in service at any time prior to delivery except for testing in accordance with the Contract Documents.
- H. Provide materials suitable for service conditions.
- I. Provide iron castings that are tough, close grained gray iron free from blowholes, flaws, or excessive shrinkage and that conform to ASTM A48.
- J. Design structural members for shock or vibratory loads.
- K. Provide steel that is at least 1/4 inch thick for all elements that will be submerged or subject to splashing all or part of the time during normal operation of the equipment. Chamfer or grind all edges to eliminate sharp exposed edges.

### **2.02 ELECTRIC MOTORS**

- A. Provide equipment with motors that comply with the following requirements unless the detailed equipment specifications have different requirements:
  - 1. Provide motors designed in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment that are appropriate for the application per these same standards.
  - 2. Provide motors designed for frequent starting duty equivalent to the duty service required by the driven equipment where frequent starting occurs.
  - 3. Provide motors rated for continuous duty at 40 deg. C ambient unless recognized and defined by the standards and codes for intermittent duty as a standard industry practice. Provide motors for which motor temperature rise above 40 deg. C ambient does not exceed the NEMA limit when operating continuously at nameplate horsepower.
  - 4. Provide motors designed to start with an appropriate starter or variable speed drive.

5. Provide motors designed for motor bearing life based upon the actual operating load conditions imposed by the driven equipment.
  6. Provide motors sized for the altitude of the location where the equipment is to be installed.
  7. Provide motors that meet the following service factor requirements:
    - a. Maximum load of 87 percent of the nameplate horsepower for motors with a 1.0 service factor; and
    - b. Maximum load of 100 percent of the nameplate horsepower for motors with a 1.15 service factor.
  8. Provide motors that comply with the latest applicable provisions of NEMA MG1 and are manufactured using the following process when the detailed specifications call for encapsulated motor windings:
    - a. Seal the stator assembly by vacuum pressure impregnation (VPI) with epoxy resin after stator assembly;
    - b. Provide two VPI treatments for stator, with each treatment consisting of a dip followed by an oven bake; and
    - c. Provide a final (third) coating of a durable epoxy varnish suitable for protection against dust, moisture, and chemical degradation after the final cure for the stator assembly.
  9. Provide motors with a clamp type grounding terminals inside the motor conduit box.
  10. Provide oversized conduit boxes for motors with external conduit boxes.
  11. Provide motors with maximum starting current that meets NEMA MG1, Class H.
  12. Provide motors with efficiencies that comply with NEMA MG1 for **[high] [premium]** efficiency motors.
  13. Provide motors with minimum insulation Type F.
  14. Provide motors that are random wound with copper coils.
  15. Provide motors rated for the appropriate classification when motors are installed in a hazardous location.
- B. Provide the manufacturer's standard motor on integrally constructed motor driven equipment such as appliances, hand tools, etc. if redesign of the complete unit would be required to provide a motor with the specified features.
- C. Provide motors within the horsepower ranges indicated below that are rated and constructed as follows unless otherwise required by the detailed equipment specifications.
1. Below 1/2 hp:
    - a. 115 volts, 60 Hertz, single phase;
    - b. Dripproof in clean and dry locations; TEPF in all other locations;
    - c. Permanently lubricated sealed bearings; and

- d. Built in manual reset thermal protector or furnished with integrally mounted stainless steel enclosed manual motor overload switch.
- 2. 1/2 to 1 hp:
  - a. 230/460 volts, 60 Hertz, 3 phase;
  - b. Dripproof in clean and dry locations, TEFC in all other locations; and
  - c. Permanently lubricated sealed bearings.
- 3. 1-1/2 hp and above:
  - a. **[230/460] [208]** volts, 60 Hertz, 3 phase;
  - b. Dripproof in clean and dry locations, TEFC in all other locations;
  - c. Oil or grease lubricated anti friction or oil lubricated sleeve bearings; and
  - d. Vertical motors must have 15-year average life thrust bearings.
- D. Provide space heaters operating on 120-volt single-phase service for motors with horsepower ratings of 15 hp or greater.

#### 2.03 EQUIPMENT APPURTENANCES

- A. Provide a safety guard covering all sides on belt or chain drives, fan blades, couplings, and other moving or rotating parts:
  - 1. Fabricate safety guards from 16 US gauge or heavier galvanized or aluminum clad sheet steel or 1/2-inch mesh galvanized expanded metal;
  - 2. Design guards for easy installation and removal;
  - 3. Provide galvanized supports and accessories for each guard;
  - 4. Provide stainless steel bolts and hardware; and
  - 5. Provide safety guards designed to prevent the entrance of rain and dripping water in outdoor locations.

#### 2.04 ANCHOR BOLTS

- A. Provide suitable anchor bolts for each product.
- B. Provide anchor bolts with templates or setting drawings in time to permit casting the anchor bolts in the concrete when concrete is placed.
- C. Provide two nuts for each bolt.
- D. Provide anchor bolts for products mounted on baseplates that are long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Bolts must be long enough to provide full nut engagement and leave three threads exposed. Housekeeping pads are not structural concrete.
- E. Provide stainless steel anchor bolts, nuts, and washers.

## 2.05 SPECIAL TOOLS AND ACCESSORIES

- A. Furnish tools, instruments, lifting and handling devices, and accessories necessary for proper maintenance and adjustment that are available only from the manufacturer or are not commonly available.

## 2.06 EQUIPMENT IDENTIFICATION PLAQUES

- A. Provide a plaque for each piece of equipment in accordance with Section 40 05 53 "Identification for Process Piping and Equipment."

## 2.07 LUBRICATION SYSTEMS FOR EQUIPMENT

- A. Provide equipment lubricated by systems which:
  - 1. Require attention no more frequently than weekly during continuous operation.
  - 2. Do not require attention during startup or shut down.
  - 3. Do not waste lubricants.
- B. Provide lubricants to fill lubricant reservoirs and to replace lubricant consumed during testing, startup, and operation prior to acceptance of equipment by the Owner.

## 2.08 INSULATION OF PIPING

- A. Insulate all piping on or related to equipment as required to prevent freezing under any condition. Insulate piping per the manufacturer's written instruction or per Section 23 07 19 "HVAC Piping Insulation" whichever is more stringent.

# PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Install equipment including equipment pre-selected or furnished by the Owner. Assume responsibility for proper installation, startup, and making the necessary adjustments so that the equipment is placed in proper operating condition per Section 01 75 00 "Starting and Adjusting."

## 3.02 LUBRICATION

- A. Lubricate all products provided or installed for this Project, including products furnished by the Owner, per the manufacturer's written recommendations until the product is accepted by the Owner.

**END OF SECTION**

## **01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Contract.

#### **1.02 DOCUMENTATION**

- A. Submit affidavits and releases on forms provided by the Construction Manager through the PMIS.

#### **1.03 SUBSTANTIAL COMPLETION**

- A. The following requirements must be met for the Project or a designated portion of the Work to be Substantially Complete per the General Conditions:
  - 1. Work must be fully functional and able to operate in accordance with the Contract Documents without special or extraordinary efforts on the part of the Owner.
  - 2. Performance Acceptance Testing (PAT) must be complete and indicated compliance with the requirements of the Contract Documents.
  - 3. Operation and maintenance manuals must be approved and operator training conducted to allow the Owner to assume responsibility for operations.
- B. Conduct inspections with superintendent, Subcontractors, and Suppliers for the Work or a designated portion of the Work prior to calling for a Substantial Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for Substantial Completion. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.
- C. Correct the identified deficiencies prior to calling for a Substantial Completion inspection.
- D. Notify the Construction Manager that the Work or a designated portion of the Work is Substantially Complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the Project will be considered for Final Completion.
- E. OPT will visit the Site to observe the Work within a reasonable time after notification is received to determine the status of the Project.
- F. Construction Manager will notify the Contractor that the Work is either Substantially Complete or that additional Work must be performed before the Project will be considered Substantially Complete.
  - 1. Construction Manager will notify the Contractor of items that must be completed before the Project will be considered Substantially Complete.
  - 2. Correct the noted deficiencies in the Work.

3. Notify the Construction Manager when the items of Work in the Construction Manager's notice have been completed.
4. OPT will revisit the Site and repeat the process.
5. Construction Manager will issue a Certificate of Substantial Completion to the Contractor when the OPT considers the Project to be Substantially Complete. The certificate will include a tentative list of items to be corrected before Final Payment will be recommended.
6. Review the list and notify the Construction Manager of any objections to items on the list within 10 days after receiving the Certificate of Substantial Completion.

#### 1.04 TRANSFER OF UTILITIES

- A. Transfer utilities to the Owner when the Certificate of Substantial Completion has been issued.
- B. Submit final meter readings for utilities and similar data as of the date the Owner occupied the Work.

#### 1.05 CLOSEOUT REQUIREMENTS

- A. Provide the following before Final Completion:
  1. Record Documents per Section 01 31 13 "Project Administration";
  2. Keys and keying schedule;
  3. Warranties, bonds, and service agreements;
  4. Equipment Installation Reports;
  5. Shop Drawings, Product Data, operation and maintenance manuals, and other documentation required by the Contract Documents;
  6. Specified spare parts and special tools;
  7. Certificates of occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the Work and access to services and utilities;
  8. Evidence of continuing insurance and bond coverage as required by the Contract Documents; and
  9. Final videos and photographs per Section 01 33 06 "Graphic Documentation."

#### 1.06 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

- A. Provide warranties, bonds, and service agreements required by Section 01 33 00 "Document Management" or by the individual Sections of the Specifications.
- B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.
- C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.
  1. Each document is to be signed by the respective Supplier or Subcontractor.

2. Each document is to include:
  - a. The product or Work item description;
  - b. The firm name, with the name of the principal, address, and telephone number;
  - c. Scope of warranty, bond, or services agreement;
  - d. Date, duration, and expiration date for each warranty bond and service agreement;
  - e. Procedures to be followed in the event of a failure; and
  - f. Specific instances that might invalidate the warranty or bond.
- D. Submit digital copies of the documents to the Construction Manager for review.
- E. Submit warranties, bonds, and services agreements within 10 days after equipment or components placed in service.

#### 1.07 FINAL COMPLETION

- A. Conduct inspections with Superintendent, Subcontractors, and Suppliers prior to calling for a Final Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for the Final Completion inspection. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.
- B. Identify, list, and correct deficiencies prior to calling for a Final Completion inspection. The Project at the call for Final Completion represents the Contractor's interpretation of a project completed in conformance with the Contract Documents and reflects the Contractor's representation of a quality project meeting the Owner's expectations.
- C. Notify the Construction Manager when:
  1. Work has been completed and complies with the Contract Documents;
  2. Equipment and systems have been tested per the Contract Documents and are fully operational;
  3. Final operation and maintenance manuals have been provided to the Owner and all operator training has been completed;
  4. Specified spare parts and special tools have been provided;
  5. Work is complete and ready for final inspection;
  6. Final documentation for all outstanding Modifications and Claims (other than those listed on the Certificate of Final Completion) have been processed and are ready for incorporation into the final Application for Payment; and
  7. Closeout requirements in Paragraph 1.05 have been completed.
- D. OPT will visit the Site to determine if the Project is complete and ready for final payment within a reasonable time after the notice is received.
- E. Construction Manager will notify the Contractor that the Project is complete or will notify the Contractor that Work is Defective.

- F. Take immediate steps to correct Defective Work. Notify the Construction Manager when Defective Work has corrected. OPT will visit the Site to determine if the Project is complete and the Work is acceptable. Construction Manager will issue a Certificate of Final Completion to the Contractor when the Project is complete or will notify the Contractor that Work is Defective.
- G. Submit the request for final payment with closeout documentation described in Paragraph 1.06 if notified that the Project is complete and the Work is acceptable.

**1.08 REINSPECTION FEES**

- A. Owner may impose a set-off against the Application for Payment in accordance with the General Conditions to compensate the OPT for additional visits to the Project if additional Work is required.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**



## **01 75 00      STARTING AND ADJUSTING**

### **PART 1 - GENERAL**

#### **1.01      SUMMARY**

- A. Provide step-by-step procedures for starting provided systems, including equipment, pumps, and processes.
- B. Provide pre-startup inspections by equipment manufacturers.
- C. Place each system in service and operate the system to prove performance and to provide for initial correction of defects in workmanship, calibration, and operation.
- D. Provide for initial maintenance and operation.
- E. Include costs for starting and adjusting provided by manufacturer's representative in the Cost of Work for the equipment package.
- F. Owner will provide chemicals, if any, required for continued operations.

#### **1.02      STANDARDS**

- A. Comply with the specified standards associated with the testing or startup of equipment.

#### **1.03      DOCUMENTATION**

- A. Provide the following documents in accordance with Section 01 33 00 "Document Management":
  - 1. A Plan of Action for testing, checking, and starting equipment as Product Data per Section 01 31 13 "Project Administration."
  - 2. Equipment Installation Reports on the form provided by the Construction Manager certifying that the equipment and related appurtenances have been thoroughly examined and approved for startup and operation.
  - 3. Operation and maintenance manuals per Section 01 33 04 "Operation and Maintenance Data." Preliminary operation and maintenance data must be approved before installation, testing, and initial operation of equipment.

#### **1.04      SPECIAL JOB CONDITIONS**

- A. Do not start or test any equipment until the complete unit has been installed and thoroughly checked.
- B. Provide the services of a qualified representative of the manufacturer to attend the tests and startup procedures as required by this Section.
- C. Do not start or test any equipment until the preliminary operation and maintenance manual per Section 01 33 04 "Operation and Maintenance Data" has been approved.

## **PART 2 - PRODUCTS**

### **2.01 TESTING INSTRUMENTATION**

- A. Provide new instrumentation and testing devices needed to conduct tests for maintenance and operation as recommended in the operation and maintenance manuals. This equipment is to become the property of the Owner and transferred in good working order as a spare part at Substantial Completion. This equipment is to be calibrated and ready for use during the startup procedure.

## **PART 3 - EXECUTION**

### **3.01 SERVICES OF MANUFACTURER'S REPRESENTATIVES**

- A. Provide the services of experienced and technically competent representatives of the manufacturer for inspections, tests, supervision of installation, training, and assistance with placing equipment in operation.
- B. Perform installation, adjustment, and testing of the equipment under the direct supervision of the manufacturer's representative where specified. Certify that the equipment and related appurtenances have been thoroughly examined and approved for startup and operation in the Equipment Installation Reports.
- C. Provide on-site services as necessary for proper and trouble free operation of the equipment.

### **3.02 INSPECTION AND STARTUP**

- A. Inspect equipment prior to placing any equipment or system into operation. Make adjustments as necessary for proper operation. Do not start or test any apparatus until the complete unit has been installed and thoroughly checked.
  - 1. Check for adequate and proper lubrication.
  - 2. Determine that parts or components are free from undue stress from structural members, piping, or anchorage.
  - 3. Adjust equipment for proper balance and operations.
  - 4. Determine that vibrations are within acceptable limits.
  - 5. Determine that equipment operates properly under full load conditions.
  - 6. Determine that the equipment is in true alignment.
  - 7. Ensure that the proper procedure is employed in startup of systems.

### **3.03 STARTING REQUIREMENTS**

- A. Refer to the individual Specification Sections for specific startup procedures or other requirements.

### 3.04 INITIAL OPERATION

- A. Start, test, and place equipment and systems into operation for 30 days to allow the OPT to observe the operation and overall performance of the equipment and to determine that controls function as intended.
- B. Operate equipment which is used on a limited or part-time basis in the presence of the OPT for a period long enough to demonstrate that controls function as specified.
- C. Perform acceptance test as specified in individual Specification Sections. Demonstrate that equipment and systems meet the specified performance criteria.
- D. Equipment and systems may be considered as substantially complete at the end of this initial operation period if the equipment is placed in continuous beneficial use by the Owner, unless specifically stated otherwise in the individual equipment Specifications.

### 3.05 INITIAL MAINTENANCE

- A. Maintain equipment in accordance with the operation and maintenance manuals until Project is substantially complete and provisions have been made by the Owner for accepting responsibility for equipment operation in accordance with the General Conditions.
- B. Service equipment in accordance with the operation and maintenance manuals immediately before releasing the equipment to the Owner.

**END OF SECTION**

## **01 78 36        WARRANTIES AND SERVICE AGREEMENTS**

### **PART 1 - GENERAL**

#### **1.01    WARRANTY REQUIREMENTS**

- A.    Provide products for this Project that comply with the requirements of this Section.

#### **1.02    WARRANTIES AND GUARANTEES**

- A.    Guarantee and warrant products furnished by the Contractor against:
  - 1.    Faulty or inadequate design;
  - 2.    Improper assembly or erection;
  - 3.    Defective workmanship or materials; and
  - 4.    Leakage, breakage, or other failure.
- B.    Guarantee and warrant the products installed under this Contract, including Goods furnished by the Owner, against leakage, breakage, or other failure due to improper assembly or erection and against improper installation of the equipment. The correction period is as defined in the General Conditions. Individual Specification Sections may have more stringent warranty requirements than those stated in the General Conditions. The most stringent warranty will be provided in the event of conflicts.
- C.    Provide all required warranties, guarantees, and related documents with the Shop Drawing. The effective date of warranties and guarantees will be the date of Substantial Completion.
- D.    Include an additional copy of equipment warranties in operation and maintenance manuals.
- E.    Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

#### **1.03    EXTENDED WARRANTIES**

- A.    Extended Warranties are defined as any guarantee of performance for the product or system beyond the one-year correction period described in the General Conditions.
- B.    Issue the warranty certificate in the name of the Owner.
- C.    Provide a warranty bond for Extended Warranties as required by the individual Specification Sections.

#### **1.04    SERVICE AGREEMENTS**

- A.    Provide Extended Service Agreements (ESA) and related documents with the Shop Drawing. An Extended Service Agreement is a contract between the Owner and an approved Subcontractor or Supplier to provide service and or maintenance beyond that required to fulfill requirements for warranty repairs or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.
- B.    Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.

- C. Enter into a contract with the service provider and assign the service contract to the Owner on the date of Substantial Completion. Once assigned to the Owner, Contract requirements for the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.
- D. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.
- E. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.
- F. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

**DIVISION 03**  
**CONCRETE**

## **03 30 00.01 CAST-IN-PLACE CONCRETE**

### **1.00 GENERAL**

#### **1.01 SUMMARY**

- A. This Section specifies normal weight, cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

#### **1.02 SUBMITTALS**

- A. Product Data and Material Certifications: For each product or material indicated in Part 2.00 "Products," excluding formwork.
- B. Design Mixture: For each concrete mixture submit:
  - 1. Mix design proportions and characteristics.
  - 2. Certifications indicating conformance of aggregate and cementitious materials.
  - 3. Admixture data sheets.
  - 4. Field test data or trial batch mixture data to validate specified compressive strength in accordance with ACI 301, latest edition.
- C. Reinforcing bar layout drawing with bar lists clearly marked and referenced to the Drawings.

#### **1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
- B. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- C. Comply with ACI 301, "Specification for Structural Concrete," including the following sections, unless modified by requirements in the Contract Documents:
  - 1. "General Requirements."
  - 2. "Formwork and Formwork Accessories."
  - 3. "Reinforcement and Reinforcement Supports."
  - 4. "Concrete Mixtures."
  - 5. "Handling, Placing, and Constructing."
- D. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

### **2.00 PRODUCTS**

## 2.01 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI 301.
  - 1. Form ties shall leave no material within 1-1/2 inches of concrete surface.
  - 2. For fluid bearing and below grade walls, provide single tie rods with midpoint washer to prevent water seepage. Systems that result in a through wall hole are not permitted.

## 2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Supports:
  - 1. Unexposed Surface: CRSI Class 3 – No Protection.
  - 2. Exposed Surface: CRSI Class 1 – Maximum Protection – uniform high density polyethylene (plastic) or fiberglass reinforced plastic (FRP). Plastic protected wire bar supports are not allowed.

## 2.03 CONCRETE MATERIALS

- A. Cementitious Material:
  - 1. Cement:
    - a. Type I or I/II Portland cement, conforming to ASTM C150.
  - 2. Fly Ash: ASTM C618, Class F/C. No more than 25 percent of the cement may be replaced with fly ash. If Class F fly ash is not available, then provide a straight cement mix.
- B. Coarse Aggregate:
  - 1. In conformance with ASTM C33, uniformly graded, as indicated in “Concrete Mixtures.”
  - 2. Class: Moderate weathering region, but not less than 3M.
- C. Fine Aggregate: Washed and screened natural sands or sands manufactured by crushing stones; conforming to ASTM C33.
- D. Water: Potable and complying with ASTM C1602 and ASTM C1602 Table 2.

## 2.04 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.



5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

## 2.05 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber, or ASTM D1752, cork or self-expanding cork.
- B. Repair Materials: Pre-packaged, low-shrink, non-slump, non-metallic, quick setting patching mortar, as approved by the manufacturer for each application.
  1. Sikatop 123 by Sika Corporation.
  2. Five Star Structural Concrete by Five Star Products, Inc.
  3. Approved equal.
- C. Non-Shrink Grout: Pre-packaged, non-metallic, precision, non-shrink grout conforming to ASTM C1107/C1107M.
- D. Normal Shrinkage Grout: One part cement to three parts of ASTM C33 fine aggregate; proportioning on a volumetric basis. Install for grouted areas not required to be non-shrink grout.
- E. Waterstops: Place in joints where indicated and any intersecting construction joints to provide a continuous barrier to prevent passage of fluids through joints.
  1. Self-Expanding Strip Waterstops, Low Expansion (Hydrophilic):
    - a. KBA-1510FP; Adeka Ultra Seal; Mitsubishi International Corporation.
      - 1). P-201 swelling sealant adhesive.
- F. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion.
- G. Zinc Richer Primer: Coat aluminum surfaces embedded or in contact with concrete. Primer shall be Tneme-Zinc or approved equal.
- H. Vapor Barriers: ASTM E1745, Class A. Include manufacturer's recommended pressure-sensitive tape.
  1. Stego Wrap Vapor Barrier (15-mil), Stego Tape, and Stego Crete Claw; Stego Industries, LLC.
  2. Approved equal.

## 2.06 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Waterproof Sheet: In accordance with ASTM C171.
- D. Water: Potable and complying with ASTM C1602 and ASTM C1602 Table 2.
- E. Membrane-Curing Compound: ASTM C309, Type 1[-D], Class B.

## 2.07 CONCRETE MIXTURES

- A. Comply with ACI 301 requirements for concrete mixtures.
- B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

| Use                          | Min. 28-Day Compressive Strength | Coarse Aggregate | Max. Water/Cement Ratio | Max Slump    |
|------------------------------|----------------------------------|------------------|-------------------------|--------------|
| General                      | 4000 psi                         | #57              | 0.45                    | 5"* (+/- 1") |
| Pipe blocking, lean concrete | 1500 psi                         | #57              | 0.70                    | ---          |

\*Slump may be increased to 8 inches with the addition of a HRWR.

- C. Air Content:
  - 1. Air entrain exposed concrete within range permitted by ACI 301 for Exposure Class F2.
  - 2. Do not allow entrapped air to exceed 3 percent in floor slabs to receive troweled finish.

## 2.08 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

## 3.00 EXECUTION

### 3.01 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

### 3.02 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Fabricate reinforcement steel to provide lapped connections, bends, and transitions in reinforcement as required for continuity of the typical reinforcement specified on the Drawings.
  - 2. Unless otherwise detailed, intersecting wall and/or beam reinforcement shall extend to the far face and terminate in a standard hook. Reinforcement at the outside face of corners shall be continuous or provide tension lap splices at each side of the corner.
- B. Do not weld reinforcement.

### 3.03 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Purposefully roughen joints to a 1/4-inch amplitude and clean.
- B. Construction Joints: Locate joints as indicated or as approved by Owner's Representative.

- C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, and as indicated.
  - 1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

### 3.04 CONCRETE PLACEMENT

- A. Comply with ACI 301 for measuring, batching, mixing, transporting, and placing concrete.
- B. Additional water may only be added to concrete prior to placement and only at Project Site. Slump shall be evaluated prior to and after the addition of all water. Do not take strength cylinders until after addition of all water.
  - 1. Quantity of water shall not exceed the amount withheld at the batch plant. Quantity withheld shall be indicated on the batch ticket. Addition of water shall not result in a slump or water-cement ratio greater than that specified.
- C. Do not allow concrete to free fall more than 5 feet. With HRWR concrete may free fall a maximum of 10 feet.
- D. Consolidate concrete with mechanical vibrating equipment.

### 3.05 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface. Do not further disturb surfaces before starting finishing operations.
- C. Float Finish: Apply float finish to surfaces to receive trowel finish or nonslip broom finish. Except as indicated below, apply a final "light float" finish to the surface as the concrete hardens. Surface shall have a uniform granular texture and shall meet the straightness requirements.
- D. Trowel Finish: Apply a normal steel trowel finish to interior surfaces exposed to view and grouted surfaces in junction boxes.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete sidewalk and ramp surfaces. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

### 3.06 FINISHING FORMED SURFACES

- A. No Finish: After forms are removed, repair or patch tie-holes and defects. Otherwise, no additional finish is required. Apply to surfaces which are not visible from the inside or outside of the completed structure or less than 12 inches below finish grade (i.e. back of retaining walls below embankment, etc.).
- B. Smooth-Formed Finish: As-cast surface texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes

and defective areas. Remove fins and other projections exceeding 1/8 inch. Apply to surfaces exposed to view and 12 inches below finish grade.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.07 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301. Additionally, comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least 7 days by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
    - a. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.08 MISCELLANEOUS CONCRETE ITEMS

- A. Non-Shrink Grout: Install and cure as recommended by manufacturer, and as required here:
  - 1. Clean and roughen exposed concrete surface; remove laitance. Saturate the foundation 24 hours before installation. Surface shall be clear of standing water. Baseplates shall be free of oil, grease, and other objectionable substances.
  - 2. Steel trowel exposed edges.
  - 3. Moist cure as specified by manufacturer, but not less than 3 days.

B. Normal Shrinkage Grout:

1. Clean and roughen exposed concrete surface, remove laitance. Saturate the foundation 24 hours before installation. Surface shall be clear of standing water. Apply scrub coat of grout immediately prior to grout placement. While scrub coat is still moist install grout.
2. Wet cure as specified for concrete.

C. Bonding Agent: Water-based epoxy modified, with integral corrosion inhibitor. Install according to manufacturer's recommendations.

1. Sika Armatec 110 EpoCem; Sika Corporation.
2. MasterEmaco P 124; Master Builders Solutions US LLC.

3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.
- B. Tests: Perform according to ACI 301.
1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

3.10 REPAIRS

- A. Remove and replace concrete that does not comply with requirements in this Section.
- B. Repair materials and surface preparation shall be completed in accordance with manufacturer recommendations. Coordinate with Owner's Representative prior to beginning any demolition of defective area.

**END OF SECTION**

**DIVISION 09**  
**HIGH-PERFORMANCE COATINGS**

## **09 95 00 COATINGS FOR WATER STORAGE TANKS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to apply protective coatings to material and equipment as specified herein, including the preparation of surfaces prior to application of coatings.
- B. Protective coatings must be applied to the following surfaces:
  - 1. Tank interior and exterior surfaces.
  - 2. Above grade piping and valves on the tank and above grade piping on the exterior of the existing pump building (inlet and outlet piping, proposed and existing)
  - 3. Exterior electrical as determined by the Engineer during construction.
  - 4. Stainless steel piping, ladders, etc. on the interior of the tank.
- C. The following shall not be coated and shall be protected from drips, overspray, etc. unless indicated otherwise:
  - 1. Stainless steel piping, materials and equipment, except those on the interior of the tank.
  - 2. Galvanized steel piping, materials and equipment.
  - 3. Aluminum materials and equipment.
  - 4. Ladder safety devices.
  - 5. Interior electrical items.
  - 6. Name and identification plates.
- D. Special applications for painting include the following:
  - 1. Buried pipe and valves shall receive a shop applied protective coating as described in the appropriate Section of the Specifications.
- E. Contain, treat, and dispose of any dust, spray, drainage, or spillage resulting from coating operations. It shall be the Contractor's responsibility to determine if the materials to be disposed of are classified as Hazardous Waste. Disposal of waste, hazardous or otherwise, must be in accordance with applicable regulations. The Contractor must be aware of and understand the regulations concerning disposal of waste generated by coating operations.

#### **1.02 EXISTING CONDITIONS**

- A. Contractor must acquaint himself with the hazards of the Work including, but not limited to, corroded components, high wind velocity, fire potentials caused by sparks from Contractor's torches, spark damage to property, and the proximity to overhead electrical lines, to residences, businesses, streets, etc. Failure to do so will not relieve the Contractor from all obligations described in the Drawings or Specifications.
- B. Contractor must evaluate the tank for loads that will be added to the tank during surface preparation and coating operations, including loads for hanging scaffolding, abrasive blasting

equipment on shell and roof, containment supports, rigging and all other loads. Contractor is responsible for all damages to the tank for improperly loading or overloading the tank.

### 1.03 QUALITY ASSURANCE

- A. Contractor's Qualifications: Contractors must be qualified in this line of work and have a minimum of 5 years of experience coating potable water storage tanks and in the application of the protective coatings of the types specified herein. Submit a list of recent projects and names of references for those projects.
- B. Contractor's superintendent/foreman must have a minimum of 5 years of experience with coating storage tanks. Superintendent/foreman must be on-site while the Work indicated within this Section is underway. Submit a list of recent projects and names of references for those projects.
- C. Contractor must provide workers who perform professional and quality work and who are experienced and knowledgeable in surface preparation, mixing and application of high-performance coating systems.
- D. Contractor's painters that will be applying any 100 percent solids coatings for this Project must be trained and approved by the coatings manufacturer for the application of the high solids coatings. Training and approval must occur at the Project Site, at the location where the coatings will be used and in the presence of the Owner's representative. Applicators must be certified using a mock structure constructed on the Site by the Contractor. Any new applicators added to the crew will need to be certified separately per this procedure.
- E. Product Quality:
  1. Use only the coatings specified in this Section. Use only those thinners and solvents recommended by the manufacturer, only in the amounts necessary to produce the manufacturer's recommended spreading rate, and in amounts not exceeding the maximum quantities stated in the manufacturer's literature.
  2. The coating material must not show excessive settling in a freshly opened full can and must be easily re-dispersed with a paddle to a smooth, homogeneous state. It shall show no curdling, livering, caking, or color separation and must be free of lumps or skim surfaces.
- F. Testing: Protective coatings must be applied under quality control procedures, which include inspection of surface preparation and for each coat applied. Do not proceed with the next step until the Owner's representative has approved the previous step. The Contractor shall be solely responsible for testing for this Section, at no further cost to the Owner. The Owner's representative shall also make such tests, if it is considered necessary. Cooperate with the Owner, providing equipment, scaffolds, and other equipment as requested by the Owner's representative.
- G. Testing Equipment: Furnish the testing apparatus necessary for testing surface preparation, environmental conditions and coatings as specified.
- H. Testing Equipment: Contractor must furnish and have the following testing apparatuses on-site during construction for the Owner's use:
  1. One set of U.S. Department of Commerce thickness calibration plates, certified by the National Bureau of Standards, to test dry film thickness.



2. Wet-film thickness gauges. Provide two to Owner's representative. Each painter must keep one to test paint as it is applied.
  3. One electronic dry-film thickness gauge capable of measuring 0-200 mils with calibration standards approved by the Bureau of Standards.
  4. One Elcometer 319 Dewpoint Meter.
  5. One Tinker and Razor Model M 1 Holiday Detector and recommended wetting agent and/or High Voltage Holiday Detector if required for interior coating thickness specified.
  6. One set of SSPC-VIS 1, 3 and 4 - Visual Standards as applicable.
- I. Contractor must schedule a construction conference prior to any field Work being completed. The meeting will be on-site and will include the Owner, Contractor, painting superintendent, Engineer, Owner's representative and coating manufacturer's representative. At this meeting the coating plan and schedule will be reviewed in detail.

#### 1.04 FIELD QUALITY CONTROL

##### A. Surface Profile Testing:

1. Provide a minimum of 3 sets of profile readings for the first 1000 square feet.
2. Provide a minimum of 2 sets of profile readings for each additional 1000 square feet.

##### B. Wet Film and Dry Film Thickness Testing:

1. Provide wet film tests during painting operations to ensure proper thicknesses of coating are being applied.
2. The dry-film thickness for each coat must be tested and be in conformance with SSPC-PA-2 with a Type 2 Electronic Gauge.

##### C. Holiday Testing:

1. Contractor must conduct holiday testing and make all interior repairs. Upon completion of the repairs, Contractor must re-test all interior surfaces in the presence of the OPT.
2. Holiday Testing must be conducted using a wet sponge low voltage holiday detector for interior coatings with total DFT of 20 mils or less and high voltage holiday detector for coatings with a total DFT greater than 20 mils in accordance with ASTM D5162 and/or NACE SP0188.
3. A holiday test must be performed on the entire interior wet area of the tank, including the roof and all appurtenances, following the application of the final coat and after all work is completed inside of the tank.
4. During the holiday testing, defective areas must be marked for repair and re-tested after repair work has been completed.
5. All touched up pinholes and re-coated areas must be completely cured prior to re-testing for holidays.
6. Holiday testing and re-testing must continue until the interior surfaces are found to be holiday free.

- D. Contractor must monitor and record ambient climatic conditions and interior tank conditions during surface preparation and coating as follows:
1. Temperature of both the sunny side and shady side of the tank must be recorded periodically each day. The tank surface temperatures, relative humidity, dry bulb, wet bulb and dew point temperatures, both interior and exterior (as appropriate), are to be recorded at least every 3 hours.
  2. The dew point must be measured by use of a sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables or with an electronic climate monitoring system approved by the Engineer.
  3. Contractor must use a form approved by the Owner for recording this data. The completed forms must be kept on the Site at all times from the time coating is first applied until the coating system is complete. Cloud based reporting systems may be utilized with the Engineer's approval.
- E. All Work, including observations, must be recorded daily by the Contractor. A copy of each daily report/log must be placed in a file kept on the Site and submitted to the Owner at the end of each day. The reports must include the documentation per "The Inspection of Coatings and Linings", Chapter 3, QC forms 2 through 6 as applicable to the work being completed.
- F. Owner's Representative Field Quality Assurance Coordination:
1. Contractor must provide a schedule for anticipated hold-points and must notify the Owner's representative at least 7 days prior to any required inspections and confirmed 24 hours prior to inspection via text message and/or email and acknowledged by the Owner's representative. Prior to scheduling an inspection, Contractor is responsible for reviewing Work and verifying it is ready for a threshold inspection. Once scheduled, if the Owner's representative finds the Work not ready for inspection or if the inspection reveals deficiencies requiring re-testing, any additional trips for re-inspection or inspection for retesting of failed tests shall be borne by the Contractor and deducted from the Contract Value by Change Order.
  2. Costs for additional inspection shall be billed at the following rates:
- | Position          | Per Day |
|-------------------|---------|
| Coating Inspector | \$874   |
3. Cost includes all travel and inspection expenses. Construction contract administration will be billed for actual effort per the rates established in Section 00 73 00 "Supplementary Conditions."
- G. Field Quality Assurance:
1. Observations may be conducted by the OPT. Final observations must be performed in the presence of the Owner or their Representative and the Contractor's superintendent. All materials and equipment used in the accomplishment of testing are subject to observation at any time by the Owner's representative. Periodic observation times will be agreed upon by the OPT and Contractor.
  2. OPT may conduct tests and observations to verify the coating manufacturer's data. If the coating testing results fall below the test requirements or visual observation, the Owner

reserves the right to have the Contractor change coating materials and/or coating manufacturers to a coating that will meet all the stated requirements in this Section.

3. All steps of the coating system will be subject to observation prior to progression to succeeding steps. Phases of observation must include, but not limited to:
  - a. All welding and welding repairs completed prior to painting.
  - b. Containment erection completed (as required).
  - c. Pre-cleaning (before surface preparation) survey of facilities to be primed.
  - d. Prior to and during surface preparation.
  - e. Prime coating application.
  - f. Stripe coating application.
  - g. During and immediately after each coating application.
  - h. Final coating observation.
  - i. Holiday detection on interior of tank.
  - j. Cure test of interior coating completed.
  - k. Substantial Completion / pre-disinfection.
4. Contractor must not move or remove scaffolding, ladders or other fixtures necessary to provide proper observation until such Work has been observed and approved by the Owner's representative.
5. OPT will make every attempt to minimize damage to newly coated areas during observation activities, but any damage caused, regardless of by whom, must be repaired by the Contractor at no additional cost to the Owner.
6. Observation and/or acceptance of Contractor's Work by the OPT in no way releases Contractor from any of the terms and conditions of the Contract Agreement.
7. The following test and observations will be performed during coating operations:
  - a. Surfaces to be coated must first be cleaned and observed by the Contractor's Superintendent to ensure that all grease, oil, and other foreign materials have been removed before coating. Any area found to be improperly cleaned, must be redone to the Owner's representative's satisfaction. Final surface preparation must be as outlined in SSPC-SP 1 through SP 13, WJ-1 through WJ-4 and NAPF 500, as specified. Prior to observation of all interior and exterior surfaces by Owner's representative, Contractor's superintendent must observe and confirm readiness for inspection.
  - b. The pattern depth of the abrasive blasted surface must be as specified by the coating manufacturer's written surface profile recommendations. The profile must be measured by a Testex Replica Tape, as indicated in Paragraph 3.02.H. SSPC-VIS 1 and/or SSPC-VIS 3 must serve as guides and in arbitration to determine the degree of surface preparation. All prepared areas of the tank surface, interior and exterior, must be prepared as per SSPC visual standards.
  - c. Prior to undertaking full-scale abrasive blasting operations, the Contractor must perform a test blast on both the exterior and the interior of the tank in the presence

of the Owner's representative and the coating manufacturer's representative. The test section must be a minimum of 5 feet high by 5 feet wide. The Engineer or Owner's representative and the manufacturer's representative must verify that the surface cleanliness and profile meet the requirements of this Section before the Work can proceed. In the event the test section fails to comply with the requirements of this Section, the Contractor shall be required to make suitable changes to the equipment and/or abrasive material and perform an additional test sections until compliance with this Section is demonstrated.

- d. Before and/or during blasting and coating operations, a field test of ventilation flow-rates must be performed by the Contractor to verify that the ventilation requirements are being provided as specified. Contractor must submit documentation of flow test results to the Engineer.
  - e. Measurement of the dry film thickness must be made in accordance with SSPC-PA 2 with a Type 2 Electronic Gauge. Measurements of the actual dry film thickness of the various coating layers applied must be made by the OPT with assistance from the Contractor. Film thickness measurements must be made at such locations as designated by the OPT.
  - f. Holiday testing must be conducted by the Contractor and observed by the OPT.
8. On days when blasting and/or coating is being performed, the Owner's representative must monitor and record ambient climatic conditions, and interior tank conditions as follows:
- a. Air temperature, steel surface temperature, humidity and dew point must be measured and recorded by the Contractor prior to beginning of blasting and prior to application of coating, daily.
  - b. Surface temperature must be measured using a surface thermometer.
  - c. Temperature of both the sunny side and shady side of the tank must be recorded periodically each day. The tank surface temperatures, relative humidity, dry bulb, wet bulb and dew point temperatures, both interior and exterior (as appropriate), are to be recorded at least every 3 hours.
  - d. The dew point must be measured by use of a sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables or by utilizing an electronic measuring device approved by the Engineer.
9. The completed forms must be kept on the Site at all times from the time surface preparation is initiated until the coating system is complete. The forms must be submitted as Product Data on a weekly basis until coating is complete.

#### 1.05 SUBMITTALS

- A. Submittals must be in accordance with Section 01 33 00 "Document Management."
- B. The following Product Data for products, including manufacturer's data sheets, are due prior to ordering coating and surface preparation materials:
  - 1. Coating manufacturer's color selection literature for coating materials and caulk.
  - 2. Sample warranty document for products.

3. Provide certification from the manufacturer that all coatings will not contain more than 0.06 percent by weight of lead in the cured coating for each coat applied.
  4. Coating manufacturer's Product Information and Safety Data Sheets (SDS) for each coating and caulk material. Product Information must include the following:
    - a. Manufacturer's product data sheets, with published instructions for use in specifying and applying all proposed coatings.
    - b. Application instructions written and published by the coating manufacturer.
  5. Provide documentation that interior coating system is compatible with the cathodic protection system per ASTM G8 (Method A).
- C. The following mock panels and samples are required prior to ordering the materials:
1. Three samples of selected exterior finish colors for approval on 6-inch by 6-inch swatches. Label each swatch with the manufacturer's name, coating name/type, color name and number.
  2. Mock structure for 100 percent solids coating systems will be constructed out of wood and incorporate:
    - a. Flat vertical wall made of plywood to simulate the shell.
    - b. Roof made of plywood to simulate coating the underside of the roof and roof to shell connection.
    - c. Rafters made of wood (4 minimum) attached to underside of the roof to simulate coating roof and rafter connections.
    - d. Contractor must provide geotextile fabric and backer rod and will demonstrate application of these on structure gaps and corners.
- D. The following Product Data is required prior to coating Work:
1. Coating Plan:
    - a. Anticipated coating process schedule by date, including dates when hold-point inspections are anticipated. Schedule must indicate detailed activities on a daily basis.
    - b. Detailed procedures and schedule for all pre-cleaning, surface preparation and application of coating, including touch-up and repair procedures for all coating systems.
    - c. Recoat schedule on the submitted coating materials.
    - d. Data sheets complete with a graduated scale or curve, produced by the coating manufacturer, with curing characteristics and recommendations regarding complete coating curing.
    - e. Provide a written plan documenting how spent cleaning debris and/or paint over spray or droplets will be contained/confined to the Site and tank site during the surface preparation and coating application operations. Reasonable care must be exercised by the Contractor to prevent damage, nuisance, or hazardous conditions to adjacent or nearby property owners. Include all materials and method to be used for

- protection of exterior surfaces, and allow for recovery and disposal of paint scraps and blast media.
  - f. Provide written plan documenting how paint and/or abrasive damage to automobiles and property will be addressed, including a process for quick removal of the paint or abrasive, and how the Work will be accomplished (this must not relieve the Contractor from the responsibility of setting claims for damage, but is intended to expedite and minimize said claims).
2. Provide documentation on proposed containment system methods for blasting and coating operations.
  3. Provide documentation on heating or dehumidification system (as required):
    - a. Calculations for dehumidification and ventilation requirements.
    - b. Fans and their locations.
    - c. Dimensions of equipment.
    - d. Maximum capacities of equipment.
    - e. Emission control devices.
    - f. Method of filtration of exhausted tank air.
    - g. EMD- continuous electronic monitoring device.
  4. Provide documentation on ventilation and filtration system:
    - a. Calculations for ventilation requirements.
    - b. Fans and their locations.
    - c. Dimensions of equipment.
    - d. Maximum capacities of equipment.
    - e. Emission control devices.
    - f. Method of filtration of exhausted tank air.
  5. Provide documentation of products and procedures utilized to repassivated stainless steel in the field.
  6. Contractor must submit evidence of notification to the appropriate state and local governing authorities prior to abrasive blasting as required. Submit copies of any obtained permits.
  7. Coating Manifest: Within 48 hours of coating delivery to the Site, the Contractor must record the batch number stamped on each coating container and submit a typed list to the Owner's representative. Minimum information required is listed below.
    - a. Date of delivery to Site.
    - b. Name and signature of Superintendent recording the data.
    - c. List of batch number including corresponding coating identification, color, date of manufacture and volume of each container.

- E. The following Certified Test Report(s) are required prior to coating Work:
1. SDS sheets for all abrasive to be used on the Project.
  2. Certification and laboratory test results indicating recycled metallic abrasive (if proposed for use) per SSPC-AB 2 or 4 and atomic absorption test results.
  3. Wash water test results.
  4. Letter from manufacturer confirming non-visible contaminant removal product is applicable to this Project and application directions.
- F. Provide the following Product Data during the construction of the Project:
1. Letter from the coating manufacturer confirming the test surface preparation for both the interior and exterior surfaces prepared by the Contractor in the field are acceptable for the product(s) being applied.
  2. On a weekly basis, submit:
    - a. Contractor's Daily Reports.
    - b. Output from automatic real-time monitoring equipment from the previous week.

#### 1.06 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety. Adhere to the latest standards and codes published by the following organizations.
1. Association for Materials Protection and Performance (AMPP):

|             |                                                                                                                                            |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| NACE TPC2   | Coating and Lining for Immersion Service: Chapter Safety, Chapter 2 Surface Preparation, Chapter 3 Curing, and Chapter 4 Inspection        |
| NACE SP0178 | Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service |
| NACE SP0188 | Discontinuity (Holiday) Testing of Protective Coatings on Conductive Substrates                                                            |
| NACE SP0178 | Plastic Weld Comparator                                                                                                                    |
| NACE RP0287 | Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape                                         |
| SSPC-VIS 1  | Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning                                                 |
| SSPC-VIS 3  | Guide and Reference Photographs for Steel Surfaces Prepared by Power and Hand Tool Cleaning                                                |
| SSPC-VIS 4  | Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting                                                                |
| SSPC Vol. 1 | Good Painting Practices                                                                                                                    |
| SSPC-AB 1   | Mineral and Slag Abrasives                                                                                                                 |
| SSPC-AB 2   | Cleanliness of Recycled Ferrous Metallic Abrasives                                                                                         |
| SSPC-AB 3   | Ferrous Metallic Abrasives                                                                                                                 |
| SSPC-AB 4   | Recyclable Encapsulated Abrasive Media in a Compressible Matrix                                                                            |

|                        |                                                                                                   |
|------------------------|---------------------------------------------------------------------------------------------------|
| SSPC-SP 1              | Solvent Cleaning                                                                                  |
| SSPC-SP 2              | Hand Tool Cleaning                                                                                |
| SSPC-SP 3              | Power Tool Cleaning                                                                               |
| SSPC-SP 11             | Power Tool Cleaning to Bare Metal                                                                 |
| SSPC-SP 15             | Commercial Grade Power Tool Cleaning                                                              |
| SSPC-SP WJ-1/NACE WJ-1 | Waterjetting to Bare Substrate                                                                    |
| SSPC-SP WJ-2/NACE WJ-2 | Very Thorough Waterjetting                                                                        |
| SSPC-SP WJ-3/NACE WJ-3 | Thorough Waterjetting                                                                             |
| SSPC-SP WJ-4/NACE WJ-4 | Light Waterjetting                                                                                |
| SSPC-PA 1              | Shop, Field and Maintenance Painting                                                              |
| SSPC-PA 2              | Measurement of Dry Film Thickness with Magnetic Gages                                             |
| SSPC-PA 10             | Guide to Safety and Health Requirements for Industrial Painting Projects                          |
| SSPC-PA 17             | Procedure for Determining Conformance to Steel Profile/Surface Roughness/Peak Count Requirements  |
| SSPC-Guide 6 (CON)     | Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations         |
| SSPC-Guide 12          | Guide for Illumination of Industrial Painting                                                     |
| SSPC-Guide 15          | Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates |
| SSPC-SP 5/NACE No. 1   | White Metal Blast Cleaning                                                                        |
| SSPC-SP 6/NACE No. 3   | Commercial Blast Cleaning                                                                         |
| SSPC-SP 7/NACE No. 4   | Brush - Off Blast Cleaning                                                                        |
| SSPC-SP 10/NACE No. 2  | Near - White Metal Blast Cleaning                                                                 |
| SSPC-SP 13/NACE No. 6  | Surface Preparation of Concrete                                                                   |

2. American National Standards Institute (ANSI):

|                      |                                                                        |
|----------------------|------------------------------------------------------------------------|
| ANSI/NSF Standard 61 | Drinking Water Components                                              |
| NSF/ANSI/CAN 600     | Health Effects Evaluation and Criteria for Chemicals in Drinking Water |

3. ASTM International (ASTM):

|           |                                                                                                              |
|-----------|--------------------------------------------------------------------------------------------------------------|
| ASTM A967 | Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts                         |
| ASTM A380 | Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems. |
| ASTM D523 | Standard Test Method for Specular Gloss                                                                      |



|             |                                                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------------------|
| ASTM D610   | Standard Test Method for Evaluating Degree of Rusted on Painted Surfaces                                                   |
| ASTM D2244  | Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates |
| ASTM D3359  | Standard Test Methods for Rating Adhesion by Tape Test                                                                     |
| ASTM D4214  | Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films                                        |
| ASTM D4285  | Standard Test Method of Indicating Oil and Water in Compressed Air                                                         |
| ASTM D4417  | Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel                                      |
| ASTM D4541  | Standard Method for Pull-Off Strength of Coatings Testing Adhesion of Applied Coating Using Portable Adhesion Tester       |
| ASTM D5162  | Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates           |
| ASTM E337   | Standard Practice Test Method for Measuring Humidity with a Psychrometer                                                   |
| ASTM E84-03 | Standard Test Method for Surface Burning Characteristics of Building Materials                                             |
| ASTM G8     | Standard Test Methods for Cathodic Disbonding of Pipeline Coatings                                                         |

4. American Water Works Association (AWWA):

|           |                                                                                      |
|-----------|--------------------------------------------------------------------------------------|
| AWWA D100 | Welded Steel Tanks for Water Storage                                                 |
| AWWA D102 | Coating Steel Water Storage Tanks                                                    |
| AWWA C210 | Liquid-Epoxy Coating Systems for Interior and Exterior of Steel Water Pipelines      |
| AWWA C222 | Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings |

5. Consumer Product Safety Act, Part 1303.

6. National Association of Pipe Fabricators (NAPF):

|             |                                                                                                                                                          |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAPF 500-03 | Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

7. Occupational Safety & Health Administration (OSHA):

|                            |          |
|----------------------------|----------|
| 1915.35 Standards - 29 CFR | Painting |
| 1926.62 Standards - 29 CFR | Lead     |

8. North Carolina Department of Environmental Quality (NCDEQ):

|                                |                                             |
|--------------------------------|---------------------------------------------|
| NCAC 15A, Subchapter 02D.0541  | Control of Emissions from Abrasive Blasting |
| NCAC Title 15A, Subchapter 18C | Rules Governing Public Water Systems        |

- B. In the event of a conflict between the published standards, codes, and this Section, the more stringent requirement shall govern.

#### 1.07 DELIVERY AND STORAGE

- A. Deliver coating products to the Site in original unopened containers, with manufacturer's label and batch number attached. Do not apply products until the Owner's field representative has approved the product for use.
- B. Use one location at each site for the storage of coating products. Protect the floor from spills and other damage. Protect the products from extreme heat or cold. Keep containers covered. Keep the storage rooms clean of trash and debris. Dispose of oily or used rags daily. Take precautions to prevent fires. The storage of flammable liquids must comply with city, state, or other fire codes.
- C. Storage of coatings and other products must be in accordance with the manufacturer's requirements. Coatings that have been damaged or not stored properly must not be applied and must be removed from the Site.
- D. All products and coatings that are not approved for the Project must be removed from the Site and must not be stored at the Site.
- E. All materials must be delivered to the Site in original sealed containers with the date of manufacture and batch number stamped thereon by the coating manufacturer. Materials shall be subject to random observations by the Owner's representative at the Site.

#### 1.08 ENVIRONMENTAL CONTROL CONDITIONS

- A. Do not apply coatings under conditions that are unsuitable for the production of good results. Remove trash and debris from enclosed buildings and thoroughly clean prior to application of coatings. Do not begin application of coatings in areas where other trades are working, or where construction activities result in airborne dust or other debris. Do not apply coatings in conditions which do not conform to the recommendations of the coatings manufacturer.
- B. Coatings shall only be applied when conditions fall within the parameters listed in the manufacturer's printed data.
- C. Do not apply any coatings when weather conditions are unfavorable. In the event that climatic conditions are not conducive for best results, postpone application of coatings until conditions conform to the manufacturer's recommendations and the provisions of this Section.
- D. Do not apply coatings to a wet or damp surface in wet or damp weather conditions, or when there is dust in the air. Surfaces exposed to direct sunlight must be shaded by awnings or other protective devices while coatings are being applied, if recommended by coating manufacturer. When necessary, provide temporary heating devices of a type that produces no fumes or introduces water vapor into the environment.
- E. Heating and Dehumidification:
  - 1. Dehumidification equipment must be used to control the environment in the tank wet area during surface preparation, rehabilitation, coating application and coating curing at no additional cost to the Owner, if acceptable environmental conditions cannot be met.

- a. If the Contractor cannot meet the required environmental conditions to apply the interior coating system per this Section and the coating manufacturer's written recommendations, Contractor will cease operations until approved dehumidification equipment has been provided and acceptable environmental conditions are achieved.
    - b. If coating system is applied without dehumidification or in conditions not acceptable by this Section and by the coating manufacturer's written requirements, Contractor must fully remove coating system applied and replace per the Engineer's direction.
  2. Automatic real-time monitoring equipment must be provided. This equipment must be used when no Contractor personnel are at the Site. Monitoring equipment may be removed during abrasive blasting and coating operations, but environmental conditions must be checked and logged manually.
  3. Contractor must furnish all labor, materials, equipment, fabrication and quality control inspections, and all other incidentals required to control and maintain the environment of the tank within the parameters stated in this Section and must incorporate these and any other expenses into its bid.
  4. Owner reserves the rights, in the event the dehumidification equipment is not performing to the minimum requirements stated in this Section, to require the Contractor to modify and or add additional equipment to satisfy the conditions of this Section, at the sole cost to the Contractor.
  5. It is the Contractor's responsibility to provide adequate dehumidification equipment to meet this Section and coating manufacturer's requirements. The coating manufacturer's limits of surface temperature, tank inside air temperature and relative humidity requirements will govern, if more stringent than the requirements stated within this Section.
  6. During abrasive cleaning and coating operations inside of the tank, the relative humidity of the air inside of the tank must not exceed 55 percent. During curing of the coating on the interior of the tank, the relative humidity of the air inside of the tank must not exceed 75 percent.
- F. Forced Ventilation:
1. Continuous forced fresh air ventilation must be provided from beginning of the tank interior wet area surface preparation through final coating operations and coating curing.
  2. Forced ventilation must be supplied to the interior of the tank per the recoat time required by the coating manufacturer and at least 48 hours after the final coat has been applied.
  3. Unless dehumidification equipment is used to provide ventilation of the tank interior, the roof vents and hatches must be kept open and clear.
  4. All tank, pedestal, dry riser and dry well openings susceptible to emissions during blasting, cleaning, and coating operations must be properly fitted and secured with suitable dust collection devices to reduce the release of emissions.

5. From the beginning of interior wet and/or dry coating application and until this coating is cured, the Contractor must monitor the air for the lower explosion limit (LEL) as published in the coating manufacturer's product SDS's.
6. During coating curing and when no coatings are being applied inside the tank, the equipment must be sized so that it is capable of changing the volume of air inside the entire tank a minimum of 1.5 to 2.0 times per hour. On smaller tanks, exchanges may be reduced as justified by the Contractor and approved by the Engineer.
7. Throughout the duration of ventilation, containment of blasting abrasives, removed coating, and applied coatings must be maintained by use of proper filtration.
8. The ventilation system must be in accordance with AWWA D102 and submitted to the Owner.
9. Contractor is responsible for supplying, installing and maintaining the forced ventilation system.
10. Ventilation during interior abrasive blasting can be reduced to one air exchange per hour.
11. The above ventilation requirements are minimum requirements. It is the responsibility of the Contractor to verify that the flow rate provided throughout the tank meets the curing requirements of the coating manufacturer for the coating applied. Should additional ventilation be required by the coating manufacturer, the Contractor must furnish additional ventilation.

G. Containment System:

1. Contractor must provide containment methods, either full or partial, which allows for the containment of the environmentally sensitive waste, dust and paint over spray that will be generated during the abrasive blasting and painting operation.
2. Minimum Containment for Field Surface Preparation:
  - a. Provide a minimum SSPC Guide 6 (CON) Class 3A.D1.E3 containment system when dry abrasive blasting.
  - b. Provide a minimum SSPC Guide 6 (CON) Class 2W containment system when wet abrasive blasting. All water must be contained and properly disposed of.
  - c. Provide a minimum SSPC Guide 6 (CON) Class 2P.E3 containment system when power tool cleaning.
3. The ground surrounding the tank must be protected from all debris, emissions, dust, and other materials generated in the cleaning operations with a minimum of two layers of polyethylene covered with plywood or the same material used for the perimeter containment system.
4. Containment is not required when blasting on the interior of a completely enclosed tank (i.e., roof is in place) as long as no visible emissions are created.
5. Contractor must ensure that no spent cleaning/blasting debris, dust, overspray, coating droplets, or emissions of any kind, escape to the atmosphere, the base of the tank, or to adjacent buildings, private property, work sites, parking lots, etc.
6. Owner reserves the right to stop Work or require containment, additional containment or different containment methods if the Contractor's operations create a nuisance

beyond the tank site property line in the sole opinion of the Owner, the Engineer, the Owner's representative, any regulatory agency, or neighbor. All costs of providing an adequate containment system must be included by the Contractor in the base bid.

7. Contractor will be responsible for all materials that are used and for any apparatus used to contain dust emissions, debris, overspray, and coating droplets. The containment system attachments to the tank must be designed not to impose excessive loading on the tank by a professional engineer licensed in the state where the Project is located. Contractor must submit the designed and sealed details of the containment system on the tank.
  - a. If the containment system will place additional loads on the tank that the tank was not originally designed for, the Contractor must reinforce the tank as necessary to prevent permanent deformation and to ensure that no damage occurs to the tank.
  - b. Any damage to the tank as a direct or indirect result of the containment system must be repaired or sections replaced by the Contractor at no additional cost to the Owner. Neither the Owner nor the Engineer assumes any responsibility for the structural ability of the tank to support the containment system.
8. If complete containment of the tank is utilized to contain all cleaning dust, debris, emissions, paint droplets, and paint overspray, the complete containment must include a full bonnet.
9. If tarps are used as part of the containment system, the tarps must be an impervious, solid, flame-resistant material, reinforced with a fiber mesh and must allow as much light as possible to pass through the material.
10. If robotic or creeper-type cleaning devices are used, the robotic or creeper-type device must meet the same containment criteria as that of the types of containment (lack of emissions). All overspray and paint droplets must be contained on the tank site.
11. Review of the containment system for containing the spent cleaning dust, debris, emissions, overspray, and coating droplets must not warrant the structural integrity of the containment system and must not warrant the structural integrity of the tank to support the containment system. Nor shall review of the containment system warrant the ability of the system to contain spent cleaning dust, debris, emissions, and overspray.
12. Damage Contingency Plan: Prior to construction, the Contractor must present a written plan for review by the Owner and Engineer concerning how dust and debris damage to automobiles will be removed. Approval of this plan will not relieve the Contractor from responsibility of settling claims, but is intended as an avenue to expedite and minimize such claims.

#### H. Visible Emissions:

1. Contractor must control visible emissions and releases while dust producing activities are underway.
2. Visible emissions more than SSPC Guide 6, Level 1 (1 percent of the workday or 5 minutes in an 8-hour shift) are unacceptable. Sustained emissions of more than 1 minute, regardless of the total time of emissions for the day is unacceptable. If unacceptable emissions are observed, Contractor must shut down immediately and correct the

situation and clean up any debris generated from the release to the satisfaction of the Engineer before continuing Work.

I. Dust Collection:

1. Contractor must provide dust collection as required to prevent any visible emissions from entering the atmosphere as a result of the abrasive blasting operation.
2. For interior tank abrasive blasting, high volume fans and dust socks at manholes and vents must be provided as a minimum requirement.
3. The dust collection must be operated on the interior of the tank during all abrasive blast cleaning and until the area is clean enough for coating application. Contractor shall be responsible for all sizing, design of ductwork, etc., based upon the Contractor's operations, number of blasters, duration of blasting, etc.
4. Contractor must take precautions to avoid a vacuum from developing inside of the tank.

WORKING CONDITIONS

- J. Provide adequate lighting at any location that coatings are being applied or testing is performed. Illumination must be of sufficient intensity as deemed necessary by the Owner's representative to achieve acceptable results. Provide explosion-proof lighting when required.
- K. Temporary ladders and scaffolds must conform to applicable safety requirements. Erect temporary scaffolds where needed to cover large areas. Provide ladders or scaffolding during testing procedures.

1.09 WARRANTY

A. Coating Manufacturer's Warranty:

1. Manufacturer's written warranty must be submitted and accepted by the Engineer prior to approval of the coatings submittal. If the warranty does not substantially meet the requirements of this Section, Contractor must provide an alternate coating manufacturer that will meet the requirements at no additional cost to the Owner.
2. General Warranty Requirements:
  - a. Coating products must prevent coating defects as defined as blistering, cracking, checking, cratering, delaminating, corrosion; etc., collectively "coating problems".
  - b. Coating products must not allow the substrate to corrode in excess of 1 percent of the surface being coated as measured in accordance with ASTM D610 for the duration of the manufacturer's warranty period.
  - c. Exterior coating system gloss and color measurement will be the average of four separate readings taken along the circumference of a circle of approximately six inches in diameter, at locations approximating 0-90-180-270 degrees. Measurement will be taken at up to four locations as determined by the OPT.
  - d. In the event the System does not provide the protection indicated herein, as applicable to the systems, the coating manufacturer's sole obligation will be to provide coating materials for the area where the coating problems occurred to make corrections for the duration of the warranty. Coating manufacturer will not be obligated to provide replacement coating materials having an aggregate value in

excess of 100 percent of the total sales price of the coating materials initially applied. At such time, if any, as coating manufacturer has supplied replacement coating material(s) with an aggregate value equal to 100 percent of the total sales price of the coating materials initially applied, the coating manufacturer's obligation under this warranty shall be deemed to have been completely fulfilled. Replacement coating materials must be the originally specified materials or as approved by the Engineer/Owner.

- e. Repairs performed under this warranty shall neither extend the term of this warranty nor affect the allowable percentage specified herein.
- f. The parties hereto agree that all disputes and differences arising under this warranty shall be resolved by binding arbitration at the location indicated by the Owner.

3. Tank Coating Warranty:

- a. IW-02 Tank Interior Wet Coating System – 100 Percent Solids Polyurethane System: Coating manufacturer must issue a 15-year warranty to the Owner for the coating applied on the interior of the tank.
- B. Warranty of All Other Coating Systems: Contractor and coating manufacturer must issue a warranty to the Owner for all coating materials, application and workmanship for all coatings installed on the Project unless specifically addressed by other Specifications. Contractor's maintenance bond may be used to assure this work, but will require the Surety's acknowledgement in writing prior to commencement of coating application on the Project.
- C. Warranty Work: Contractor and coating manufacturer must coordinate warranty work requested by the Owner at any time during warranty period. Owner is only required to contact Contractor to initiate warranty work.

## **2.00 PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Products listed herein are specified to establish a standard of quality. Products which comply with the Contract Documents and are manufactured by the following companies will be acceptable. Products from other coating manufacturers shall not be submitted and will not be considered.
  - 1. Carboline.
  - 2. PPG.
  - 3. Sherwin-Williams Company.
  - 4. Tnemec Company, Inc.
- B. To ensure coating compatibility, Contractor must use products of a single coating manufacturer for all coatings applied to the tank and/or its components, unless prior approvals are obtained in writing from the Owner and the coating manufacturer.

### **2.02 GENERAL COATING REQUIREMENTS**

- A. All coatings must be free of heavy metals such as arsenic, barium, chromium, selenium, silver, lead, mercury and cadmium.

- B. All interior coatings, thinners and products used on interior wet surfaces (all surfaces within the tank bowl and interior piping and valves) must meet the applicable requirements of NSF/ANSI/CAN 600 according to the requirements of NSF/ANSI/CAN 61, including the most current health effects criteria for xylenes, toluene and ethylbenzene for the application and volume of tank on the Project.
- C. No coating submitted or used on this Project must have a VOC (volatile organic content) in excess of 360 grams/liter or 3.0 lb./gal.
- D. Primers factory-applied must be those specified. Notify manufacturers which shop prime coats will be required in order to be compatible with field-applied finish coats. Where equipment is purchased which has the manufacturer's standard primer or a factory finish which is other than as specified in this Section, remove the factory-applied paint system or apply passivators or other special coatings as required to make the surface compatible with the finish coat specified.
- E. No inorganic zinc-rich primers shall be permitted on the tank interior surfaces.

#### COATING SCHEDULES

- F. IW-02 Tank Interior Wet Coating System – 100 Percent Solids Polyurethane System:
  - 1. Interior wet surfaces, include the tank roof, shell, bottom, accessories, piping and appurtenances that are exposed to the stored water or its vapor. These include items constructed of stainless steel, such as ladders and piping.
  - 2. Coating must be considered a "100 percent solids" (98 percent +/- 2 percent solids) and must cover all edges, bridge all gaps and be monolithic and holiday free. Material must be in accordance with ANSI/AWWA C222.
  - 3. Surface Preparation:
    - a. Solvent Cleaning: SSPC-SP 1. Prior to abrasive blasting, all surfaces must be thoroughly washed with solvent. Remove deposits of grease, oil and/or other contaminants from the surface prior to any other surface preparation. Neutralize and flush solvents with fresh water washing at a minimum of 3500 psi to remove solution.
    - b. Abrasive Cleaning: SSPC-SP 10 / NACE No. 2.
  - 4. Application Method(s): Spray. All weld seams, gaps, edges, bolts and difficult areas to coat must receive an additional pass/stripe coat during spray application.
  - 5. Full removal of preconstruction primer is required in accordance with SSPC-SP 10 / NACE No. 2.
  - 6. Refer to Paragraph 1.03, Quality Assurance, for training and certification required for applicators.
  - 7. Unsealed joints must be sealed with 100 percent solids lining system. Appropriately sized foam backer rod must be used as needed to fill spaces in unwelded joints. 30 mil thick high solids lining system must be sprayed behind backer rod and over backer rod once it is in place.



8. System (including all thinners and additives) to be one of the following and of the same manufacturer of all other coating products used on this Project:

a. Carboline:

| Coat              | Product           | DFT          | Color     |
|-------------------|-------------------|--------------|-----------|
| Spray Stripe Coat | Reactamine 760 HB |              | Light Tan |
| Single Coat       | Reactamine 760 HB | 30 mils min. | Light Tan |

b. PPG:

| Coat              | Product                                | DFT          | Color                       |
|-------------------|----------------------------------------|--------------|-----------------------------|
| Spray Stripe Coat | Amerthane 490 or<br>Aquataflex 505/506 |              | Off White<br>/Relaxed Khaki |
| Single Coat       | Amerthane 490 or<br>Aquataflex 505/506 | 30 mils min. | Off White<br>/Relaxed Khaki |

a. Sherwin-Williams:

| Coat              | Product       | DFT          | Color |
|-------------------|---------------|--------------|-------|
| Spray Stripe Coat | Poly-Cote 115 |              | Beige |
| Single Coat       | Poly-Cote 115 | 30 mils min. | Beige |

b. Tnemec:

| Coat              | Product                  | DFT          | Color     |
|-------------------|--------------------------|--------------|-----------|
| Spray Stripe Coat | Elasto-Shield Series 406 |              | Off White |
| Single Coat       | Elasto-Shield Series 406 | 30 mils min. | Off White |

9. Interior Wet Galvanized Painter's Rails:

- a. After interior coatings are complete, the interior wet galvanized painter's rails must receive two coats of NSF 61/600 certified epoxy.
- b. Epoxy coating is to be as recommended by the coating manufacturer and approved by the Engineer. Minimum requirements are as follows:
  - 1). Surface Preparation: SSPC-SP 1 Solvent Clean followed by an SSPC-SP 2/3 hand tool or power tool clean to abrade and roughen the surface or as recommended by the manufacturer for galvanized surfaces.
  - 2). Prime Coat: Epoxy, 4-6 mils DFT.
  - 3). Finish Coat: Epoxy, 4-6 mils DFT.

G. ID-01 Tank Interior Dry System - Zinc Rich Primer/Epoxy/Epoxy:

1. System applies to all interior dry surfaces of the finished structure that are not exposed to the elemental atmosphere, the stored water, or its vapor. These areas include, but are not limited to the interior of the access tube, interior of the steel pedestal, and the underside of a suspended bottom within the pedestal.
2. Finish coat shall be satin.

## 3. Surface Preparation:

a. Solvent Cleaning: SSPC-SP 1. Prior to abrasive blasting, all surfaces must be thoroughly washed with solvent. Remove deposits of grease, oil and/or other contaminants from the surface prior to any other surface preparation. Neutralize and flush solvents with fresh water washing at a minimum of 3500 psi to remove solution.

b. Abrasive Cleaning: SSPC-SP 6 / NACE No. 3.

## 4. Application Method(s): Spray or roller. Brush must only be used for touch up and stripe coating.

## 5. Organic zinc-rich primer must be minimum 80 percent zinc by weight.

## 6. Preconstruction Priming:

a. Preconstruction priming must be in accordance with AWWA D102. Full removal of construction primer is not required if the primer is fully compatible with the specified paint system primer. A letter from the paint manufacturer certifying compatibility must be submitted with coating submittal. The zinc primer indicated in the schedules below is not a preconstruction primer and must be field applied.

b. Weld seams and bare steel must be cleaned to SSPC-SP 6 / NACE No. 3.

c. Areas with in adherent preconstruction primer or rusting must be cleaned to SSPC-SP 7 / NACE No. 4.

d. A full field coat of the specified prime coat indicated below must be applied over the spot-cleaned bare steel and remaining preconstruction primer.

## 7. Three-coat system to be one of the following and of the same manufacturer of all other coating products used on this Project:

## a. Carboline:

| Coat                               | Product       | DFT        | Color             |
|------------------------------------|---------------|------------|-------------------|
| Prime Coat                         | Carbozinc 859 | 3-5 mils   | Gray              |
| Stripe Coat                        | Carboguard 60 | 2-3 mils   | Contrasting Color |
| Intermediate Coat                  | Carboguard 60 | 4-6 mils   | Beige             |
| Finish Coat                        | Carboguard 60 | 4-6 mils   | T.B.D.            |
| Minimum and Maximum DFT for System |               | 11-17 mils |                   |

## b. PPG:

| Coat                               | Product        | DFT        | Color             |
|------------------------------------|----------------|------------|-------------------|
| Prime Coat                         | Amercoat 68HS  | 4-5 mils   | Gray              |
| Stripe Coat                        | Amerlock 2/400 | 2-3 mils   | Contrasting Color |
| Intermediate Coat                  | Amerlock 2/400 | 4-6 mils   | Beige             |
| Finish Coat                        | Amerlock 2/400 | 4-6 mils   | T.B.D.            |
| Minimum and Maximum DFT for System |                | 16-17 mils |                   |

## c. Sherwin-Williams:

| Coat                               | Product              | DFT        | Color             |
|------------------------------------|----------------------|------------|-------------------|
| Prime Coat                         | Corothane I Galvapak | 3-4 mils   | Gray              |
| Stripe Coat                        | Macropoxy 646*       | 2-3 mils   | Contrasting Color |
| Intermediate Coat                  | Macropoxy 646*       | 4-6 mils   | Beige             |
| Finish Coat                        | Macropoxy 646*       | 4-6 mils   | T.B.D.            |
| Minimum and Maximum DFT for System |                      | 11-16 mils |                   |

\*Macropoxy 5500LT is an approved equal to the Macropoxy 646

## d. Tnemec:

| Coat                               | Product              | DFT           | Color             |
|------------------------------------|----------------------|---------------|-------------------|
| Prime Coat                         | 90G-1K97 Tneme-Zinc  | 2.5-3.5 mils  | Reddish Gray      |
| Stripe Coat                        | Epoxoline Series 141 | 2-3 mils      | Contrasting Color |
| Finish Coat                        | Epoxoline Series 141 | 8.5-12.5 mils | T.B.D.            |
| Minimum and Maximum DFT for System |                      | 11-16 mils    |                   |

## H. EN-02 Tank Exterior System – Zinc Rich Primer/Polysiloxane System:

1. System applies to all exterior surfaces of the tank roof, shell, steel pedestal, legs, accessories, piping connecting to the tank and appurtenances that are exposed to the elemental atmosphere.
2. Finish coat shall be high gloss.
3. Surface Preparation:
  - a. Solvent Cleaning: SSPC-SP 1. Prior to abrasive blasting, all surfaces must be thoroughly washed with solvent. Remove deposits of grease, oil and/or other contaminants from the surface prior to any other surface preparation. Neutralize and flush solvents with fresh water washing at a minimum of 3500 psi to remove solution.
  - b. Abrasive Cleaning: SSPC-SP 6 / NACE No. 3.
4. Application Method(s): Spray or roller as recommended by the paint manufacturer. Brush must only be used for touch up and stripe coating. The mils indicated may be difficult to achieve by roller in a single coat. Additional coats may be required to achieve the specified mils at no additional cost to the Owner.
5. Organic zinc-rich primer must be minimum 80 percent zinc by weight.
6. Shop Priming:
  - a. Shop priming must be in accordance with AWWA D102.
  - b. Shop-applied primer may be eliminated or applied at reduced thickness within 4-inches of any area to be welded.
  - c. Field work after the tank is erected consists of spot cleaning and spot priming exposed weld margins and primer abrasions. Weld seams and bare steel must be cleaned to

SSPC-SP 6 / NACE No. 3. Spot priming must be in accordance with the manufacturer's recommendations.

7. Preconstruction Priming:

- a. Preconstruction priming must be in accordance with AWWA D102. Full removal of construction primer is not required if the primer is fully compatible with the specified paint system primer. A letter from the paint manufacturer certifying compatibility must be submitted with coating submittal. The zinc primer indicated in the schedules below is not a preconstruction primer and must be field applied.
  - b. Weld seams and bare steel must be cleaned to SSPC-SP 6 / NACE No. 3.
  - c. Areas with adherent preconstruction primer or rusting must be cleaned to SSPC-SP 7 / NACE No. 4.
  - d. A full field coat of the specified prime coat below must be applied over the spot-cleaned bare steel and remaining preconstruction primer.
8. Three-coat system to be one of the following and of the same manufacturer of all other coating products used on this Project:

a. Carboline:

| Coat                               | Product                | DFT       | Color             |
|------------------------------------|------------------------|-----------|-------------------|
| Prime Coat                         | Carbozinc 859          | 3-5 mils  | Gray              |
| Stripe Coat                        | Carboxane 2000 or 2100 | 2-3 mils  | Contrasting Color |
| Intermediate Coat                  | Carboxane 2000 or 2100 | 3-4 mils  | T.B.D.            |
| Finish Coat                        | Carboxane 2000 or 2100 | 3-4 mils  | T.B.D.            |
| Minimum and Maximum DFT for System |                        | 9-13 mils |                   |
| Logo                               | Carboxane 950 VOC      | 2-3 mils  | T.B.D.            |

b. PPG:

| Coat                               | Product                  | DFT          | Color             |
|------------------------------------|--------------------------|--------------|-------------------|
| Prime Coat                         | Amercoat 68HS            | 3-5 mils     | Gray              |
| Stripe Coat                        | PSX 700/805 Polysiloxane | 2-3 mils     | Contrasting Color |
| Intermediate Coat                  | PSX 700/805 Polysiloxane | 3-4 mils     | T.B.D.            |
| Finish Coat                        | PSX 700/805 Polysiloxane | 3-4 mils     | T.B.D.            |
| Minimum and Maximum DFT for System |                          | 9-13 mils    |                   |
| Logo                               | Corafon ADS Intermix     | 1.5-2.2 mils | T.B.D.            |

c. Tnemec:

| Coat        | Product              | DFT          | Color             |
|-------------|----------------------|--------------|-------------------|
| Prime Coat  | 90G-1K97 Tneme-Zinc  | 2.5-3.5 mils | Reddish Gray      |
| Stripe Coat | Siloxilon Series 690 | 2-3 mils     | Contrasting Color |

| Coat                               | Product              | DFT       | Color  |
|------------------------------------|----------------------|-----------|--------|
| Intermediate Coat                  | Siloxilon Series 690 | 3-4 mils  | T.B.D. |
| Finish Coat                        | Siloxilon Series 690 | 3-4 mils  | T.B.D. |
| Minimum and Maximum DFT for System |                      | 9-12 mils |        |
| Logo                               | Series 700 Hydroflon | 2-3 mils  | T.B.D. |

## d. Sherwin-Williams:

| Coat                               | Product              | DFT       | Color             |
|------------------------------------|----------------------|-----------|-------------------|
| Prime Coat                         | Corothane I Galvapac | 3-4 mils  | Gray              |
| Stripe Coat                        | Sher-Loxane 800      | 2-3 mils  | Contrasting Color |
| Intermediate Coat                  | Sher-Loxane 800      | 3-4 mils  | T.B.D.            |
| Finish Coat                        | Sher-Loxane 800      | 3-4 mils  | T.B.D.            |
| Minimum and Maximum DFT for System |                      | 9-12 mils |                   |
| Logo                               | FluoroKem HS 100     | 2-3 mils  | T.B.D.            |

## I. SS-01 Interior/Exterior Equipment, Pumps, Motors, Valves and Piping:

1. System applies to Interior/Exterior Equipment, Pumps, Motors, Valves and Piping that are bare or shop primed with epoxy, alkyd, acrylic, or unknown primer type. System is not to be used for submerged piping, piping in vaults or piping with insulation. Above grade exterior piping attached to tank is to be prepared and coated per the tank's specified exterior coating system.
2. Finish Coat Colors:
  - a. Non-Potable Water Piping and Valves: Purple.
  - b. Valve Hand Wheels: Red.
  - c. Overflow Drain Flap Valve: Gray.
3. Finish coat shall be satin.
4. Surface Preparation:
  - a. Steel Pipe and Fittings:
    - 1). Solvent Cleaning: SSPC-SP 1. Prior to abrasive blasting, all surfaces must be thoroughly washed with solvent. Remove deposits of grease, oil and/or other contaminants from the surface prior to any other surface preparation. Neutralize and flush solvents with fresh water washing at a minimum of 3,500 PSI to remove solution.
    - 2). SSPC-SP 6 / NACE No. 3.
  - b. Ductile Iron Pipe and Fittings: Clean per NAPF 500-03-01, NAPF 500-03-04 and NAPF 500-03-05, with degree of cleanliness, Blast Clean No. 2.

c. Field preparation of Shop Primed Surfaces:

- 1). Consult Engineer for surface preparation requirements for removal of asphaltic coatings.
  - 2). Slag and weld metal accumulations and splatters not removed by the fabricator must be removed in the field by chipping or grinding. Sharp edges must be peened, ground or otherwise blunted.
  - 3). Clean per SSPC-SP 1 for steel applications. Clean per NAPF 500-03-01, Solvent Cleaning, for ductile iron applications.
  - 4). Areas adjacent to welds or any area where shop primer has been damaged must be thoroughly cleaned in accordance with SSPC-SP 11, preparation and re-primed for steel applications. Clean in accordance with NAPF 500-03-02, Hand Tool Cleaning, and NAPF 500-03-04, Power Tool Cleaning, preparation and re-primed for ductile iron applications. All edges adjacent to damaged primer must be feathered.
  - 5). If damage is too extensive or uneconomical to touch up or if the existing primer shows signs of wear or weathering, the entire item must be re-cleaned and coated in accordance with SSPC-SP 7 / NACE No. 4 using fine (30 to 100 mesh) abrasive for steel applications. Re-clean per NAPF 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe and NAPF 500-03-05, Abrasive Blast Cleaning for Cast Ductile Iron Fittings, Cleanliness Level No. 2 for ductile iron applications. Welds and irregular surfaces must receive a stripe coat of the specified primer prior to the application of the first field coat.
  - 6). Provide final solvent cleaning as specified prior to coating.
  - 7). 100 to 200 grit sandpaper must be used to roughen the surface and feather edges of the existing coating system.
  - 8). Motors, electrical, equipment name plates, labels, tags, site glasses, gauges, etc. must be protected from damage during abrasive blasting.
5. Application Method(s): Spray or brush. Brush must be used for touch up and stripe coating.
6. Three-coat system to be one of the following and of the same manufacturer of all other coating products used on this Project:
- a. Carboline:

| Coat                               | Product          | DFT        | Color        |
|------------------------------------|------------------|------------|--------------|
| Prime Coat                         | Carbomastic 15   | 4-6 mils   | Aluminum     |
| Stripe Coat                        | Carboguard 60    |            | Beige        |
| Intermediate Coat                  | Carboguard 60    | 4-6 mils   | Beige        |
| Finish Coat                        | Carbothane 134HG | 2-4 mils   | As specified |
| Minimum and Maximum DFT for System |                  | 10-16 mils |              |

## b. PPG:

| Coat                               | Product           | DFT        | Color        |
|------------------------------------|-------------------|------------|--------------|
| Prime Coat                         | Amerlock 2/400 AL | 5-6 mils   | Aluminum     |
| Stripe Coat                        | Amerlock 2/400    |            | Beige        |
| Intermediate Coat                  | Amerlock 2/400    | 5-6 mils   | Beige        |
| Finish Coat                        | Amercoat 450HS    | 2-3 mils   | As specified |
| Minimum and Maximum DFT for System |                   | 12-15 mils |              |

## c. Sherwin-Williams:

| Coat                               | Product                | DFT        | Color        |
|------------------------------------|------------------------|------------|--------------|
| Prime Coat                         | Epoxy Mastic II        | 4-6 mils   | Aluminum     |
| Stripe Coat                        | Macropoxy 646          |            | Beige        |
| Intermediate Coat                  | Macropoxy 646          | 5-10 mils  | Beige        |
| Finish Coat                        | Hi-Solids Polyurethane | 3-5 mils   | As specified |
| Minimum and Maximum DFT for System |                        | 13-25 mils |              |

## d. Tnemec:

| Coat                               | Product                                    | DFT        | Color             |
|------------------------------------|--------------------------------------------|------------|-------------------|
| Prime Coat                         | Chembuild Series 135 or Series 133 ProTuff | 4-6 mils   | Aluminum          |
| Stripe Coat                        | N69 HB Epoxoline II                        |            | Contrasting Color |
| Intermediate Coat                  | N69 HB Epoxoline II                        | 4-6 mils   | Beige             |
| Finish Coat                        | 1094 Endura-Shield                         | 3-5 mils   | As specified      |
| Minimum and Maximum DFT for System |                                            | 11-17 mils |                   |

## 2.03 COATING REPAIR

- A. Coating repair materials will be as recommended by the coating manufacturer and as approved by the Engineer.
- B. All repair materials in contact with potable water meet the applicable requirements of NSF/ANSI/CAN 600 according to the requirements of NSF/ANSI/CAN 61, including the most current health effects criteria for xylenes, toluene and ethylbenzene.

## 2.04 SLIP-RESISTANT ADDITIVE

- A. Slip resistant additive is to be added to finish coating within guardrail areas and as indicated on the Drawings. Additive must be compatible with the finish coating to provide a slip

resistant surface without compromising the longevity of the coating. Engineer may require areas with a slip-resistant additive to be a contrasting color at no additional cost to the Owner.

B. Coating manufacturer must confirm the product(s) are compatible with coating systems.

C. Approved Manufacturers:

1. H&C SharkGrip Slip-Resistant Additive.
2. Approved Equal.

## 2.05 GEOTEXTILE FABRIC

A. Fabric Material must be a non-woven, 100 percent polypropylene fabric, with a “heat-set” on one side. Material to weigh 8 to 10 oz./sq. yd. and be approved by the coating manufacturer.

## 2.06 STAINLESS STEEL CLEANING AND PASSIVATION

A. Product must be designed for the cleaning and passivation of stainless steel products.

B. Approved Manufacturers/Products:

1. CitriSurf 2210.
2. Approved Equal.

## 2.07 CAULK SCHEDULE

A. IC – 01 Tank Interior/Exterior System:

1. Sika Flex 1A or Approved Equal.
2. Product must meet the applicable requirements of NSF/ANSI/CAN 600 according to the requirements of NSF/ANSI/CAN 61, including the most current health effects criteria for xylenes, toluene and ethylbenzene.
3. Color:
  - a. Caulking within the interior of the tank must be a contrasting color to the finish coat as approved by the Owner.
  - b. Exterior and exposed caulking color must be approved by the Owner.

## 2.08 SALT AND CHLORIDE REMOVAL

A. The following products may be used to remove salts from surfaces. Product must not interfere with the adhesion of the protective coatings and linings. Coating manufacturer must provide a letter indicating no adverse effects prior to use. Contractor must test wash water and confirm hardness and water quality for compatibility with product. Provide letter from manufacturer confirming suitability and application instructions specific to the project and wash water test results. Provide dechlorinated and/or activated carbon-filtered wash water as required by the product manufacturer at no additional cost.

B. Approved Products:

1. Chlor\*Rid Salt Remover.
2. Holdtight 102.



3. CleanWirx 207.
4. Approved Equal.

## 2.09 COLOR SELECTION

- A. Contractor must submit drawdowns for Owner's review and approval of final color selection for all exterior coating systems.
- B. Use a multi-color system coating for any surface receiving more than one coat. Each coat must be tinted differently from the preceding coat in a manner that will allow the various coats to be easily distinguished. Colors must generally be from light to dark shades, but the Contractor may have the option to select tint shades to ensure coats will receive adequate coverage without bleeding or otherwise showing through the preceding coat.
- C. Piping and equipment must be color coded in accordance with the requirements of the NCDEQ or as indicated above.

## 2.10 ABRASIVE MATERIALS

- A. Abrasive materials used must be non-carcinogenic when properly used, properly graded, be sharp, have proper angularity, and be clean and free of contaminants that would interfere with adhesion of coating, including lead, chromium, cadmium, arsenic, chlorides, dirt, oil, etc., such as steel grit or approved equal.
- B. All expendable abrasives must meet SSPC-AB 1 and all abrasives must meet the requirements of SSPC-AB 1, Class A for silica content with less than 1 percent silica by weight before blasting.
- C. New ferrous recyclable abrasive must meet SSPC-AB 3 and SSPC-AB 2.
- D. Ferrous and Non-Ferrous recycled abrasive must meet the requirements of SSPC-AB 2/4, for new and re-manufactured abrasives. Recycled abrasive used on this Project must be sampled before use by the Owner's representative and the Contractor. Contractor must take samples in the presence of the Owner's representative. Every barrel or container of recycled abrasive must be tested. Contractor must have the samples sent to a laboratory for testing per SSPC-AB 2/4 and for atomic absorption testing for total lead, cadmium, chromium, barium and arsenic. The recycled abrasive must not be used until the results of the atomic absorption testing, testing required by SSPC-AB 3/4 and chain of custody forms are submitted and accepted by the Engineer. Test results must indicate that the total lead levels are less than 1000 ppm (<0.1 percent) to be allowed to be used on this Project. Test must be used for abrasives used in both shop and field abrasive blasting.
- E. The grade must be of such size as to achieve an acceptable anchor pattern or surface profile as required by the coating manufacturer.
- F. Silica sand, coal slag, and/or copper slag must not be used as a blast abrasive.

## 3.00 EXECUTION

### 3.01 GENERAL

- A. All materials must be handled and applied in accordance with the coating manufacturer's recommendations and this Section.

- B. No coatings shall be applied while water is in the tank.
- C. All coating material for the exterior topcoat must be mixed from one batch number. Batching should occur so that the shelf life extends beyond the end of the Project.
- D. All blasting and coating equipment must be in first class condition and comply with all recommendations of the coating manufacturer and these specifications. Owner reserves the right to have the Contractor immediately repair, modify or remove equipment functioning poorly or creating a nuisance as determined by the Owner.
- E. Do not apply any coating to machinery, piping, or other surfaces before testing has been completed and systems approved. Any damage to coatings resulting from subsequent corrective procedures must be stripped back to bare metal and repainted with the appropriate paint system as directed by the Engineer.
- F. Surfaces which will be inaccessible after installation must be coated prior to installation, or must be coated and approved in stages as the Work is installed.
- G. At least 7 days shall be allowed for drying of finished surfaces before any machinery can be placed into service.
- H. Do not apply coating over nameplates or other identification plaques. Mask such plates and keep protected. Remove tape and polish nameplates after painting is complete.
- I. Coating application procedures must conform to the standards of craftsmanship as discussed in the Steel Structures Painting Manual, Volume 1 "Good Painting Practice".
- J. All thinning must be as per the coating manufacturer's recommendations. Use only those thinners expressly approved by the manufacturer for the coatings used on this Project. Do not allow thinners to be stored in unmarked containers at any time.
- K. Illumination equipment must be provided by the Contractor in accordance with SSPC Guide 12. Explosion-proof lights and electrical equipment must be provided. The minimum illumination at the surface of the work during surface preparation and coatings is 215 lux (20 fc). The minimum illumination during inspection is 538 lux (50 fc). Whenever required by the Owner's representative, the Contractor must provide additional illumination and necessary supports to cover all areas to be inspected.
- L. Project lighting must not interfere with existing residences or schools. Complaints from adjacent residential neighbors shall require Contractor to modify lighting plan to address complaint. Project lighting is considered subsidiary work relating to various bid items of the Contract.
- M. Contractor must provide covers and plugs for the intake, discharge and drain piping at the point where the pipe enters the water compartment to prevent debris, or any other foreign matter from entering the water mains. The covers and plugs must remain in place from beginning of the job until just prior to filling the tank for disinfection. Prior to filling the tank, Contractor must allow and support the Owner in flushing inlet lines into tank.
- N. Grating or grills must be securely attached to all openings not otherwise secured at the end of work each day until work commences again. Gratings or grills must be used on all openings until the tank is secured for service. Grates or grills must be of at least 1/4-inch wire mesh, with a minimum of two square inch mesh openings and a maximum of six square inch openings, to allow adequate free air passage and tank protection.

- O. Engineer must approve surfaces for application of coatings at each stage. Any material that is coated prior to the Engineer's approval must be stripped back to bare metal and repainted.
- P. Cleaning and coating must be scheduled such that dust and other materials from adjoining Work will not contaminate wet or newly coated surfaces.
- Q. Roof plates must be jacked off rafters as required to abrasive blast and coat between the rafters and roof plates. Contractor is responsible for any damages to the tank and structural members resulting from point loading or over jacking the roof. Contractor must use swivel or angle tips to allow abrasive blasting and coating between rafter and roof plates and other tight areas not accessible with straight tips.
- R. Where inspection shows that the specified thickness is not developed, apply additional coats to produce the required dry film thickness. If the re-coat window has passed, Contractor must abrade and prepare the surface in accordance with the manufacturer's recommendations. Contractor must submit surface preparation to the Engineer for review prior to starting Work.
- S. Stainless steel may be welded to the tank. Exterior coating system must be applied 6 inches onto any stainless steel materials welded to the tank. The stopping point on the stainless steel surfaces that are to be coated must be masked with painter's tape. The tape must be removed after the coating has dried to a soft consistency, but before it is cured. All exposed stainless steel must be cleaned and passivated to remove free iron from surfaces. Contractor must follow cleaning product manufacturer's instructions when cleaning and passivating stainless steel.
- T. Contractor may install painter's nipples in the roof of the tank for supporting staging on the interior of the tank, only with the express written permission of the Engineer. The nipples must remain a part of the tank after construction is complete. Nipples are to be constructed of 316 stainless steel and coated with the specified coating system. Contractor must plug nipples with PVC plugs on the interior and exterior. Contractor must submit Shop Drawings for the nipples, the location of the nipples, and a narrative on how the nipples will be prepared for interior coatings. No other penetrations in the tank shell, roof, or floor will be permitted without the express written permission of the Engineer.
- U. All applicable equipment must be electrically grounded as required and must have clean operating gauges, moisture traps, etc.
- V. Effective oil and water separators combined with after coolers or desiccant dryers must be used in compressed air lines serving abrasive blasting operations to remove detrimental oil and moisture from the air. Compressors may be tested periodically by the Owner's representative for oil and water contamination of compressed air per ASTM D4285. All compressor units found to produce unacceptable amounts of oil and or water must be replaced with a compressor that is acceptable.
- W. Any Work found to be deficient, damaged, or otherwise unacceptable must be repaired in accordance with the coating manufacturer's written repair recommendations as approved by the Engineer at no additional cost.
- X. Effective oil and water separators combined with after coolers or deliquescent dryers must be used in compressed air lines to remove detrimental oil and moisture from the air. Compressors must be tested daily prior to starting work by the Contractor for oil and water contamination of compressed air per ASTM D4285. All compressor units found to produce unacceptable amounts of oil and or water must be removed from the project site.

### 3.02 SURFACE PREPARATION

- A. Shop Surface Preparation: Clean and degrease surfaces prior to abrasive blasting to SSPC-SP 1. Methods described in SSPC-SP 1 include solvents, detergent/water, emulsions, and steam. Proposed method must be documented in the coating plan. Contractor must contain and properly dispose of all runoff and debris from cleaning. Prepare surfaces by abrasive blasting as specified and apply shop prime coat. Shop primed steel plates must not have primer extended within 4 inches along all edges to be welded. All primer within 4 inches of an area to be welded must be removed prior to welding. Welding of painted surfaces will not be allowed.
- B. Field Surface Solvent Cleaning: Clean and degrease surfaces prior to abrasive blasting to SSPC-SP 1. Methods described in SSPC SP-1 include solvents, detergent/water, emulsions, and steam. Proposed method must be documented in the coating plan. Contractor must contain and properly dispose of all runoff and debris from cleaning. Remove heavy deposits of grease or oil from the surface prior to any other surface preparation. Neutralize and flush chemical contamination prior to any surface preparation. Contractor must contain and properly dispose of all runoff and debris from cleaning.
- C. All weld slag, spatter, rough welds and other sharp or rough areas must be removed to a profile conforming to NACE SP0178, Profile 'D'.
- D. All rusted, abraded and unpainted areas must be abrasive blast cleaned as specified. Touch up prime coat with primer as specified.
- E. If the following conditions exist or are prevalent, surface preparation and coating must be delayed or postponed until conditions are favorable. Each day's coating must be completed in time to permit the film sufficient drying time prior to damage by atmospheric conditions or changes. No surface preparation shall begin or coating applied:
  - 1. When the surface, air or material is below or above the manufacturer's printed instructions.
  - 2. When surfaces are wet or damp.
  - 3. During weather conditions of rain, snow, fog or mist.
  - 4. When the air and steel temperature is less-than or equal to 5 deg. F above the dew point temperature.
  - 5. If the relative humidity is above 85 percent.
  - 6. When it is expected that the air and/or surface temperature will be below or above the coating manufacturer's recommended temperatures within 4 hours after applications of coating, minimum. Coating manufacturer may require additional time between application and temperature and weather changes based on existing environmental conditions.
- F. All pre-assembled shop primed items must be prepared in accordance with these specifications and inspected by the Owner's representative before and after priming.
- G. For both immersion and non-immersion service, all sharp edges and welds must be ground smooth to a rounded contour and all weld splatter must be removed prior to abrasive blasting. Edges of metal to be coated must be rounded to a minimum of 1/16-inch radius of chamfered a minimum of 1/16 inch at an angle of 45 degrees.

#### H. Abrasive Blasting:

1. Prior to extensive abrasive blasting operations, the Contractor must perform a test blast on both the exterior and interior of the tank in the presence of the Engineer or Owner's representative. Test section must be a minimum of 5 feet by 5 feet. The Engineer or Owner's representative must verify that the surface cleanliness and profile meets the requirements of the Specifications and the coating manufacturer's requirements for the coating to be applied. If the test section does not meet the requirements, the Contractor must make changes to the abrasive materials and methods to provide suitable blast.
2. Adequate surface preparation must be verified throughout surface preparation per SSPC-PA 17. Minimum testing requirements:
  - a. Test the surface profile within the first 15-minutes and one additional time during each work shift or 12-hour period, whichever is shorter for each gun or blasting apparatus used or at any time the process producing the acceptable profile indicated above is changed, as interpreted by the Engineer.
  - b. Select a minimum of three 6-inch square locations and take two readings. The average to the two readings is a "profile measurement." The group of three locations is the "location average." The location average must be within the specified profile range.
  - c. Contractor must report the location averages (lowest location average and highest location average) and the profile measurement for each surface preparation apparatus.
3. If the tank has been previously coated, an existing profile may exist. Contractor must adjust blast media size to ensure that the surface profile yield meets the profile required.
4. Abrasive blast only the amount of surface area which can be primed the same day or before any rust starts to form, whichever occurs first. Areas which are not painted the same day must be re-blasted on the day the prime coat is applied. Contractor must leave an unpainted stripe of abrasive blasted surface to clearly identify the previous day's work.
5. Blasting abrasive may be left on the tank floor while painting the interior roof and walls provided no paint is applied to the walls within 4 feet of the floor.
6. Shrouding or recovery of all blast material will be mandatory during all exterior blasting.
  - a. The NCDEQ has established, 15A NCAC 02D .0541, Control of Emissions from Abrasive Blasting, and 15A NCAC 2D .0521, Control of Visible Emissions. All Work must be performed in accordance with these regulations and are hereby made part of this Section by reference.
  - b. Contractor must comply with all record keeping and reporting requirements in accordance with 15A NCAC 02D .0605 and 15A NCAC 02D .0535.
7. Contractor must contain all waste and process discharge in accordance with the accepted methods for the process and materials that are in abatement.
8. Air filtration/dust collectors must be used in conjunction with the dehumidification and/or ventilation equipment during blasting operations.
9. Where abrasive blast cleaning will not remove or properly prepare metal surfaces, hand and/or power tool cleaning must be used to remove such conditions as weld splatter,

laminations and radius-sharp edges. Hand tool or power tool must be used on areas less than 2 feet in diameter or smaller or on corners and edges of the tank and its internal support members. The surface must be re-blasted after hand work is completed.

10. All abrasive blast equipment must be equipped with, including but not limited to the following:
  - a. Noise reducing devices.
  - b. Hose coupling safety devices.
  - c. Electrical grounding devices.
  - d. Moisture traps and filters.
  - e. Fresh air hoods for all blasters.
  - f. "Dead Man" switches on all blast hoses.
  - g. Air Dryers.
11. Alternate Methods: Alternate removal methods must have prior written approval by the NCDEQ Air Quality Division prior to submittal to the Owner for consideration.
- I. Surface profile must be in accordance with the manufacturer's printed requirements and as specified herein. In the event of a discrepancy, the Engineer's decision will be final.
- J. The adequacy of the preparation of surfaces must be determined by comparing the surface with SSPC-VIS 1, SSPC-VIS 3, SSPC-VIS 4 and NACE RP0178.

### 3.03 COATING STAINLESS STEEL

- A. The requirements for preparing carbon steel for painting apply to stainless steel, with the exception that the Contractor must not use metallic abrasives on stainless steel. Surface profile of stainless steel must be a minimum of 1.5 mils.
- B. All stainless steel components must be passivated during fabrication per ASTM A967. Any contaminated components must be repassivated during final assembly in accordance with ASTM A380.
- C. At locations where stainless steel is welded to carbon steel, prepare stainless steel surface and extend coatings 4 inches on to stainless steel. Provide a taped symmetrical and clean edge at the end of the coatings on the stainless steel.

### 3.04 APPLICATION

- A. After abrasive blast cleaning, dust and spent abrasive must be removed from the surfaces by air blasting and brush sweeping. The prime coat must be applied as soon as possible after the blasting and surface cleaning is completed, inspected and approved by the Inspector.
- B. Blasted surfaces must be coated before rust forms on the surface. No prepared surface will be allowed to receive a coating if "rust bloom" or surface discoloration has occurred. All blasted surfaces must be coated to within 6 inches of the edge of a blasted area. No visible rust must be coated under any circumstances, including rust bloom or if discoloration has occurred, regardless of elapsed time between blasting and coating.
- C. Provide mist coat if recommended by the coating manufacturer.

D. Maximum and minimum DFT must be per the supplied coating manufacturer's printed requirements and as required by this Section. DFT will be measured per SSPC-PA 2, Level 2 with an allowable measurement of spot DFT of:

1. Minimum DFT as specified, no less than the minimum specified will be accepted.
2. 120 percent of maximum DFT specified.

Areas that fail to meet this criterion must be corrected. Use of an instrument such as a Tooke Gauge, precision groove grinder, etc., is permitted if a destructive test is deemed necessary by the Engineer and the total DFT is less than 50 mils.

- E. Contractor must apply each coat at the rate and in the manner specified by the coating manufacturer, except as may be modified herein. If material has thickened or must be diluted for application, coating must be built up to the same dry film thickness as specified for each coat of the complete system. Additional thinner may not be added after the initial thinning.
- F. Contractor and painting technicians are responsible for the application of the coating system and must have current applicator approvals from the coating manufacturer, as required.
- G. Manufacturer must certify that coating system is compatible with the tank's cathodic protection system.
- H. No coating shall be used which has an expired shelf or pot life.
- I. Coating must be applied by skilled workmen and must be brushed out or sprayed evenly, without runs, crazing, sags, or other blemishes. Use of rollers are not permitted on the interior surfaces of the tank.
- J. Sand between coats to remove over spray and/or dry spray as necessary.
- K. Apply the first coat to the surface, including cutting in around edges, before the second coat is applied. The second coat and any successive coats must not to be applied before notifying the Owner's field representative and obtaining approval. Each coat must be tested before the successive coat is applied.
- L. The coating curing period must be adjusted to compensate for surface temperatures and humidity, as recommended by the coating manufacturer, for complete curing of the entire coating system. The full curing time recommended by the manufacturer shall be provided.
- M. Coating must be continuous and must be accomplished in an orderly manner to facilitate proper inspection control.
- N. Where a roller or brush is used to apply the coating, additional coats may be necessary to achieve the recommended dry film thickness and/or to achieve total coverage of the underlying surface. Coated surfaces must be totally free of all roller nap, roller marks, brush bristles and brush marks.
- O. To the extent possible, the interior and exterior of all piping entering through the walls of the tank must be blasted and recoated the same as their respective tank walls. The interior of piping entering through the tank floor must be blasted and recoated the same as the interior of the tank. Methods of recovering blast material from the inside of the pipes must be submitted and approved by the Owner.
- P. Field applied material must overlap onto cleaned and prepared adjacent coating system by a minimum of 6 inches. Preparation must be per the manufacturer's recommendations and

included in submitted coating plan. Coatings may not be applied to a surface that has not been properly prepared.

- Q. Check for compatibility when applying coatings over existing coatings. Apply a test patch of the recommended coating system, covering at least 2 to 3 square feet or as directed by the Engineer. Allow to cure 1 week before testing adhesion per ASTM D3359 in the presence of the Engineer. If adhesion does not meet the manufacturer's published data, consult with the Engineer.

### 3.05 100 PERCENT SOLIDS INTERIOR LINING SPECIAL SURFACE PREPARATION

- A. Coatings must not be applied to flash rusted surfaces or to existing coatings.
- B. All weld seams, gaps, edges, bolts and difficult areas difficult to coat must receive an initial spray applied stripe coat of the high solids coating just before application of the liner over the entire surface.
- C. Geo-Textile Fabric:
  - 1. Contractor must apply geo-textile fabric over sharp edges, areas of pitting as determined by the Engineer, over bolted and gasketed seams and other locations determined by the Engineer.
  - 2. Contractor is to stripe coat the area to be treated. Place pre-cut length of fabric and press evenly into coating. "Heat-set" side of fabric is to be facing out, i.e., "fuzzy" side towards the steel. Fabric is to be embedded in the stripe coat and then encapsulated as the same time as the rest of the structure. Exposed fabric fibers, edges or other discontinuities are not acceptable.
- D. Backer-Rod: In unsealed joints, corners and gaps, fill gaps with backer rod. Backer rod is to be packed into gaps after stripe coat of the area and then coated with final coat.
- E. Contractor must provide primer over pitted or corroded areas per the coating manufacturer's recommendation and as approved by the Engineer. No separate pay.

### 3.06 STRIPE COAT

- A. Stripe coat must be applied by brush and thinned according to written coating manufacturer's recommendations and applied to all welds, weld seams, tack welds (new and old), edges, bolts, rivets, ladder rails and rungs, seamed corners, joints of any kind and locations where brackets, lugs and other difficult to coat surfaces exist. Stripe coat on all welds and weld seams must extend 2 inches minimum above, below and beyond all welded sections.
- B. For 100 percent solids coatings, the stripe coat is considered an extra spray pass during the application of the final coat. Use brushes or other means as required to push coating into crevasses and difficult to coat surfaces.
- C. Stripe coat must occur in coating system layering as stated in Coating Schedule.
- D. Stripe coat is accomplished by moving the brush back and forth in a scrubbing motion working primer into all crevices. Stripe coat must be performed with a high-quality bristle brush using primer that has been thinned according to manufacturer's instructions. Bristles left on the surface must be removed before the coating dries. If bristles are discovered after the coating



has dried, the bristle must be removed, the coating removed, and the area correctly re-coated at no additional cost to the Owner.

### 3.07 FINISH

- A. All primer, intermediate and finish coats must be inspected visually and must be free of all sags, runs, bubbles, cratering, drips, waves, laps, unnecessary brush marks, over spray, environmental contaminants or other physical defects, including shadows, and be uniform in color, texture and gloss. All coatings must be applied in a professional manner to achieve the specified dry film thickness (DFT) leaving a smooth and uniform coating.
- B. Prior to application of the intermediate and finish coats, exterior surfaces must be thoroughly waterjet cleaned per SSPC-SP WJ-4 - Light Cleaning to remove any and all surface contamination, visible and non-visible in accordance with the coating manufacturer's recommendations.
- C. Sand between coats to remove over spray and dry fall.
- D. Finish coat must have a uniform color and texture. Any "bleed through" will not be accepted and Contractor must provide additional coatings as required to provide a uniform color at no additional cost to the Owner.

### 3.08 SLIP-RESISTANT ADDITIVE

- A. Provide slip-resistant additive to finish coating for areas indicated on the Drawings. If not indicated on the Drawings, provide additive for all areas within roof guardrails, 3 feet around the center vent and provide 3-foot paths connecting appurtenances on the roof.
- B. Contractor must provide mock panels on cardboard or other material to demonstrate the pattern and roughness to be provided for Engineer review prior to application.
- C. Coating is to be applied per the manufacturer's written directions.

### 3.09 INTERIOR WET GALVANIZED PAINTER'S RAILS

- A. After interior coatings are complete, the interior wet galvanized painter's rails must receive NSF 61/600 certified epoxy coatings as specified.

### 3.10 COATING REPAIRS

- A. All coating repairs must be in accordance with the manufacturer's recommendations and must be included in the submitted coating plan. No coatings may be applied to a surface that has not been properly prepared.
- B. Square off areas to be repaired with blue painter's tape.

### 3.11 PROTECTION OF EXISTING STRUCTURES

- A. Contractor must take every precaution available while cleaning and coating the tank and pedestal to avoid dusting or spraying the Project Site, nearby residences and vehicles with either blast debris or over-spray coating. Shrouding is mandatory for exterior abrasive blasting and for spray application of coatings. All shrouding, containment and disposal of waste will be in conformance with NCDEQ requirements. Contractor will be responsible for properly loading, securing, transporting and disposing of all waste.

- B. If, in the opinion of the Owner's representative, modifications or repairs are necessary to the shroud or ground cover apparatus to provide improved containment of blasting or coating operations, blasting and coating operations must stop until the Owner's representative indicates to the Contractor that adequate repairs are complete.
- C. Prior to any surface preparation, the ground surrounding the tank and pedestal must be covered with tarps or a similar ground cover that will allow for recovery of paint scraps and blast media. Adequate protection of all areas surrounding the tank must be provided during coating application.
- D. Contractor is responsible for complete cleanup of all areas contaminated by blast debris.
- E. Contractor is responsible for all damages to on-site facilities, residences, vehicles and/or public health, including any fines or penalties resulting from improper containment during blasting or coating of the tank and pedestal.
- F. If present at the Site, all security equipment (light poles, camera poles, microwave beam poles, etc.) must be protected by construction of temporary fences or barricades around above ground devices. Four feet must remain clear of construction materials and activities around all security equipment devices.
- G. Protect adjacent materials from damage, including over spray or spillage. Provide drop cloths or other protective tarps to cover floors, equipment or other adjacent materials.

### 3.12 CLEANING AND ADJUSTING

- A. Promptly remove trash and debris resulting from painting operation from the Site. Remove drop cloths, masking tapes and other protective coverings. Remove paint spills, splatters, overlap of paint from adjacent material and other defects. Spot paint nicks and other defects.
- B. Remove paint containers and waste products. Thoroughly clean paint storage rooms, removing spilled paint from walls and floors.

### 3.13 WARRANTY INSPECTION

- A. To establish if remedial work is required, the OPT and Contractor will observe all surfaces of the tank within 11 to 23 months after the tank has been accepted for Substantial Completion and placed in service to establish if remedial work is required. If the Owner is not able to remove the tank from service for the inspection or for any repair work, due to adverse weather conditions, drought or system limitations, the inspection or repair work may be delayed by the Owner for up to 16 months at no additional cost, including an extension of the project warranty/maintenance bonds.
- B. Contractor must have an approved work plan, coating manufacturer's recommended repair procedures, confined space entry plan and repair schedule prior to the start of the repairs. Repairs must be completed and the tank returned to service within 60 calendar days from the date of the initial inspection or as approved by the Owner.
- C. Owner will isolate the tank from the distribution system and drain it. The Contractor must open, clean out, high-pressure water wash and rinse the tank prior to the anniversary observation. After observation of the tank is complete and repair work accepted by Owner, the Contractor must follow disinfection procedures specified. All repairs must be made as per the coating manufacturer's written repair work instructions. Holiday testing must be

conducted by the Contractor to check all tank interior coating repairs, including the interior roof.

- D. Contractor must provide lighting, ventilation, rigging, cable climbers, mirrors, inspection equipment, and sufficient man-power to clean, disinfect and move equipment and tools around the tank, etc., in accordance with this specification and as may be necessary to facilitate complete observation of all coated surfaces. The Contractor will bear all costs of the anniversary observation and must incorporate such costs into the bid.
- E. Any location with coating defects, including but not limited to locations where a coating has peeled off, bubbled, blistered, chipped, or cracked, etc., or where pinholes and/or holidays are present and locations where rusting or corrosion is evident, will be considered a failure or defect of the coating system and must be repaired. Repairs will be made at areas or locations where coating failures are found, even though metal surfaces may be protected by a cathodic protection system, if applicable.
- F. Methods of testing for coating failure which, may or may not be evident, must include, but not be limited to, adhesion tests, film thickness measurement, holiday testing, etc. Testing may be non-destructive or destructive. Contractor must repair all areas where destructive tests are performed.
- G. If failures in any portion of the coated surfaces, exceeds 5 percent of that portion, as determined by the OPT, then for that portion, the entire coating system must be completely removed, re-coated and re-tested in accordance with the specifications herein. In the event any portion of the tanks surface requires coating replacement, partial or complete, a second anniversary observation must be made unless the Owner otherwise deems it not to be necessary. If subsequent anniversary observations are made, time stipulations, coating removal, repair; re-testing requirements are the same as provided for in this Section. Each subsequent repair will have a warranty observation to occur within 12 months after the repair is completed.

#### **END OF SECTION**

## **09 97 16 PIPELINE COATINGS AND LININGS**

### **1.00 GENERAL**

#### **1.01 WORK RESULTS**

- A. This Section covers the Work necessary to apply external polyurethane coating on steel pipe, field coating of joints, and field repair of coating damage, complete.
- B. Exposed steel pipe will be coated as specified in Section 09 95 00 "Coatings for Water Storage Tanks" unless specifically specified otherwise.

#### **1.02 SUBMITTAL REQUIREMENTS**

- A. Contractor submittals shall be made in accordance with Section 01 33 00 "Document Management."
- B. Shop Drawings: Catalog cuts; material safety data sheets; manufacturer's recommendations and instructions on surface preparation, application and curing; product performance reports; and other information for all products proposed. Provide copy of approved coating system submittals to the coating applicator.
- C. Coatings Inspector: Submit certification from AMPP/NACE Certified Coatings Inspector Level III indicating the pipeline was properly inspected and defective coatings detected were properly repaired.
- D. Quality Control Submittals: Furnish the following:
  - 1. Applicator's Experience with list of references substantiating compliance.
  - 2. Coating manufacturer's certification stating the applicator meets or exceeds their coating application requirements and recommendations.
  - 3. Coating manufacturer shall provide a copy of the manufacturer's coating application quality assurance manual.
  - 4. If the manufacturer of field-applied coating differs from that of the shop applied primer, provide written confirmation from both manufacturers' that the two coating materials are compatible.
  - 5. Certified Test Reports for all coating and lining.
  - 6. At the start of coating and/or lining operations, the manufacturer shall certify that the coatings are being applied in accordance with the Specifications.
  - 7. Submit reports from monthly follow-up site visits from manufacturer stating that the shop-applied coatings are being applied in accordance with the Specifications based upon monthly visits.

#### **1.03 QUALITY ASSURANCE**

- A. Coating Applicator's Experience and Certification:
  - 1. Coating Application Company and coating application supervisor (Certified Applicator) shall have a minimum of 5 years' experience applying the specified coating system. Coating application personnel, whom have direct coating application responsibility, shall

have a minimum of 2 years' practical experience in application of the indicated coating system.

2. Coating applicator shall be certified by the coating manufacturer as an approved applicator.
- B. Coating and/or lining manufacturer technical representative shall be present for a minimum of 2 weeks for technical assistance and instruction at the start of coating and/or lining operations within the shop. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to ensure conformance with application instructions, recommended methods, and conditions.
  - C. Prior to shipping, each finished pipe, fitting shall be inspected for markings, metal thickness, coating thickness, lining thickness (if shop applied), joint dimensions and roundness. The final inspection will also include testing for exterior coating holidays, adhesion, pitting scaring and any visible defects.
  - D. Coating and/or lining manufacturer technical representative shall be on-site for 2 weeks, minimum, at the start of each construction season to inspect coating application and procedures in the field. During this visit, the technical representative shall observe surface preparation and coating application and conduct tests of the coating to insure conformance with application instructions, recommended methods, and conditions.
  - E. Coating and/or lining manufacturer shall include 8 hours per month of field or shop coating technical support when requested by the Engineer.
  - F. Coating and/or lining manufacturer technical representative shall provide a written report to the Engineer for each visit. Report shall include copies of test data collected, description of observations, and all recommended corrective actions. Report shall be submitted within 5 working days after the visit. When deemed necessary by the Engineer, Work will not be permitted to proceed until the recommended corrective actions have been implemented. After all corrective recommendations have been completed; the manufacturer representative shall return and certify that the application complies with the manufacturer's coating application recommendations.
  - G. Additional visits by the manufacturer's representative shall be made at sufficient intervals during surface preparation and coating or lining as may be required for product application quality assurance, and to determine compliance with manufacturer's instructions, and as may be necessary to resolve problems attributable to, or associated with, manufacturer's products furnished for this Project.

#### 1.04 ABBREVIATIONS

- A. The following abbreviations are used in this Section:

| Abbreviations |                                                                     |
|---------------|---------------------------------------------------------------------|
| AMPP          | Association of Materials Protection and Performance (formerly NACE) |
| ANSI          | American National Standards Institute                               |
| ASTM          | ASTM International                                                  |
| AWS           | American Welding Society                                            |

| Abbreviations |                                         |
|---------------|-----------------------------------------|
| AWWA          | American Water Works Association        |
| ISO           | International Organization of Standards |
| MDFT          | Minimum Dry Film Thickness              |
| Mils          | Thousandths of an Inch                  |
| NACE          | NACE International                      |
| NSF           | NSF International                       |
| OSHA          | Occupational Safety and Health Act      |
| SSPC          | Society for Protective Coatings         |

#### 1.05 DEFINITIONS

- A. Manufacturer's Representative: Employee of coating manufacturer who is factory trained and knowledgeable in all technical aspects of their products and systems. Sales representatives are not acceptable as a technical representative unless written authorization from the coating manufacture is provided which states the sales representative has full authority to act on the behalf of the coating manufacturer.
- B. Owner Technical Representative: A third-party coatings and linings inspector with AMPP/NACE training and acting under the supervision of a AMPP/NACE Level III Coatings Inspector.

#### 1.06 REFERENCE STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:

- 1. American National Standards Institute (ANSI) / NSF International (NSF) Standards:

|             |                                                     |
|-------------|-----------------------------------------------------|
| ANSI/NSF 60 | Drinking Water Treatment Chemicals – Health Effects |
| ANSI/NSF 61 | Drinking Water System Components – Health Effects   |

- 2. ASTM International (ASTM) Standards:

|                 |                                                                                    |
|-----------------|------------------------------------------------------------------------------------|
| ASTM C33/C33M   | Standard Specification for Concrete Aggregates                                     |
| ASTM C150/C150M | Standard Specification for Portland Cement                                         |
| ASTM C595       | Standard Specification for Blended Hydraulic Cements                               |
| ASTM D412       | Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension |
| ASTM D522/D522M | Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings           |
| ASTM D570       | Standard Test Method for Water Absorption of Plastics                              |
| ASTM D2240      | Standard Test Method for Rubber Property – Durometer Hardness                      |

|               |                                                                                                |
|---------------|------------------------------------------------------------------------------------------------|
| ASTM D4060    | Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser          |
| ASTM D4541    | Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers         |
| ASTM E96/E96M | Standard Test Methods for Water Vapor Transmission of Materials                                |
| ASTM G14      | Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)          |
| ASTM G95      | Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method) |

3. American Water Works Association (AWWA) Standards:

|              |                                                                                                               |
|--------------|---------------------------------------------------------------------------------------------------------------|
| AWWA C205-80 | Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4-inch and Larger- Shop Applied              |
| AWWA C209    | Cold Applied Tape Coatings for the Exterior for Steel Water Pipe, Special Sections, Connections, and Fittings |
| AWWA C210    | Liquid-Epoxy Coatings and Linings for Steel Water Pipeline and Fittings                                       |
| AWWA C216    | Heat-Shrinkable Cross-linked Polyolefin Coatings for Steel Water Pipe and Fittings                            |
| AWWA C217    | Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings                    |
| AWWA C222    | Polyurethane Coatings and Linings for Steel Water Pipe and Fittings                                           |
| AWWA C602    | Cement-Mortar Lining of Water Pipelines in Place – 4-inch and Larger                                          |

4. International Organization for Standardization (ISO) Standards:

|            |                                                                                                                                                                                         |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 8502-3 | Preparation of Steel Substrates before Application of Paints and Related Products – Part 3: Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure Sensitive Tape Method) |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

5. National Association of Corrosion Engineers (NACE) Standards:

|              |                                                                                                   |
|--------------|---------------------------------------------------------------------------------------------------|
| NACE SP 0188 | Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates               |
| NACE SP 0274 | High Voltage Electrical Inspection of Pipeline Coatings                                           |
| NACE RP 0287 | Field Measurement of Surface Profile of Abrasive Blast-Cleaning Steel Surfaces Using Replica Tape |

6. Steel Structures Painting Council (SSPC) Standards:

|           |                            |
|-----------|----------------------------|
| SSPC-SP-1 | Solvent Cleaning           |
| SSPC-SP-2 | Hand Tool Cleaning         |
| SSPC-SP-3 | Power Tool Cleaning        |
| SSPC-SP-5 | White Metal Blast Cleaning |
| SSPC-SP-6 | Commercial Blast Cleaning  |

|            |                                |
|------------|--------------------------------|
| SSPC-SP-10 | Near-White Blast Cleaning      |
| SSPC-SP-11 | Bare Metal Power Tool Cleaning |

#### 1.07 SPECIAL WARRANTY REQUIREMENTS

- A. The Contractor and coating applicator shall warrant to the Owner and guarantee the Work under this Section against defective workmanship and materials for a period of 2 years commencing on the date of final acceptance of the Work.

#### 1.08 OBSERVATION OF WORK

- A. The Contractor shall give the Owner Technical Representative a minimum of 14 days advance notice of the start of any Work to allow scheduling for shop or field observation. Provide Owner Representative a minimum 3 days' notice for actual start of surface preparation and coating application Work.
- B. Provisions shall be made to allow Owner Technical Representative full access to facilities and appropriate documentation regarding coating application.
- C. Observation by the Owner Technical Representative or the waiver of observation of any portion of the Work shall not be construed to relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents.
- D. Materials shall be subject to testing for conformance with the Contract Documents as the Owner Technical Representative may determine, prior to or during incorporation into the Work.

### 2.00 MATERIALS

#### 2.01 GENERAL

- A. Exterior and interior pipe and fitting surfaces shall be prepared and coated in accordance with referenced standards, written directions of the coating or lining manufacturer's, and this Section, whichever is more stringent.
- B. Coatings and linings will be stored, handled, and applied per manufacturer's written directions.
- C. Pipeline coating or lining shall be the product of a single manufacturer. Product substitutions during the Project will not be permitted.

#### 2.02 CONTRACTOR FURNISHED TEST EQUIPMENT

- A. Contractor shall provide the following coating test equipment for field testing of pipe for holidays:
  - 1. Holiday Test Equipment:
    - a. Elcometer Model D236, 0 to 30 kV high voltage tester.
    - b. External pipe rolling spring probe, sized for the Project pipe diameter.
    - c. Right-angle wire brush probe, 20-inches or larger.



- d. Telescopic probed extension handle, 2 to 4-foot length range.

## 2.03 EXTERIOR SHOP-APPLIED COATINGS

### A. General:

1. Steel pipe shall be coated in accordance with AWWA C222, except as modified herein.
2. Concrete cylinder pipe shall be externally overcoated with polyurethane coating as specified herein and in accordance with the coating manufacturer's recommendations for concrete substrates.
3. Overcoating of concrete cylinder pipe with polyurethane shall be performed from joint to joint and shall include the minimum length as shown on the Drawings.
4. Pipe that is atmospherically exposed shall be shop primed as specified herein.
5. Buried dielectrically coated pipe and fittings passing through a structure wall or floor shall be coated for a minimum of 2 inches beyond the interior wall or floor surface.

### B. Plural Component Polyurethane:

1. General: Plural component, polyurethane coating system (referred to as a polyurethane system) shall be applied in accordance with AWWA C222, and as modified herein.
2. Shop Surface Preparation:
  - a. Steel pipe: SSPC-SP5, White Metal blast, 3.00 mil profile, minimum, or as required by the manufacturer, whichever is greater using standardized testing procedures.
  - b. Concrete Pipe:
    - 1). Abrasive blast to remove all laitance and loose material and create a suitable anchor profile.
    - 2). Cement mortar coating shall be allowed to cure 15 days or steam cured not less than 7 days prior to surface preparation of the mortar and coating application. Hand applied mortar lining shall be allowed to cure a minimum of 15 days or as required to meet the coating manufacturer's requirements for application on cement, whichever is greater.
    - 3). Mortar coating shall be dry during coating application.
3. Shop Applied Coating Requirements:
  - a. Self-priming, plural component, 100 percent solids, non-extended polyurethane, suitable for burial or immersion.
  - b. One coat, 35 mils total dry film thickness, minimum, or as required to meet the holiday and coating defects limits specified in this Section.
  - c. Shall be one of the following products, subject to review and acceptance of submitted product performance reports:
    - 1). Protec II, Futura Coatings, Montgomeryville, PA.
    - 2). Chemthane 2265, Chemline, Inc, St. Louis, MO.
    - 3). Polyclad 777, Carboline Global, St. Louis, MO.

- 4). Durashield 110 or Durashield 210, LifeLast, Pflugerville, TX.
- 5). No approved equal.
- d. Acceptance of submitted product is contingent upon:
  - 1). Submission of an independent testing report conducted within 3 years prior to bid opening documenting conformance to the coating performance criteria specified herein.
  - 2). Verification that no significant change in product formulation has occurred through comparison of current product Part A and B formulation with infrared spectrometry analysis of test product for the laboratory test report.
4. Laboratory Coating Testing and Report:
  - a. General: Coating manufacturer shall submit to the Engineer for approval, test reports indicating conformance to the specified performance criteria using prepared Samples as defined using coating materials conforming to the following general requirements:
    - 1). Polyurethane coating material tested shall have been manufactured within 30 days of test Sample preparation.
    - 2). Coating material to have a minimum of 3 years prior pipeline coating application history.
    - 3). Extended polyurethane coatings will not be acceptable.
    - 4). Submission of incomplete reports, use of test procedures or methods other than those specified, or preparation of Samples with a coating material other than those listed will result in rejection of the coating.
    - 5). Reports shall be submitted for review and approval not less than 30 days prior to coating application along with current product data sheets and MSDS sheets for parts A and B.
    - 6). New product formula tests shall be accompanied with Part A and B wet Samples for infrared spectrometry analysis. Wet Samples shall be from the lot and batch tested and shall be collected and sealed by the Engineer for laboratory analysis by the Engineer.
  - b. Test Sample Preparation:
    - 1). Coating manufacturer to provide 10 days advanced notification of coating Sample preparation for Engineer observation.
    - 2). Failure to fully conform to the preparation requirements will result in rejection of the submitted coating material.
    - 3). Sample preparation completed by the coating manufacturer shall be fully documented and reported to the testing agency by the manufacturer.
  - c. Sample Surface Preparation:
    - 1). Method: Abrasive Blast, Green Diamond or Steel Grit, SSPC-SP5, White Metal.
    - 2). Profile: 3.25 mils (plus or minus 0.25 mils), Angular profile, 90 Peak Count per inch minimum, measured and recorded using surface profilometer.

- d. Coating Application:
  - 1). Method: Spray film, in accordance with manufacturer's written shop application requirements.
  - 2). Thickness: 35 mils, minimum, 40 mils maximum.
  - 3). Cure: Air cure only, oven or other accelerated cures will not be acceptable.
  - 4). Form: Sheet, steel panel, or steel pipe as required for test procedure.
- e. Sample Quantity: Three minimum for each test performed or as required by the ASTM Test Standard, whichever is more stringent.
- f. Coating Tests:
  - 1). Testing shall be performed by a certified independent laboratory testing agency with a minimum 5 years' experience in the performance of ASTM test procedures on coating systems.
  - 2). All testing shall be at room temperature, unless specifically required otherwise by the ASTM test procedure.
  - 3). Water Absorption (ASTM D570):
    - a). Criteria: 2.00 percent, maximum.
    - b). Method: Long-term Immersion.
    - c). Sample: Sheet, 1-mm maximum thickness.
  - 4). Impact Resistance (ASTM G14):
    - a). Criteria: 75 inch-pounds, minimum.
  - 5). Cathodic Disbondment (ASTM G95):
    - a). Criteria: 12 mm, maximum.
    - b). Potential: -3.00 volts.
    - c). Duration: 30 days.
    - d). Radius: Measured from original holiday radius.
  - 6). Adhesion to Steel, Dry (ASTM D4541):
    - a). Criteria: 1500 psi, minimum.
    - b). Equipment: Delfesko Positest.
    - c). Dollies: 20 mm, maximum, scored to metal substrate.
  - 7). Abrasion (ASTM D4060):
    - a). Criteria: 100 mg loss, maximum.
    - b). Conditions: CS-17 wheel, 1000 grams weight, 1000 revolutions.
    - c). .
  - 8). Hardness, Shore D (ASTM D2240):
    - a). Criteria: 65, Shore D, minimum.

9). Flexibility (ASTM D522):

- a). Criteria: Pass (no cracking).
- b). Mandrel Diameter: 3 inches, 180 degrees.

g. Reporting:

- 1). As required by the ASTM test method, and the following additional information:
  - a). Sample panel preparation date and identification.
  - b). Surface preparation method and abrasive.
  - c). Surface Preparation profile and peak count.
  - d). Coating lot and date of manufacture.
  - e). Application spray gun and equipment used.
  - f). Application temperatures of coating materials and material temperature at the gun, ambient temperature, and panel surface temperature.
- 2). Include all periodic test data and/or observations for all tested Samples and show all multiple measurements in both table and graph.
- 3). Show all calculations as required by the ASTM test method.
- 4). Include digital photographic documentation of all visual assessments, test apparatus, and final panel condition using 4 mega pixels minimum resolution.
- 5). Submit reports in both PDF and color printed format with photographs in JPEG format.

- C. Exterior Coating for Exposed Steel Pipe: All atmospherically exposed or vault piping shall be shop primed with the coating system as specified in Section 09 95 00 "Coatings for Water Storage Tanks."

## 2.04 INTERIOR SHOP-APPLIED LININGS

### A. Cement Mortar Lining:

- 1. Clean and cement mortar line steel pipe and fittings in accordance with AWWA C205.
- 2. Cement: Conform to ASTM C150, Type II, or ASTM C595, Type II.
- 3. Shop applied cement mortar lining shall be uniform in thickness over the full length of the pipe joint. Curing of the linings shall conform to the requirements of AWWA C205.
- 4. Aggregate shall be silica sand or other aggregate that is not subject to leaching. Conform to ASTM C33.
- 5. Water for cement mortar: Clean and free from organic matter, strong alkalis, vegetable matter, and other impurities.

### B. Liquid Applied Epoxy Coating:

- 1. Provide liquid epoxy primer and lining in all cement mortar lined metallic pipe at insulating joints for a minimum of two pipe diameters on each side of the insulated joint.

2. Epoxy coatings shall be NSF approved coatings suitable for potable water contact in accordance with ANSI/NSF Standards 60 and 61.
3. Epoxy shall be applied over the cement mortar lining where specified for the pipeline lining material.
4. Prepare the cement mortar lining by abrasive blasting to remove all laitance and provide a surface profile.
5. Cement mortar shall be allowed to cure for a minimum of 15 days prior to surface preparation and coating application or 7 days with steam curing.
6. Mortar lining shall be dry when epoxy lining is applied.

## 2.05 SPECIALS, FITTINGS, AND CONNECTIONS

- A. Coating and lining application for special sections, connections, and fittings for steel or ductile iron pipe shall conform to coating system and application requirements as specified in this Section.
- B. Specials, fittings, and connections shall be defined as any pipe section with turnouts for blowoffs, interconnects, any valve, or other appurtenances; tees; crosses; wyes; laterals; manholes; mitered angles or elbows; and pipes which require special fabrication that prevents mechanical production application of the specified coating system from end to end of pipe joint.
- C. In addition to the items listed as specials, the following items shall also be considered as specials:
  1. Pipe joints with pass through holes.
- D. Hand applied tape coatings will not be permitted on any specials, fittings, connections, and elbow fittings.
- E. Specials, fittings, and connections shall be externally coated with polyurethane coating system applied from end to end of pipe joint on all specials, fittings, and connections.

## 2.06 EXTERIOR FIELD JOINT COATING

- A. Pipe joints shall be field coated after pipe assembly in accordance with AWWA C216, or AWWA C217, whichever is applicable and as specified herein.
- B. Field joint coating shall be compatible with the shop-applied coating system and provided by the same manufacturer or a manufacturer approved by the pipe coating manufacturer.
- C. All joints on pipe 24 inches in diameter or greater shall be coated with a heat shrink coating material.
- D. Field joint coating materials shall be as follows or an approved equal.
  1. Heat Shrink Sleeves:
    - a. Filler Material:
      - 1). Provide filler material for all push-on, flange, and coupling type joints and at all changes in outside diameter greater than 1/8 inch.

- 2). Filler material shall adhere to the pipe and heat shrink sleeve. Size and type shall be as recommended by the sleeve manufacturer for type of pipe and joint.
    - 3). Filler mastic for joints subject to weld after backfill shall exceed 500 F melt point temperature.
    - 4). Filler material shall be applied in a manner and thickness that no tenting or voids remain under the heat shrink sleeve.
    - 5). Filler material shall be Polyken 939 filler.
  - b. Joint Coating:
    - 1). Heat shrink, cross-linked polyolefin wrap or sleeve with a mastic sealant, 85-mil nominal thickness, suitable for pipeline operating temperature, as recommended by the manufacturer.
    - 2). Provide standard recovery sleeve for welded or bell and spigot steel pipe joints. High recovery sleeves shall be provided for flange joints and coupling style joints.
    - 3). Width of heat shrink sleeves shall be overlap existing coating 2 inches minimum.
    - 4). Consideration sleeve shrinkage during installation and joint profile in determining sleeve width required. Overlapping of two or more heat shrink sleeves to achieve the necessary width on pipe joints will not be permitted without Engineer approval.
    - 5). Sleeve shall meet requirements for "Weld After Backfill" when allowed and approved by Engineer.
  - c. Holdback Primer: Per the specified coating system.
  - d. Heat Shrink Outer Sleeve: SFL Covalence WaterWrap.
2. Wax Tape Coating:
- a. Apply coating in accordance with AWWA C217, except as modified herein.
  - b. Wax tape coatings shall be field applied on all buried flexible joints, thrust restraint rods and brackets, and on joints, fittings, or irregular shapes or complex configurations that are not suited for the use of heat shrink coating system.
  - c. Do not use wax tape coating systems on vault piping, atmospherically exposed piping and appurtenances, or where subject to UV exposures.
  - d. Provide filler material to fill and smooth all irregular surfaces, such that no tenting or voids remain under the applied wax tape.
  - e. Use sand backfill to protect wax coating from damage.
  - f. Coating System:
    - 1). Surface Preparation: SP11 Power Tool to Bare Metal.
    - 2). Primer: Petroleum or petrolatum wax.
    - 3). Filler Material: Filled Petroleum or petrolatum wax.
    - 4). Inner Tape: Petroleum or petrolatum wax impregnated fabric, 6-inch width maximum, 40 mils thick.

- 5). Outer Wrap: PVC or tape suitable for application to inner tape.
- 6). Wax tape coating system shall be as manufactured by:
  - a). Denso North American Inc., Houston, TX.
  - b). Trenton Corporation, Ann Arbor, MI.
  - c). Or approved equal.

## 2.07 FIELD-APPLIED INTERIOR JOINT LINING

### A. Mortar Lining:

1. Pipe joints shall be field coated after pipe assembly in accordance with AWWA C602.
2. Field-applied joint lining shall be compatible with the shop-applied lining system and provided by the same manufacturer or a manufacturer approved by the shop-applied lining manufacturer.
3. After the backfill has been completed to final grade, the interior joint recess shall be filled with grout. The grout shall be tightly packed into the joint recess and troweled flush with the interior surface. Excess shall be removed.
4. At no point shall there be an indentation or projection of the mortar exceeding 1/16 inch.
5. With pipe smaller than 24 inches in diameter, before the spigot is inserted into the bell, the bell shall be daubed with grout. The joint shall be completed and excess mortar on the inside of the joint shall be swabbed out.

## 2.08 REPAIR OF COATINGS AND LININGS

### A. General:

1. Coating or lining repair materials shall be compatible with the shop-applied coating or lining system and shall be approved by the coating or lining manufacturer.
2. All major repairs on pipe greater than 24 inches in diameter or coated with polyurethane coating system shall be repaired using heat shrink sleeves as specified for field joint coating in accordance with AWWA C216, except as modified herein.
3. Minor coating repairs for polyurethane coated or exposed pipe shall be as specified herein.

### B. Coating Repair Materials:

1. Heat Shrink Sleeves (Major Repair):
  - a. Filler Mastic: Provide mastic filler to fill tape void as required.
  - b. Full Wrap Coating: Cross-linked polyolefin wrap with a mastic sealant, 85-mil thickness nominal, suitable for pipeline operating temperature, sleeve material recovery as recommended by the manufacturer. Sleeve length shall provide a minimum of 3 inches overlap onto intact pipe coating.
  - c. Manufacturers: SFL Covalence WaterWrap.

2. Heat-Applied Patches (Minor Repair):

- a. Heat applied adhesive, polyolefin backed, mastic coated tape, 12 inches maximum size.
- b. Patch shall provide a minimum of 2 inches overlap onto intact pipe coating; except for "Pritec" coated pipe shall have a minimum overlap of 3 inches in the circumferential direction.
- c. Manufacturers: Covalence PERP patch.

C. Polyurethane Coating:

- 1. Polyurethane coating system repair shall be in accordance with the coating manufacturer's recommended procedures.
- 2. Coating material for minor repairs shall be single-use kits or other mix ratio-controlled packages of slow set polyurethane coating material similar to the existing coating.
- 3. Major repairs will be completed using the coating material specified for the coating or the lining. Coating shall be reapplied using plural component spray equipment by a manufacturer certified coating applicator.
- 4. Pinhole holidays or adhesion test coating repairs shall be with minor repair coating material specified or melt stick repairs, such as Denso-Protal 7125 fast cure epoxy.

D. Exposed Pipe Coating System: Touch-up repair all damage to the primer and/or intermediate coats with the specified coating system prior to final coating of the pipeline.

### 3.00 EXECUTION

#### 3.01 ENVIRONMENTAL LIMITATIONS

A. General:

- 1. Products shall comply with federal, state, and local requirements limiting the emission of volatile organic compounds and worker exposure.
- 2. Comply with applicable federal, state, and local, air pollution and environmental control regulations for surface preparation, blast cleaning, disposition of spent aggregate and debris, and coating application.
- 3. Do not perform abrasive blast cleaning whenever the relative humidity exceeds 85 percent, whenever surface temperature is less than 5 degrees above the dew point of the ambient air.
- 4. Do not apply coatings when:
  - a. Surface and ambient temperatures exceed the maximum or minimum temperatures recommended by the coating manufacturer or the Specifications.
  - b. In dust or smoke-laden atmosphere, blowing dust or debris, damp or humid weather, or under conditions that could cause icing on the metal surface.
  - c. For epoxy coatings or linings when it is expected that surface temperatures would drop below 5 degrees above dew point within 4 hours after application of coating.
  - d. Whenever relative humidity exceeds 85 percent for polyurethane coating application.



5. Where weather conditions or Project requirements dictate, Contractor shall provide and operate heaters and/or dehumidification equipment to allow pipe surfaces to be abrasive blasted and coated as specified and in accordance with the manufacturer's coating application recommendations.
6. Work activities can be restricted by the Engineer until adequate temperature and humidity controls are in place and functioning within the environmental limits specified.
7. Coating applicator shall provide a monitoring system approved by the coating manufacturer that constantly records pipe and coating conditions during coating application. Recorded monitoring parameters shall include pipe temperature, line speed, surface preparation, holiday test and other parameters applicable to the type of coating.

B. Temperature Control:

1. In cold weather or if moisture collects on the pipe, preheat pipe to a temperature between 45 and 90 degrees or 5 degrees above dew point, whichever is greater.
2. When temperatures are above or below the coating manufacturer's recommended application temperatures, the Contractor will provide temperature controls as necessary to permit Work to precede within the manufacturer's temperature limitations.
3. Provide tenting, insulating blankets, baffles, or bulkheads as required to zone and control heating or cooling effectiveness.
4. Heating shall be with indirect fired heaters that do not increase humidity levels within the work area. Heaters shall be sized for the area to be heated.

C. Dehumidification and Ventilation:

1. Contractor shall provide dehumidification equipment when necessary for shop or field environmental control during surface preparation and/or coating application. Dehumidification equipment shall be properly sized to maintain dew point temperature 5 degrees or more below surface temperature of metal surfaces to be cleaned and coated.
2. Cleaned metal surfaces shall be prevented from flash rusting throughout the Project duration, condensation or icing shall be prevented throughout surface preparation and coating application.
3. Equipment size and power requirements shall be designed by personnel trained in the operation and setup of dehumidification equipment based on Project requirements and anticipated weather conditions.
4. Dehumidification equipment shall operate 24 hours per day and continuously throughout surface preparation and coating application.
5. Contractor to provide personnel properly trained in the operation and maintenance of the dehumidification equipment or provided training by the dehumidification equipment Supplier.
6. Daily environmental condition monitoring and maintenance requirements of the equipment shall be documented in writing and posted near the equipment for review by the Engineer.

7. Reblasting of flash rusted metal surfaces or removal of damaged coatings, because of equipment malfunction, shutdown, or other events that result in the loss of environmental control, will be at the sole expense of the Contractor.
8. If the required environmental conditions cannot be maintained throughout the coating process, the Installation Contractor shall provide the following:
  - a. Desiccant dehumidification equipment to maintain environmental conditions 24 hours a day during abrasive blasting, coating application and cure. Liquid, granular or loose lithium chloride drying systems will not be acceptable.
  - b. Ventilation within the environmentally controlled areas shall meet the following requirements:
    - 1). Two air exchanges per hour, minimum.
    - 2). Maintenance of lower explosive limits (LEL) to less than 50 percent of the most volatile solvent used in the performance of the Work.
    - 3). Maintenance of personnel exposure limits (PEL) at 50 percent of OSHA PEL limits for all chemicals used in the performance of the Work.

### 3.02 SURFACE PREPARATION

#### A. General:

1. Inspect and provide substrate surfaces prepared in accordance with the Contract Documents and the printed directions and recommendations of coating manufacturer whose product is to be applied.
2. Visible oil, grease, dirt, and contamination shall be removed in accordance with SSPC-SP1, solvent cleaning.
3. Surface imperfections such as metal slivers, burrs, weld splatter, gouges, or delaminations in the metal shall be removed by filing or grinding prior to abrasive surface preparation.
4. Protect prepared pipe from humidity, moisture, and rain. All flash rust, imperfections, or contamination on cleaned pipe surface shall be removed by reblasting.
5. Priming and coating of pipe shall be completed the same day as surface preparation.

#### B. Weld Surface Preparation:

1. Requirements: Spray applied coating systems do not require weld grinding.

#### C. Steel Surface Preparation:

1. Surface preparation of steel pipe shall be in accordance with SSPC surface preparation standards utilizing the degree of cleanliness specified for the coating system to be applied or as specified herein, whichever is more stringent.
2. Grit and/or shot abrasive mixture and gradation shall be as required to achieve the degree of cleanliness and coating adhesion specified.
3. Pipe cleaned by abrasive blasting with recyclable steel grit and/or shot or other abrasive shall be cleaned of debris and spent abrasive in an air wash separator.

4. Polyurethane coating system shall have a sharp angular surface profile of the minimum depth specified.
5. Work shall be performed in a manner that does not permit the cleaned metal surface to rust back or flash rust.
6. Rust back or flash rust shall be fully removed with the steel surface cleanliness equal to the metal surface cleanliness prior to rust back or flash rusting. Determination of the equivalent surface cleanliness shall be at the Engineer's sole discretion.

### 3.03 SHOP -APPLIED COATING SYSTEMS

#### A. Polyurethane Coating or Lining:

1. Applicator Qualifications:
  - a. Equipment will be certified by the coating manufacturer to meet the requirements for material mixing, temperature control, application rate, and ratio control for multi-part coatings.
  - b. Equipment not meeting the written requirements of the coating manufacturer shall be rejected for coating application until repairs or replacement of the equipment is made to the satisfaction of the Engineer.
  - c. Personnel responsible for the application of the coating system shall have certification of attendance at the coating manufacturer's training class within the last 3 years. The certified applicator shall be present during all coating application Work and shall have responsibility for controlling all aspects of the coating application.
2. Pipe surface temperature shall be between 50 and 100 F or 5 F above dew point, whichever is greater.
3. Coating application shall be performed in an environmentally controlled shop area that meets or exceeds the written environmental application requirements of the coating manufacturer. Application in outdoor conditions will not be acceptable without adequate environmental shelter, environmental controls, and/or dehumidification.
4. Coating adhesion and holiday testing shall be tested as specified in this Section.
5. Coating manufacturer shall provide to the Engineer a copy of the manufacturer's coating application quality assurance manual prior to beginning coating application. Strict conformance to the requirements of the manual will be required. Deviation from the requirements of the manual will be grounds for the Engineer to reject the applied coating.
6. Unacceptable Coating Application:
  - a. Coating applied under improper environmental conditions will be rejected.
  - b. Pipes that exceed the allowable quantity of coating defects, regardless of size or cause, shall be rejected.
  - c. Coating which fails the adhesion or holiday testing as specified in this Section shall be rejected.
  - d. Pipe coating that is subject to off ratio application, blistering, or is not applied in conformance with the coating manufacturer's written instructions or recommendations shall be rejected.

7. Rejected coating shall be removed from the full length of the pipe to bare metal and reapplied using proper application methods in accordance with the quality assurance manual and the requirements of the Contract Documents.
8. Perform coating and lining repairs as specified in this Section.

### 3.04 EXTERIOR COATING HOLDBACK

- A. Coating holdbacks shall be straight and cut through the full thickness of the coating.
- B. Cutbacks shall be completed in a manner that permits field coating of joints in accordance with the manufacturer's recommendations and as specified herein.
- C. Holdbacks shall be as required for proper jointing of pipe, considering joint welding requirements, and be as follows:

| Holdbacks             |                                 |
|-----------------------|---------------------------------|
| Push-on joint, spigot | 1 inch before centerline gasket |
| Push-on, bell         | Flush with bell end             |
| Welded, spigot        | 3 inches, minimum               |
| Welded, Bell          | 4-inches, minimum               |

- D. Dielectric Coating Holdback Corrosion Protection:
  1. Holding primer for corrosion protection of cutbacks or holdbacks shall be compatible with the specified joint coating system and weld after backfill requirements, when applicable.
  2. Approved holdback primers are:
    - a. Tnemec Omnithane: Suitable for all joints, except joints subject to weld after backfill.
    - b. Tnemec 90E-92 Ethyl Silicate Inorganic Zinc-Rich Primer: Suitable for all joints, including weld after backfilling joints.
    - c. ICI Devoe Cathacoat 304V Ethyl Silicate Inorganic Zinc Primer: Suitable for all joints including weld after backfilling joints.
    - d. Polyken or Other Tape Primers: Not allowed.
  3. Primer shall not result in running or melting of the coating or cause toxic fumes when heated during weld after backfilling operations.
  4. Application and thickness of holding primer shall be in accordance with the coating manufacturer's recommendations but shall not impair the clearances required for proper joint installation.
  5. Primer application on spigot end of field welded pipe shall be held back 1 to 2 inches from the end of the spigot or as necessary to prevent toxic fumes during field welding.
  6. Any corrosion within the holdback areas shall be abrasively blasted to near white metal in accordance with SSPC-SP10 or power tool cleaned to bare metal in accordance with SSPC-SP11 prior to applying joint coating.

### 3.05 PIPE LINING APPLICATION

#### A. Shop-applied Cement Mortar Lining:

1. Centrifugally line straight sections of pipe. Lining of special pieces or fittings shall be by mechanical, pneumatic, or hand placement. Provide cement mortar lining of uniform thickness. Finish to a smooth dense surface.
2. Steel plate specials larger than 16 inches in diameter shall have lining reinforced with 2-by-4-inch No. 13 gage welded steel wire mesh.
3. Brace and support pipe during lining application to minimize pipe distortion or vibration. Bracing and supports shall not damage the pipe, coating, or lining.
4. Tightly close ends of pipe and fittings with plastic sheet caps. Plastic end caps shall be of thickness and strength to resist shipping, handling, and storage stresses.
5. Damage to the cement mortar lining, including disbondment, cracking, or blistering, caused by improper curing, shipping, handling, or installation shall be repaired in accordance with AWWA specifications and to the satisfaction of the Engineer.
6. Other requirements of mortar lining materials and processes: As specified in AWWA C205.

#### B. Liquid Epoxy Lining:

1. Clean and coat the interior of cement mortar lined pipe at insulating joints or where specified with two coats of epoxy coating.
2. Epoxy coating applied at insulating joints shall be applied to both sides of the insulating joint for a minimum of one pipe diameter. If only one side of the joint can be coated the coating shall be applied for a minimum of two pipe diameters.
3. Mortar lining shall be allowed to cure 15 days or steam cured not less than 7 days prior to surface preparation of the mortar and epoxy coating application. Hand applied mortar lining shall be allowed to cure a minimum of 15 days or as required to meet the coating manufacturer's requirements for application on cement or concrete, whichever is greater.
4. Prepared mortar lining by abrasive blasting to remove all laitance and create a suitable anchor profile.
5. Epoxy coating shall be applied in two coats minimum, at a total coating thickness of 16 mils dry film thickness. Coating applied over cement mortar lining shall be applied in a manner that will minimize gassing and pinholes in the completed lining.
6. Mortar lining shall be dry during epoxy lining application.

### 3.06 FIELD COATING JOINTS

#### A. General:

1. Remove all oil or grease contamination by solvent wiping the pipe and adjacent coating in accordance with SSPC-SP1, Solvent cleaning.
2. Clean pipe surface and adjacent coating of all mud, corrosion, and other foreign contaminants in accordance with SSPC-SP11, Power Tool Cleaning to Bare Metal or

abrasive blast joints in accordance with SSPC-SP10, near white metal blast, that exhibit any surface corrosion or staining. When required, clean the full circumference of the pipe and a minimum of 6 inches onto the existing coating.

3. Remove all loose or damaged pipe coating at joint and either repair the coating as specified herein or increase the length of the joint coating, where reasonable and practical.
4. Complete joint bonding of pipe joints before application of joint coating. Joint bonds shall be installed as specified in Section 13 47 13 "Cathodic Protection." Joint bonds shall be low profile bonds and all gaps and crevices around the bonds shall be filled with mastic sealant.
5. Contractor to electrically test completed joint coating for holidays with high voltage spark tester.

**B. Weld After Backfill Joint Requirements:**

1. Post-welded or 'Weld after Backfill' joints are defined as welded pipe joints that have been coated and backfilled prior to completing interior welds.
2. Post welded joints shall be coated and protected as follows:
  - a. Joint coating shall be SFL Covalence WaterWrap heat shrink joint sleeves only. Tape wrapped joints will not be acceptable.
  - b. Hold back primer shall be suitable for post weld conditions as specified in this Section and shall not exhibit any binder breakdown in the heat effect zone that causes loss of joint coating adhesion to the holdback primer.
  - c. Filler mastic materials shall be high temperature materials with 500 F melting point.
  - d. Joints shall be fully buried prior to welding, with not less than 36 inches cover of soil or flowable fill material on all sides. Sand or flowable fill backfill is preferred for weld after backfilling joints.
3. Welding of the joints shall be in conformance with the Specification 33 11 13.13 "Steel Pipe and Fittings" and as modified herein:
  - a. All welding shall be with stick electrodes and two or more weld passes as required to meet the specified AWS qualified welding procedures and maximum coating temperature limitations. 'Weld after Backfill' procedures on wall thicknesses of 1/4 inch or less must be approved by the Construction Manager based on field testing demonstrating the welding procedures can comply with the requirements of this Section.
  - b. Welding speed, amperage, and voltage shall be as required to maintain a maximum heat input of 23,000 joules or a maximum surface temperature at the coating/steel interface of 800 F, whichever is least.
  - c. Maximum weld temperature and duration shall not result in carbonization of the joint coating adhesive. Carbonization is defined as the loss of volatile organic compounds that result in loss of tackiness, adhesion to the steel, and corrosion protection properties.

- d. Finished joint coating shall not have any visual creases or folds in the joint coating backing material that extends through both the inner protective layer and outer joint sleeve.
  4. If Contractor elects to post-weld any joints, Contractor shall demonstrate that the joint welding procedures will not significantly damage the coating by fully excavating the first two joints for evaluation of the joint coating condition. Engineer will randomly select up to three additional post-welded joints for excavation by Contractor for evaluation of joint coating condition. Joint coating will be destructively evaluated by the Engineer. Contractor will remove and replace joint heat shrink sleeve upon completion of the evaluation.
  5. If any excavated post welded joint exhibits any heat related damage as defined herein, Contractor shall modify and test a new post welding procedure prior to completing any additional post-welded joints. Contractor shall demonstrate that the revised joint welding procedure will not significantly damage the coating by repeating the weld after backfill evaluation requirements defined in this Section, including excavation of the three additional randomly selected joints for destructive evaluation.
- C. Heat Shrink Sleeve Joint Coating:
1. Store, handle, and apply field heat shrink sleeve coatings in accordance with AWWA C216 and this Section.
  2. Store sleeves in shipping box until use is required. Keep dry and sheltered from exposure to direct sunlight. Store off the ground or concrete floors and maintain at a temperature between 60 and 100 degrees as recommended by the sleeve manufacturer.
  3. Metal surface shall be free of all dirt, dust, and surface corrosion prior to sleeve application. Surface preparation shall be in accordance with the joint coating manufacturer's recommendations.
  4. Where corrosion in the holdback area is visible, surfaces shall be prepared in accordance with SSPC-SP10, near white metal blast, or SSPC-SP11, power tool cleaning to bare metal.
  5. Preheat pipe uniformly as recommended by the sleeve manufacturer. Monitor pipe temperature using a surface temperature gauge, infrared thermometer, or color changing crayons. Protect preheated pipe from rain, snow, frost, or moisture with tenting or shields and do not permit the joint to cool.
  6. Fill all cracks, crevices, gaps, and step-downs greater than 1/4 inch with filler mastic in accordance with the manufacturer's recommendations for the full circumference of the pipe.
  7. Apply heat shrink sleeve when it is at a minimum temperature of 60 degrees and while maintaining the pipe temperature above the preheat temperature specified. Apply sleeve in accordance with the manufacturer's instructions and center the sleeve over the joint to provide a minimum 2-inch overlap onto the existing pipe coating.
  8. Completed joint sleeve shall be fully bonded to the pipe and existing coating surface without voids. Mastic beading shall be visible along the full circumference of the sleeve. There shall be no wrinkling or excessive burns on the sleeves. Sleeves that do not meet these requirements shall be removed and the joint recoated as directed by the Engineer.

Minor repairs may be repaired using heat applied patch material specified for minor coating repairs.

9. Allow the sleeve to cool before backfilling. In hot climates, provide shading from direct sunlight. Water quenching will be allowed only when permitted by the sleeve manufacturer.
10. Heat shrink joint coatings which have become wrinkled or disbonded because of prolonged exposure to UV light or thermal cycling shall be removed and replaced.
11. Double coating of defective or damaged heat shrink coatings will not be permitted. Any double coated heat shrink sleeves shall be immediately rejected and Contractor shall remove and recoat the joint.

### 3.07 REPAIR OF COATING AND LININGS

#### A. General:

1. All areas where holidays are detected or coating is visually damaged, such as blisters, tears, rips, bubbles, wrinkles, cuts, or other defects shall be repaired. Areas where no holidays are detected but are visually damaged shall also be repaired.
2. Maximum allowable defects shall be as specified herein for the coating system.

#### B. Polyurethane Coating or Lining Repairs:

##### 1. General:

- a. Complete coating or lining repairs in accordance with the coating manufacturers written instructions and this Section, whichever is stricter.
- b. Defect Size:
  - 1). Minor repairs: Repairs that are less than 6 inches in the greatest dimension.
  - 2). Major repairs: Repairs that exceed 6 inches in the greatest dimension.
- c. Pipes exceeding the maximum number or size of coating defects shall be stripped of coating, reblasted, and recoated.
- d. Pipe arriving in the field with defects or repairs exceeding the maximum number or size of coating defects will be returned to the shop for recoating at the Contractor's expense.

##### 2. Maximum Quality of Defects Allowed:

- a. Coating or lining repairs on any joint of pipe shall not exceed 1.5 per 100 square feet of surface area.
- b. Two or more minor repairs within 6 inches diameter circle will be considered a single repair.
- c. Repairs for adhesion testing will not be included in the total number of repairs.
- d. Minor repairs:
  - 1). Surface Preparation: Clean and feather the defect by power tool sanding with 80 grit or coarser sandpaper to roughen the existing coat and feather the edges of the defect for a minimum of 2 inches around the defect.



2). Shop Repair Materials:

- a). Slow setting parent material polyurethane coating material in syringes or other single use packaging that controls mix ratio.
- b). Coating manufacturer's polyurethane coating repair products subject to Engineer's approval.

3). Field Repair Materials:

- a). Melt stick coating repair (not acceptable for repairs greater than 1-inch diameter); 3M Scotchkote 226P, Canusa-CPS Melt Stick, or approved equal.
  - b). Heat applied coating materials or approved equal.
  - c). Coating manufacturer's polyurethane coating repair products subject to Engineer's approval.
- 4). Apply a single coat of the specified patch coating material at the specified coating thickness.
- 5). Repaired adhesion shall be 50 percent of the specified coating adhesion.

3. Major Repairs:

- a. Major repairs shall not exceed two per pipe joint and the combined area shall not be greater than 50 percent of the pipe.
  - 1). The metal surface and surrounding coating shall be abrasively blasted in accordance with SSPC-SP10, near white metal, or to equal in cleanliness and profile as the original surface preparation.
  - 2). Existing coating shall be feathered and roughened to the equivalent of 40 grit sandpaper.
- b. Shop Repair Materials: Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.
- c. Field Repair Materials:
  - 1). Same material as the pipeline coating or lining and shall be applied by using plural component spray equipment.
  - 2). Heat shrink sleeves as specified for pipeline joints.
- d. One coat of the specified original coating material shall be applied over the repaired surface at the specified thickness.
- e. Repair adhesion shall be equal to the specified coating adhesion.

C. Cement Mortar Coating or Overcoat:

- 1. Cement mortar coating that is cracked or disbonded shall be repaired in accordance with AWWA C205, except for mortar overcoat or dielectric steel.
- 2. Disbonded coating with disbondment greater than 25 percent of the pipe surface shall be rejected and recoated.

### 3.08 INSPECTION AND TESTING

#### A. General:

1. Applicator shall inspect and test the coating system in accordance with referenced standards and this Section, whichever is more stringent.
2. The frequency of the testing shall be determined by the applicator but shall not be less than the requirements of this Section.
3. Owner or Owner's representative will conduct random independent inspections and tests for the final acceptance or rejection of pipe coating or lining.
4. Installation Contractor to preform holiday testing in the field using equipment provided as specified in Paragraph 2.02. Tests will be completed in the presence of the Owner's representative on each joint of pipe and fitting once the pipe has been lifted to be lowered into the trench. Holidays shall be repaired as specified.

#### B. Adhesion Testing:

##### 1. General:

- a. Adhesion testing shall be conducted at the shop prior to shipment. Pipe shipped without adhesion testing will be field-tested. Pipe rejected in the field will be returned to the shop for repair at the sole expense of the Contractor.
- b. A minimum of two pipes will be tested for adhesion from each lot of pipe coated up to 3000 square feet of pipe. An additional adhesion test will be conducted on every increment up to 2000 square feet of pipe coated in excess of the first 3000 square feet of pipe. (i.e. if one workday of production is 6000 square feet of pipe, four adhesion tests will be conducted on the pipe lot.) Adhesion testing shall be conducted on not less than 50 percent of each pipe produced within a lot.
- c. A pipe lot is defined as the quantity of pipe that is coated by a single crew within a work shift, but not to exceed 12 hours.
- d. The pipe coating applicator shall repair all coating damage from shop adhesion testing. Contractor shall be responsible for coating repairs for all field adhesion testing.
- e. Adhesion tests will be performed not less than 24 hours after coating application. Tests conducted prior to 24 hours will be acceptable only if the test meets or exceeds the adhesion criteria specified and the test was requested by the pipe fabricator.
- f. Pipe will be randomly selected for adhesion testing.
- g. Owner or the Owner's representative has the right to conduct additional adhesion testing as deemed necessary to assure the pipe meets or exceeds the requirements of this Section at any time and location.

##### 2. Rejection of Coating:

3. If any pipe within a lot fails to meet the test criteria specified for the coating type, that pipe shall be rejected along with all other pipes within the lot. Each pipe within the rejected pipe lot will then be individually tested and rejected on a pipe-by-pipe basis in conformance with the test procedures and criteria specific for the coating type.

4. All rejected pipe shall have all coating removed from the full-length pipe and the pipe abrasive blasted and recoated.
5. Polyurethane Adhesion Testing:
  - a. Acceptance Criteria:
    - 1). Polyurethane coating or lining shall have an adhesion to steel of 1750 pounds per square inch, minimum. Acceptance will be based on one pull minimum, with no pulls less than the minimum criteria where multiple pulls are conducted on the same joint of pipe.
    - 2). The median value for all coating or lining adhesion pulls performed within a lot of pipe shall not be less than 2000 psi.
    - 3). Each pipe failing the minimum adhesion criteria shall be rejected. AWWA C222 rejection of pipe based on multiple adhesion pulls is specifically excluded from this Section.
    - 4). Pipe lots failing the median value for all adhesion pulls shall be rejected and each pipe within the lot tested for adhesion. Each pipe that fails the adhesion criteria shall be rejected.
    - 5). Failure shall be by adhesive and cohesive failure only. Adhesive failure is defined as separation of the coating from the steel substrate. Cohesive failure is defined as failure within the coating, resulting in coating remaining both on the steel substrate and dolly.
  - b. Test Procedures:
    - 1). Polyurethane coating adhesion to steel substrates shall be tested using self-aligning pneumatic pull off equipment, such as the Delfesko Positest, and test procedures in accordance with ASTM D4541 and AWWA C222, except as modified in this Section.
    - 2). All adhesion test pull records shall be maintained in an electronic spreadsheet that includes pipe identification, pipe coating date, adhesion test date, surface tested (interior or exterior), surface temperature, coating thickness, tensile force applied, rate of pressure change per second, mode of failure, and percentage of substrate failure relative of dolly surface.
    - 3). Dollies for adhesion testing shall be 20 millimeters in diameter, glued to the coating surface and allowed to cure for a minimum of 12 hours before testing.
    - 4). Polyurethane coatings shall be scored around the dolly prior to conducting the adhesion test. Scoring shall be completed manually, normal to the pipe surface, or in a manner that does not stress or overheat the coating.
    - 5). Adhesion testing shall be performed at temperatures between 55 and 100 F. Tests may be performed at temperatures up to 115 F if no significant affect in the test results are statistically detectable.
    - 6). Partial substrate and glue failures will be retested if the substrate failure is less than 50 percent relative of the dolly surface area and the applied tension was less than the specified adhesion. Pipes that have partial substrate failures greater

than 50 percent and less than the specified adhesion will be rejected as a substrate adhesion failure.

- 7). Glue failures in excess of the minimum required tensile adhesion would be accepted as meeting the specified adhesion requirements.
- 8). If multiple adhesion pulls on the same pipe are performed, adhesion pulls shall be performed in a circumferential direction with all pulls in a straight line and within an area 1-1/2 inches in width and spacing between dollies between 1 and 2 inches.
- 9). Adhesion tests will be conducted on polyurethane pipe coating and lining independently and will be accepted or rejected independently of the other.

c. Adhesion Test Repairs:

- 1). Repair patches on the polyurethane coating shall be randomly selected for adhesion testing in a manner as described herein and at the discretion of the coating inspector conducting the adhesion tests. Adhesion of repairs shall be as specified for the type of repair.

C. Holiday Testing:

1. Holiday tests on polyurethane coatings, linings or heat-shrink sleeves will be conducted on the completed coating or lining after cure or 24 hours, whichever is less, using a high voltage spark test in accordance with AMPP/NACE Standard SP0274 and the Specifications.
2. Coating thickness used for holiday testing shall be the minimum specified coating thickness.

D. Dry Film Thickness Testing:

1. Coatings shall be tested for dry film thickness using a properly calibrated magnetic pull off or eddy current equipment.
2. Coating thickness measurements shall be conducted as necessary and without limitation. Testing conformance to the requirements of SSPC PA-2 is specifically excluded from this Section.

### 3.09 HANDLING, TRANSPORTATION, AND STORAGE

- A. Pipe shall be handled in such a manner as to protect the pipe and coating from damage.
- B. Coated pipe shall not be shipped or installed until coating has developed full adhesion and cure.
- C. During coating application, storage, loading, transportation, unloading, laying and installation, every precaution shall be taken to protect and prevent damage to pipe, lining, and coating. Forklift equipment shall have all bearing surfaces padded with suitable padding material. Lift pipe with web slings a minimum of 12 inches wide and of a type that will not damage the coating. Metal chains, cable, tongs, forklifts or other equipment likely to damage the coating will not be permitted. Dragging or skidding of pipe on grade or in the trench will not be permitted.

- D. Provide transportation vehicles with padded bolsters between each layer of pipe and heavy padding under load ties. Bolsters shall be curved to fit the outside of the pipe and 12 inches wide, minimum. All pipe contact locations shall be heavily padded with carpet and strips of the outer tape wrap material (adhesive side against the carpet) during shipment to the Site and from the storage yard to the point of installation.
- E. Pipe shall not be stored on rocks, gravel, or other hard materials that might damage the coating. Provide padded 12-inch wide skids and chucks, sandbags, select loamy or sand berms, or suspended from cutback ends, where possible, to minimize coating damage. Pipe shall not be laid on asphalt without suitable padding at all contact points.
- F. Pipe shall be inspected by the Contractor at the Site for damage. Any damage to the pipe, lining, or coating shall be repaired as directed if, in the opinion of the Engineer, a satisfactory repair can be made; otherwise, the damaged section shall be replaced at the sole expense to the Contractor.
- G. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the finished coating. Workmen shall not be permitted to walk on the coating except when absolutely necessary and approved by the Engineer. When permitted, shoes with rubber or composition soles and heels or other suitable footwear that will not damage coating shall be used.
- H. Long-term Exposure: Pipe shall either be provided with UV inhibitor for lengthy above grade exposure or covered to prevent UV degradation of outer wrap. Amount of UV stabilizers required will depend on the Project location, laying schedule, anticipated length of exposure, and type of outer wrap. Manufacturer shall be consulted for recommended UV inhibitors requirements or pipe shall be stored under a protective cover. Protective covering can be colored plastic sheeting, canvas, or other UV blocking material. Clear plastic sheets are not acceptable. Areas of coating that display UV degradation shall be removed and repaired at sole cost of the Contractor.
- I. End Caps: Pipe ends of mortar lined pipe and fittings shall be tightly closed with a plastic wrap to aid in curing and to minimize drying out of and contamination of the lining. Plastic end cap shall consist of a minimum of one 10-mil sheet of polyethylene or other suitable material. End caps shall be substantial enough to resist shipment, handling, and storage loads and firmly attached in place. The plastic end cap shall remain intact and in place until pipe installation. Damaged or missing plastic end caps shall be repaired or replaced.
- J. Bracing:
  - 1. The steel pipe manufacturer shall furnish and install adequate bracing or strutting to keep the pipe from becoming deformed, or damage from occurring to the coating or linings. Strut-type bracing shall be installed as soon as possible after application of lining. Struts shall remain in place during handling, storage, transportation and installation of pipe and fittings until after the pipe zone material is compacted.
  - 2. The struts shall be installed with pads and wedges in such a manner that the pipe lining will not be damaged and the struts will not be dislodged during shipping and handling of the pipe. If struts are welded, they shall be installed and removed in such a manner to prevent damage to the steel cylinder, lining or coatings. All damage shall be repaired to the satisfaction of the Engineer.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

**DIVISION 10**  
**SPECIALTIES**



## **10 40 13 FALL PREVENTION AND SAFETY SYSTEMS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment, and incidentals to install the following complete systems:
  - 1. Ladder safety system.
  - 2. Guardrail safety gates.
  - 3. Safety related signage.

#### **1.02 REFERENCES**

- A. Occupational Safety and Health Administration (OSHA):
  - 1. OSHA 1910 – Occupational Safety and Health Standards.
- B. American National Standard Institute (ANSI):
  - 1. ANSI Z 359.1 - American National Standard Safety Requirements for Personal Fall Protection Systems and Components

#### **1.03 SUBMITTALS**

- A. Submittals must be in accordance with Section 01 33 00 “Document Management” and must include:
  - 1. Ladder Safety System:
    - a. Manufacturer’s product data sheets.
    - b. Material list of products to be installed on Project.
    - c. O&M data for product.
  - 2. Safety Gates:
    - a. Manufacturer’s product data sheets.
    - b. Material list of products to be installed on Project.
    - c. O&M data for product.
  - 3. Manufacturer’s product data sheet for safety related signage.

### **2.00 PRODUCTS**

#### **2.01 LADDER SAFETY SYSTEM**

- A. The complete system shall allow the worker to operate freely in a normal climbing position during ascent or descent. The device is to be installed in accordance with the manufacturer’s instructions in such a manner to enable the worker to be attached to the device at all times while climbing ladders without having to remove his hands from the ladder to operate the system effectively and to be able to easily pivot onto and off of work platforms or landings

while safely attached to the device. System must attach to ladders as specified and indicated on the Drawings.

**B. Materials and Construction:**

1. The rail, cables, hardware and all system components shall be of Type 316 stainless steel.
2. All rails, cables, components, brackets, etc. shall be on-site to complete installation.
3. The fall prevention system shall be installed in accordance with the manufacturer's installation instructions by a competent person.
4. Fall prevention system shall not be installed until all painting and/or construction has been completed on the tank.

**C. Carrier Sleeve:**

1. Provide Owner with three carrier sleeves.
2. The carrier sleeve shall be capable of being attached and detached to and from the rail. The carrier sleeve shall attach to the front of the user's harness with a twist lock carabiner supplied with each sleeve.
3. The carrier sleeve shall be constructed of corrosion resistant materials and be lightweight and easy to use.
4. Approved Manufacturers:
  - a. FrenchCreek Production - TS Products Rigid Rail Climbing System.
  - b. MSA Safety – Latchways Engineered Fall Protection Vertical Lifeline System.
  - c. 3M DBI/SALA
  - d. Approved Equal.

**2.02 PERSONAL PROTECTIVE EQUIPMENT**

**A. Body Harnesses:**

1. Provide Owner with two body harnesses, sizes are to be selected by the Owner during construction.
2. Harness must be full body type.
3. Sliding back D-ring on full body harness for fall arrest.
4. Hip positioning D-rings.
5. Harness must include lower back pad support.
6. Front D-rings on belt and sternum must be provided for climbing with the ladder safety system.
7. The manufacturer of the body harness must be of the same manufacturer of the provided ladder safety system.
8. Approved Manufacturers:
  - a. FrenchCreek Stratos 800 Series.
  - b. MSA Safety.

- c. 3M DBI/SALA
- d. Approved Equal.

B. Lanyards:

- 1. Provide two total, double (split) bungee cord type shock absorbing lanyards. Lanyard must be 4.5 feet long un-deployed, with 2-1/4-inch throat large rebar locking snap hooks on each lanyard.
- 2. Contractor must match lanyard manufacturer with the manufacturer of the harness.

## 2.03 SAFETY GATES

- A. Gate must have at least two stainless steel hinges that are spring loaded to close automatically. Hinge spring tension must be field adjustable. Gate must be attached with a minimum of two u-bolt supports, incorporating a receiver plate for pipe guard rails. Gate must be of sturdy construction with solid opening and closing without flexing at hinges, etc.
- B. Gates must be equipped with a kick plate and stop tab opposite of the hinge side to stop the gate at the guardrail post. Stop tab may be integral with the gate or fabricated on the adjacent guardrail.
- C. Gate material will be as indicated on the Drawings or match the material of the adjacent guardrail. If guardrail is painted, provide 304 stainless steel gate.
- D. Mounting hardware must be 304 stainless steel.
- E. Gate to be sized as required on the Drawings; provide double gates as required to fully protect the open area at no additional cost to the Owner.
- F. Approved Manufacturers:
  - 1. FabEnCo – ZT Series.
  - 2. Approved Equal.

## 2.04 SAFETY RELATED SIGNAGE

- A. Provide “Danger Fall Hazard Follow Written Instructions for use of this Ladder. Report any Unsafe Conditions” or similar signage at the base of all ladders requiring cable safety climb systems. Self-adhesive vinyl with minimum dimensions 10 inches high by 14 inches wide.
- B. Provide “Danger Follow Confined Space Entry Procedures Before Entering” or similar signage on all hatches. Provide 0.040-inch aluminum sign with 4.0-mil vinyl printing layer and 2.5-mil UV and moisture resistant laminate layer. Approximate Dimensions 10 inches high by 14 inches wide. Mount signs on or adjacent to all openings into confined spaces.
- C. Use stainless steel hardware for mounting signage, as applicable.

## 3.00 EXECUTION

### 3.01 INSTALLATION

- A. Install according to the approved Shop Drawings and manufacturer's instructions. Fall protection systems shall be installed by manufacturer's authorized, trained and certified

personnel. Install anchorage and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this Section.

- B. The products must be installed in accordance with manufacturer's installation instructions by a competent person.
- C. Ladder fall prevention systems must not be installed until all painting operations are completed.

### 3.02 INSPECTION

- A. All components, brackets, etc., shall be on-site to complete installation.
- B. It must be verified that required products and components are stainless steel.
- C. Determine products are new and undamaged.

### 3.03 SCHEDULES

- A. Fall Prevention System Schedule:

| Ladder                     | Ladder Safety System Required |
|----------------------------|-------------------------------|
| Tank Exterior Leg Ladder   | X                             |
| Tank Exterior Shell Ladder | X                             |

**END OF SECTION**

**DIVISION 26**  
**ELECTRICAL**

## **26 01 26 TESTING OF ELECTRICAL SYSTEMS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, material, equipment and incidentals of an independent testing agency.
- B. These specifications cover the suggested field tests and inspections that are available to assess the suitability for initial energization and final acceptance of electrical power equipment and systems.
- C. The purpose of these specifications is to assure that electrical equipment and systems are operational, are within applicable standards and manufacturer's tolerances, and are installed in accordance with design specifications.
- D. The Work specified in these specifications may involve hazardous voltages, materials, operations, and equipment. These specifications do not purport to address all of the safety issues associated with their use. It is the responsibility of the user to review all applicable regulatory limitations prior to the use of these specifications.
- E. Testing shall be inclusive of all low voltage equipment including conductors that are provided under this Contract.

#### **1.02 QUALITY ASSURANCE**

- A. Testing Organization:
  - 1. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
  - 2. Testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
  - 3. The Testing organization shall use technicians who are regularly employed for testing services.
  - 4. An organization having a designation of NETA Accredited Company issued by the International Electrical Testing Association meets the above criteria.
  - 5. Independent testing agency shall follow all tests and recommendations in NETA Acceptance Testing Specification for all equipment provided.
  - 6. Testing Organization performing the Work shall submit appropriate documentation to demonstrate that it satisfactorily complies with these requirements.
  - 7. Testing Personnel:
    - a. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.

- b. Technicians shall be certified in accordance with ANSI/NETA ETT, Standard for Certification of Electrical Testing Technicians. Each on-site crew leader shall hold a current certification, Level 3 or higher, in electrical testing.

### 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  1. Electrical Qualifications & List of Test Submittals: 60 days prior to any testing taking place, Contractor shall submit to the Owner/Engineer the name of the testing agency; a list of all tests to be conducted shall also be submitted at this same time. No testing shall take place until this has been submitted and approved by the Engineer.
  2. Electrical Testing Plan: A minimum of 2 weeks before testing is to take place, Contractor shall submit a detailed testing plan of the different configurations to be tested for the Owner's and Engineer's approval.
  3. Electrical Testing Report:
    - a. A written report shall be submitted by the testing agency performing installation checks, operation and testing of the low voltage equipment. This report shall certify that:
      - 1). The equipment has been properly installed.
      - 2). Is in accurate alignment.
      - 3). Meets the acceptance testing specifications of NETA and the equipment manufacturer.
    - b. Provide a detailed list of all tests that were performed and the test results as part of the Electrical Testing Report.
    - c. Electrical Testing Report(s) shall be submitted to the Engineer for approval no later than 1 week after testing has been conducted.

### 1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
  1. American National Standards Institute (ANSI).
  2. Association of Edison Illuminating Companies (AEIC).
  3. ASTM International (ASTM).
  4. Electrical Apparatus Service Association (EASA).
  5. Institute of Electrical and Electronic Engineers (IEEE).
  6. Insulated Cable Engineers Association (ICEA).
  7. International Electrical Testing Association (NETA).
  8. National Electrical Manufacturers Association (NEMA).
  9. National Fire Protection Association (NFPA).

10. Occupational Safety and Health Administration (OSHA).
11. State and local codes and ordinances.
12. Underwriters Laboratories, Inc. (UL).

## **2.00 PRODUCTS (NOT APPLICABLE)**

## **3.00 EXECUTION**

### **3.01 GENERAL**

- A. All testing shall be witnessed by the Owner's representative. Types of equipment required to be tested by these specifications shall include but not be limited to the following:
  1. Low Voltage Cables.
  2. Panelboards.
  3. Grounding.
- B. At a minimum, unless indicated otherwise, all testing shall be in accordance with the manufacturer's recommendations for energization and startup of the equipment.
- C. Testing shall include a complete functionality testing of electrical equipment under all the different operating parameters identified by the Owner and Engineer.
- D. Electrical testing instrument calibration shall be as indicated in ANSI/NEMA ATS-2017.

### **3.02 TEST REPORT**

- A. The test report shall include the following:
  1. Summary of the Project.
  2. Description of equipment tested.
  3. Description of tests.
  4. Test data.
  5. Analysis and recommendations.
- B. Test data records shall include the following minimum requirements:
  1. Identification of the testing organization.
  2. Equipment identification.
  3. Nameplate data.
  4. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
  5. Date of inspections, test, maintenance, and/or calibrations.
  6. Identification of the testing technician.
  7. Identification of inspections, tests, maintenance, and/or calibrations to be performed and recorded.



8. Identification of expected results when calibrations are to be performed.
  9. Identification of as-found and as-left results, as applicable.
  10. Identification of all test results outside of specified tolerances.
  11. Sufficient spaces to allow all results and comments to be indicated.
- C. The testing organization shall furnish a copy or copies of the complete test report as specified.

### 3.03 TEST DECAL

- A. The testing organization shall affix a test decal on the exterior of equipment or equipment enclosure of protective devices after performing electrical tests.
- B. The test decal shall be color-coded to communicate the condition of maintenance for the protective device. Color scheme for condition of maintenance of overcurrent protective device shall be:
1. White: Electrically and mechanically acceptable.
  2. Yellow: Minor deficiency not affecting fault detection and operation, but minor electrical or mechanical condition exists.
  3. Red: Deficiency exists affecting performance, not suitable for service.
- C. The decal shall include:
1. Testing organization.
  2. Project identifier.
  3. Test date.
  4. Technician identifier.

### 3.04 POWER SYSTEM TESTING

- A. Contractor shall test the operation of the power distribution system, for the various possible system configurations under load conditions.
- B. Contractor shall submit a detailed testing plan of the different configurations to be tested for the Owner's and Engineer's approval.

## END OF SECTION

## **26 05 00 COMMON WORK RESULTS FOR ELECTRICAL**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment, and incidentals necessary for complete and operational electrical systems, as specified herein.
- B. This Section, as well as Division 01, concerns all other Sections in Division 26, and shall be considered a part of each of those Sections as if written in their entirety.
- C. Permanent Utilities:
  - 1. Contractor shall be responsible to coordinate power at the Site with local utility company.
  - 2. Owner will be responsible to absorb the cost of providing utility power to the Site. However, Contractor is responsible for providing civil and electrical improvements identified on design drawings to assist local utility in onsite upgrades. Such improvements identified on design drawings include but are not limited to primary service entrance trenching and conduit, riser conduits, transformer, and metering cabinet concrete pads, etc. Coordinate all additional requirements with local utility.

#### **1.02 QUALITY ASSURANCE**

- A. Electrical Contractors' Qualifications: Use adequate numbers of skilled workmen, trained, and experienced in their crafts, and who are familiar with the specifications and methods of performing the work in this Division. A licensed Journeyman shall be on site at all times when electrical work is being performed. Electrical work shall be performed under the direct supervision of a Master Electrician who holds a valid license in the State of North Carolina. Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the job site and thoroughly reviewed the work. THE REPORT SHALL BE SIGNED BY THE MASTER ELECTRICIAN AND INCLUDE THE DATE AND TIME THE MASTER ELECTRICIAN WAS ON SITE. THE REPORT SHALL BE INCLUDED IN THE PAY APPLICATION. NO PAYMENT WILL BE GRANTED WITHOUT REPORT.
- B. Workmanship: Work shall be performed in accordance with quality, commercial practices. The appearance of finished work shall be of equal importance to its operation. Materials and equipment shall be installed based upon the actual dimensions and conditions at the Project Site. Locations for materials or equipment requiring an exact fit shall be field measured. Conduit, transformers, and motors shall be isolated to avoid unacceptable noise levels from objectionable vibrations from all systems.

#### **1.03 SUBMITTALS**

- A. Submittals shall be in accordance with Division 01, ANY DEVIATIONS FROM THE SPECIFICATIONS MUST BE CLEARLY NOTED AND IDENTIFIED IN THE SUBMITTALS, and shall include:
  - 1. Submittals shall be submitted separated by Specification Section. Combined submittals will not be reviewed. Submittal will be marked not approved, revise and resubmit.

2. Each Section submittal shall be complete, contain all of the items listed in the Specification Section, and shall be clearly marked to indicate which items are applicable on each cut sheet page. The Submittal shall list any exceptions to the Specifications and Drawings, and the reason for such deviation. Shop Drawings, not so checked and noted, will be returned unreviewed.
3. Contractor shall check Shop Drawings for accuracy and contract requirements prior to submittal to the Owner/Engineer. Errors and omissions on approved Shop Drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and Drawings. Shop Drawings shall be stamped with the date checked and a statement indicating that the Shop Drawings conform to Specifications and Drawings. Only one Specification Section shall be made per transmittal.
4. Material shall not be ordered or shipped until the Shop Drawings have been approved. No material shall be ordered, or shop work started if Shop Drawings are marked "APPROVED AS NOTED CONFIRM", "APPROVED AS NOTED RESUBMIT" or "NOT APPROVED".
5. Submittals in PDF format shall be provided with bookmarks for each section and component to navigate the file contents.
6. Provide only pertinent information for component. Do not submit entire catalog sections to limit the size of submittals. Complete catalog sections will not be reviewed. Submittal will be marked not approved, revise and resubmit.
7. Component catalog number and manufacturing data sheet, indicating pertinent data and clearly marked identifying each component by the item number and nomenclature as specified.
8. Submit copy of Master Electrician's license and each Journeyman's license that will be working on the Project. Workers must be licensed to work in the city where the Project is located.
9. Component drawings showing dimensions, mounting, and external connection details.
10. Complete interconnection and point to point wiring diagrams in AutoCAD format for all field control and instrumentation wiring between instruments, electrical equipment, starters, VFDs, etc. A hard copy shall be submitted to the Engineer for approval prior to the final AutoCAD files being submitted. Interconnection/wiring diagrams shall include cable numbers, wire tags, actual equipment terminal strip numbers at both ends of the cable, etc.
11. Unless other additional information is required by the detailed equipment specifications, the following information shall be included for motors:
  - a. Motor identification number and nomenclature as specified.
  - b. Make and motor type.
  - c. Brake horsepower of the motor.
  - d. Locked rotor current at full load.
  - e. Motor efficiency at full load (3-phase motors only).

- f. Starting torque.
  - g. Method of insulating and impregnating motor coils (3-phase only).
  - h. Speed of the motor at full torque.
  - i. Full load current.
  - j. Service factor.
  - k. Motor temperature rise measured by resistance over 40 degrees C ambient.
- B. Contractor shall provide a monthly report to the Owner/Engineer for review stating that the Master Electrician has been to the job site and thoroughly reviewed the work. The report shall be signed by the Master Electrician and include the date and time the Master Electrician was on site.
- C. Contractor shall:
- 1. Prepare, and keep up to date, the Record Drawings and detailed construction drawings which shall be available at each monthly pay application.
  - 2. Record the exact locations of each of these differences, sizes and details of the Construction Work as executed, with cross-references to and other requirements on the Record Drawings.
    - a. Record Drawings shall include the location of all pull boxes, junction boxes, concrete pull boxes, manholes and hand holes that were provided under this contract and those existing boxes that were modified under this Project (by either the addition or removal of cable/conduits).
      - 1). Contractor shall also include on the Drawings a label next to each pull box, junction box, concrete pull box, manhole and handhole to reflect the nameplate label installed (existing or new) at each device.
      - 2). Refer to Section 26 05 53 "Identification for Electrical Systems" for labeling requirements for pull boxes, junction boxes, concrete pull boxes, manholes and hand holes.
      - 3). Keep the Record Drawings on the Work Site.
      - 4). Upon completion of the Work, or at such other time as may be determined by the Engineer, submit the Record Drawings and copies to the Owner's representative in accordance with the Owner's requirements.
      - 5). Underground Interference drawing showing all underground duct banks, ground rods, ground conductors, pipes, piers, vaults, manholes, pull boxes, etc. that clearly identifies the location and routing of these systems. All interferences shall be brought to the Engineer's attention. Provide as a minimum the ductbank dimensions, burial depth and coordinates of terminations and those of any changes of direction. The GPS coordinates of the ductbank shall be measured (width, depth, and burial depths) prior to back filling.
      - 6). Provide revised final Shop Drawings in AutoCAD format noting any changes made to equipment during start-up.
      - 7). Submit master electricians report with each pay application.

- D. Contractor shall provide a copy of the complete one-line diagram at the Site. The one-line diagram shall be as follows:
  - 1. The one-line shall reflect all changes made including but not limited to changes made during construction.
  - 2. Each page of the one-line shall be framed in a separate picture frame with plexiglass. The copy of the sheet shall lay flat against the glass without any wrinkles and other material necessary for the copy to lay flat shall be provided within the picture frame.

#### 1.04 STANDARDS

- A. Electrical Work shall be executed in accordance with local, State and national codes, ordinances and regulations which have jurisdiction or authority over the Work. If the standards and codes conflict with each other, the most stringent shall apply. The applicable provisions of the following standard shall apply as if written here in their entirety:
  - 1. National Electrical Manufacturer Association (NEMA).
  - 2. ASTM International (ASTM).
  - 3. National Fire Protection Association (NFPA).
  - 4. National Electrical Safety Code (NESC).
  - 5. Institute of Electrical and Electronic Engineers (IEEE).
  - 6. National Electrical Code (NEC).
  - 7. Underwriters' Laboratories (UL).
  - 8. American National Standards Institute (ANSI).
  - 9. Uniform Building Code (UBC).
  - 10. Occupational Safety and Health Administration (OSHA).
  - 11. Local utility companies.
  - 12. Local Electrical Ordinance.
  - 13. Rural Electrification Association (REA).
  - 14. Insulated Power Cable Engineers Association (IPCEA).
  - 15. International Electrical Testing Association (NETA).
  - 16. National Electrical Contractors Association (NECA).
  - 17. Association Edison Illuminating Companies (AEIC).
- B. Electrical Work shall be performed under the direct supervision of a Master Electrician who holds a Valid license in the State of North Carolina.

#### 1.05 DELIVERY AND STORAGE

- A. Follow the manufacturer's directions for the delivery, storage and handling of equipment and materials. Tightly cover equipment and materials and protect it from dirt, water, chemical or mechanical injury and theft. Major electrical equipment shall be stored indoors in a climate-

controlled atmosphere and space heaters energized where applicable. Stored equipment shall be properly protected from rodents such as mice and rats.

- B. Equipment that will be stored indoors for an extended period of time and that do not have space heaters shall have a 100-watt incandescent light placed in it and energized to eliminate the build-up of condensation in the equipment. Coordinate with equipment manufacturer for additional storage requirements. Damaged equipment shall not be acceptable. Upon installation, protect the materials until the Work is completed and accepted by the Owner. Improperly stored equipment is subject to rejection by the Owner/Engineer and will not be allowed to be installed.

## 1.06 JOB CONDITIONS

- A. Permits, licenses, inspections, and testing shall be secured and paid for as required by law by the Contractor for the completion of the Work. Certificates of approval shall be secured, paid for, and delivered to the Owner before receiving the final acceptance of the Work.
- B. The location of materials, equipment, devices, and appliances indicated are approximate and subject to revisions at the time the Work is installed. Final location shall be as proposed by the Contractor and approved by the Engineer.
- C. Should project conditions require any rearrangement of Work, or if equipment or accessories can be installed to a better advantage than the general arrangement of Work on the Drawings, Contractor shall before proceeding with the Work prepare and submit plans of the proposed rearrangement for the Engineer's review and approval.
- D. Motor Horsepower ratings identified are anticipated ratings. If the actual equipment is a different size, the Contractor shall provide the appropriate wiring, conduit, over current protection, starters, and accessories for a complete and working system at no cost to the Owner.
- E. Enclosures for equipment in the air-conditioned rooms shall be NEMA 12, 14-gauge steel and NEMA 3R, 304 Stainless Steel for all other interior locations unless noted otherwise. All enclosures shall have a quick release luggage type clasp or single handle operated, 3-point latching system.
- F. All enclosures for equipment unless specified otherwise shall be NEMA 4X, 304 Stainless Steel for exterior applications. All enclosures shall have a quick release luggage type clasp.
- G. No equipment is to be energized until the Power System Studies have been completed, the protective relays and breakers have been set per the Short Circuit and Protective Device Study and the arc flash labels have been installed on the equipment. NO EXCEPTIONS.

## 2.00 PRODUCTS (NOT USED)

## 3.00 EXECUTION

### 3.01 INTERPRETATION OF DRAWINGS

- A. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.
- B. Install each 3-phase circuit in a separate conduit unless otherwise shown on the Drawings.

- C. Unless otherwise approved by the Owner/Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
- D. Where circuits are shown as "home runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
- E. Verify the exact locations and mounting heights of lighting fixtures, switches, and receptacles prior to installation.
- F. Except where dimensions are shown, the locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Owner/Engineer during construction. Obtain information relevant to the placing of electrical Work and in case of any interference with other Work, proceed as directed by the Owner/Engineer and furnish all labor and materials necessary to complete the Work in an approved manner.
- G. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.
- H. Redesign of electrical or mechanical Work, which is required due to the Contractor's use of a pre-approved alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Owner/Engineer for approval. No additional compensation will be provided for changes in the Work, either his/her own or others, caused by such redesign.
- I. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete operating system. Refer to riser diagrams for signal system wiring. Homeruns, as shown on the Drawings, are to assist the Contractor in identifying raceways to be run exposed and raceways to be run concealed. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.
- J. Contractor shall run all conduit and wire to RTU and/or PLC termination cabinets, where designated on the Drawings. The conduit and wire as shown on the interface drawings may not necessarily be shown on the floor plan.
- K. Install conductors carrying low voltage signals (typically twisted shielded pair cables) in raceways totally separate from all other raceways containing power or 120-volt control conductors.
- L. Raceways and conductors for thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment, and the motor starters for a complete operating system. All raceways and power conductors shall be in accordance with Division 26. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats and controls.

- M. Raceways and conductors for the fire alarm, sound and page party systems are not shown on the Drawings. Provide raceways and conductors as required by the system manufacturer for a complete operating system. All raceways and power conductors shall be in accordance with Division 26. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in process spaces.

### 3.02 INSTALLATION

- A. All enclosures for equipment unless specifically identified otherwise shall be:
  - 1. NEMA 1 enclosures for indoor air-conditioned areas.
  - 2. NEMA 1 enclosures for indoor ventilated areas.
  - 3. NEMA 4X, FRP for rooms housing Chlorine or Chlorine feed equipment.
  - 4. NEMA 4X stainless steel for exterior applications and all other locations.
- B. Maintain the waterproof integrity of conduit penetrations through the roof, exterior walls, and floors. Roof penetrations shall not be located above any electrical equipment.
- C. Install stainless steel sleeves for each conduit passing through floors. Extend sleeves 1-1/2" above the floor slab and grout watertight. The sleeve sizes shall permit the subsequent insertion of a properly sized conduit or raceway.
- D. Submit location drawings and obtain Engineer approval prior to installing conduit penetrations through slabs, beams, ceiling, and walls. Contractor shall not core drill through existing beams. After the conduits are installed fill the annular space between the conduits with mastic. The complete installation shall be watertight and the fire rating of penetrations through walls, floors and ceilings shall be maintained.
- E. Install steel reinforced concrete foundations below floor mounted switchboards, panelboards, motor control centers, soft starters, adjustable frequency drives, transformers, and other floor mounted electrical equipment. Concrete foundations shall not be less than 4 inches high or as indicated on the Drawings. Neatly chamfer top edges. Concrete foundations shall be 6 inches wider and 6 inches longer than the base of the equipment being installed or as indicated on the Drawings. Concrete shall be in accordance with Division 03 and shall be reinforced with a minimum of 6 inches x 6 inches #6 welded wire mesh or as indicated on Drawings.
- F. Route all conduits parallel to building lines, columns, or steel route conduits near to columns and roof beams. Conduits shall maintain a minimum of 3 inches away from adjacent Work (duct work, insulations, etc.).

### 3.03 EQUIPMENT PADS AND SUPPORTS

- A. Electrical equipment pads and supports, of concrete or steel including structural reinforcing and lighting pole foundations, are shown on the Structural Drawings.
- B. No electrical equipment or raceways shall be attached to or supported from sheet metal walls.



### 3.04 SLEEVES AND FORMS FOR OPENINGS

- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical Work and form before concrete is poured.
- B. Exact locations are required for stubbing up and terminating concealed conduit. Obtain Shop Drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.
- C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Owner/Engineer may allow the installations of such conduit to be exposed. Requests for this deviation shall be submitted in writing. No additional compensation for such change will be allowed.
- D. Seal all openings, sleeves, penetration, and slots as specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

### 3.05 CUTTING AND PATCHING

- A. Coordinate with Divisions 02 and 03 for cutting and patching.
- B. Core drill holes in concrete floors and walls as required. Contractor shall obtain written permission from the Owner/Engineer before core drilling any holes larger than 2 inches.
- C. Install Work at such time, as to require the minimum amount of cutting and patching.
- D. Do not cut joists, beams, girders, columns, or any other structural members.
- E. Cut opening only large enough to allow easy installation of the conduit.
- F. Patching shall be of the same kind and quality of material as was removed.
- G. The completed patching work shall restore the surface to its original appearance or better.
- H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.
- I. Remove rubble and excess patching materials from the premises.
- J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

### 3.06 PHASE BALANCING

- A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on motor control centers and panelboards shall be field connected to result in evenly balanced loads across all phases.
- B. Field balancing of circuits shall not alter the conductor color coding requirements.

### 3.07 TESTS AND SETTINGS

- A. Test systems and equipment furnished under Division 26 and repair or replace all defective Work. Make adjustments to the systems as specified and/or required.
- B. Prior to energizing electrical equipment, make all tests as required by the individual Specification Sections. Submit a sample test form or procedure and submit the required test

reports and data to the Owner/Engineer for approval at least two weeks prior to the startup of the tested equipment. Include names of all test personnel and initial each test.

- C. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.
- D. Check wire and cable terminations for tightness.
- E. Check rotation of motors prior to energization. Disconnect driven equipment if damage could occur due to wrong rotation. If the motor rotates in the wrong direction, the rotation shall be immediately corrected, or tagged and locked out until rotation is corrected.
- F. Verify all terminations at transformers, equipment, capacitor connections, panels, and enclosures by producing a 1 2 3 rotation on a phase sequenced motor when connected to "A", "B" and "C" phases.
- G. Mechanical inspection, testing and setting of circuit breakers, disconnect switches, motor starters, control equipment, etc. for proper operation.
- H. Check interlocking, control, and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by schematic and wiring diagrams.
- I. Testing shall be scheduled and coordinated with the Owner/Engineer at least two weeks in advance. Provide qualified test personnel, instruments, and test equipment.
- J. Refer to the individual equipment Sections for additional specific testing requirements.
- K. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

### 3.08 PAINTING

- A. Maintain the original factory finish on material and equipment installed, unless specifically indicated on the Drawings or Specifications. If the finish is marred in transit or during installation, re-finish to a neat, workmanlike appearance equal to the original factory finish. Leave equipment and raceway systems clean and free of grease, dirt, rust, and in a suitable condition for painting.

### 3.09 EXCAVATION, TRENCHING, BACKFILLING AND GRADING

- A. Prior to any excavation or trenching, notify the Owner's representative, utility companies and Owner's facilities department. Allow sufficient time for utilities to be located prior to excavation to avoid disruption of services. Provide a minimum of 72 hours written notice to the Owner prior to trenching or excavation. Do not proceed with trenching or excavation until authorized by the Owner. Utilities or services which are damaged, which are identified prior to excavation or trenching, or where confirmation by utility companies has not been obtained verifying that utilities are marked, shall be repaired to operable condition immediately, at no cost to the Owner.
- B. Barricade open trenches and excavations for the entire duration of the Project. Barricades for excavations shall have warning lights maintained during hours of darkness. Trenches shall be marked with warning tape, or access to trenches shall be prohibited with readily identifiable sawhorses, warning tape or other acceptable means. Barriers shall be illuminated

or recognizable during hours of darkness. Barriers and tape shall be properly maintained at all times.

- C. Protect all adjacent Work, structures, and properties. Damage to adjacent Work, structures or properties shall be repaired, or the cost of repair reimbursed in full.

### 3.10 LOCKING OF ELECTRICAL FACILITIES

- A. Install locks immediately upon the installation of the electrical facility. Provide padlocks for exterior electrical facilities subject to unauthorized entry. Furnish the Owner with 2 keys per lock up to a quantity of 10 keys. Furnish locks to match the Owner's locking system. Locks shall also be provided where required to obtain an electrical Certificate of Occupancy.

### 3.11 CLEAN AND ADJUST

- A. Remove shipping labels, dirt, paint, grease, and stains from equipment. Remove debris as it accumulates. Upon completion of the Work, clean electrical equipment, and the entire electrical installation so that it is suitable for the Owner's use.

### 3.12 TRAINING

- A. Contractor shall provide manufacturer's training as specified in each individual section of the Specifications.

## **END OF SECTION**

## **26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Furnish labor, materials, equipment and incidentals necessary to install 2000 volt and below single conductors, cables, wiring connections and terminations. Electrical work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical".

#### **1.02 SUMMARY**

- A. Section Includes:
  - 1. Building wires and cables rated 2000 V and less.
  - 2. Connectors, splices, and terminations rated 2000 V and less.

#### **1.03 SUBMITTALS**

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

#### **1.04 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

#### **1.05 DELIVERY AND STORAGE**

- A. Deliver cable and wire to the Site in the original packages. Conductors with damaged insulation or exposed nylon jacketing shall not be permitted.
- B. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable.
- C. Check for reels not completely restrained, reels with interlocking flanges or broken flanges, damaged reel covering or any other indication of damage. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel.
- D. Do not drop reels from any height.
- E. Unload reels using a sling and spreader bar. Roll reels in the direction of the arrows shown on the reel and on surfaces free of obstructions that could damage the wire and cable.
- F. Store cable on a solid, well drained location. Cover cable reels with plastic sheeting or tarpaulin. Do not lay reels flat.
- G. Provide moisture protection by using manufacturer's standard procedure or heat shrinkable self-healing end caps applied to both ends of cable. Do not remove end caps until cables are ready to be terminated.

## **2.00 PRODUCTS**

### **2.01 CONDUCTORS AND CABLES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alpha Wire Company.
  - 2. Belden Inc.
  - 3. Encore Wire Corporation.
  - 4. General Cable Technologies Corporation.
  - 5. Southwire Company.
  - 6. Okonite.
  - 7. Houston Wire & Cable.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable used in VFC circuits.
- E. Conductors: Copper, complying with NEMA WC 70/ICEA S-95-658.
  - 1. Conductor Insulation: Conductor with thermoplastic insulation rated at 600 volts. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association. Comply with NEMA WC 70/ICEA S-95-658 for Type XHHW-2.
- F. Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type USE with ground wire.

### **2.02 CONNECTORS AND SPLICES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. 3M Electrical Products.
  - 2. Ideal Industries, Inc.
  - 3. ILSCO.
  - 4. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 5. AFC Cable Systems, Inc.
  - 6. Hubbel Power systems, Inc.
  - 7. Thomas & Betts Corporation, A Member of the ABB Group.
  - 8. Tyco Electronics Corp.

- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Connectors, Compression, Copper, 600 Volt: The appropriate hole sizes and spacing which are in accordance with NEMA standards; two holes in the tongue for use on conductor sizes 250 kcmil or larger; not required for connections to the circuit breakers in the lighting and/or receptacle panels. All compression connectors shall be long-barrel type, no exceptions.
- D. 600-Volt Plastic Tape: Minnesota Mining & Manufacturing Company No. 35.
- E. Wirenuts: Silicone-based pre-filled spring wire connecting devices with plastic covering; UL listed for damp and wet locations. Wirenut shall meet requirements of UL 486D for Sealed Wire Connector Systems. Wirenut shall be spring insulated, properly sized and resistant to vibration may be used for No.12 through No.10 solid gauge conductor for lighting and branch circuits only.
- F. Split Bolts: Shall be usable for connecting conductors which are both copper, both aluminum or one copper and one aluminum. Split bolts shall have a spacer between the two conductors, which it connects.
- G. Mechanical Set Screw Connector: Consisting of an aluminum body which has openings on opposite ends for insertion of the conductors. Conductors inserted into these holes shall each be clamped by two set screws. Connectors shall be suitable for use with copper conductors.
- H. Rubber Tape: Scotch 2210.
- I. Vinyl Tape: Scotch 88.
- J. Arc Proofing Tape: 3M "Scotch 77 Fire and Electric Arc Proofing Tape". Fireproofing shall be done with a half-lapped layer of arc proofing tape, anchored at each end with a double wrap of 3M "Scotch 69 Glass Cloth Electrical Tape".
- K. Insulating Resin: Scotch 3576, 3577, or 3578.
- L. Power Distribution Blocks: Rated for 600 VAC and termination of copper conductors. Individual poles shall be constructed of tin plated aluminum and mounted on an insulating base.

### **3.00 EXECUTION**

#### **3.01 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

#### **3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type XHHW-2, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

- D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

### 3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.
- B. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- C. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- G. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
- H. Install raceway first as a complete system without conductors. Do not install pull wires and conductors until the raceway system is in place in accordance with the NEC and these specifications. Exception: Only flexible connections to motors shall be permitted to be installed after the installation of the remainder of the raceway system. The installation of these conductors shall be limited to exposure to damage for a maximum of 1 week prior to installing flexible connection and making final terminations. Any conductors exposed to damage (i.e. not installed in raceway) longer than 1 week shall be subject to rejection by the Owner and/or Engineer. If rejected, the cables shall be removed, discarded, replaced, reinstalled and retermination at the Contractor's expense.
- I. Installed unapproved wire shall be removed and replaced at the Contractor's expense.
- J. Grouping conductors together into one conduit shall not be allowed where the plans indicate the conductors to be placed in separate conduits. Each home run shown on the plans shall be in its own conduit.
- K. Neatly train wiring inside boxes, equipment and panelboards. Pull conductors into a raceway at the same time and use UL listed, wire pulling lubricant for pulling No. 4 AWG and larger wire.
- L. Except for hand-pulled conductors into raceways, all wire and cable installation shall be installed with tension-monitoring equipment. Where conductors are found to have been installed without tension-monitoring, the conductors and cables shall be immediately removed from the raceways, permanently identified as rejected material, and removed from the Site. New conductors and cables shall be reinstalled, tagged and raceways resealed, all at the Contractor's expense.

- M. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii. Where pulling compound is used, use only UL listed compound compatible with the cable outer jacket and with the raceway involved.
- N. Where single conductors and cables in manholes, hand holes, vaults, cable trays, and other indicated locations are not wrapped together by some other means such as arc and fireproofing tapes, bundle throughout their exposed length all conductors entering from each conduit with nylon, self-locking, releasable, cable ties placed at intervals not exceeding 4 inches on center.
- O. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief as required.
- P. Arrange wiring in cabinets and panels neatly cut to proper length, remove surplus wire, and bundle and secure in an acceptable manner. Identify all circuits entering motor control centers or other control cabinets in accordance with the conductor identification system specified herein and in Section 26 05 53 "Identification for Electrical Systems."
- Q. Cap and label each side of spare conductors not terminated with the UL listed end caps.
- R. Where conductors pass through holes or over edges in sheet metal, remove all burrs, chamfer all edges, and install bushings and protective strips of insulating material to protect the conductors.
- S. For conductors that will be connected by others, provide at least 6 feet spare conductors in free standing panels and at least 2 feet spare in other assemblies. Provide additional spare conductor in any particular assembly where it is obvious that more conductor will be needed to reach the termination point.
- T. Each circuit shall include a ground wire. Sharing grounds or neutrals is not allowed.

### 3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Power Conductors: Splicing of existing power conductors shall be permitted where specifically indicated on the plans. Splices for all other circuits shall be disallowed. Splice in junction boxes or at outlets only for lighting and receptacle branch circuits. Splices for all other circuits shall be disallowed. All splices are subject to the Engineer's approval. Obtain approval from Engineer before installing any splices.
- D. For existing installations, splices of 120 V circuits shall use twist-on wire nuts.
- E. Where pre-approved by Engineer, 480 V splices shall terminate conductors using power distribution blocks mounted in a junction box.
- F. No splicing of conductors shall be performed in any below ground structure.
- G. Condulet type fittings shall not contain splices. Under no condition shall conductors of a different color be spliced together.



- H. For No. 10 and smaller, connect conductors with a silicone filled twist-on spring wirenut. If a splice or tap is below 3 feet above the final grade, fill the spring connectors with an electrical insulating resin so that the resin encapsulates conductor and spring materials. Conductor splices and taps inside the MCC, VFDs, panels, etc. shall be on the terminal strips or power distribution blocks.
- I. For No. 8 and larger, connect conductors with a split bolt type of connector or a mechanical, set screw type connector. Wrap splices and taps with a single half-lapped layer or rubber tape followed by successive layers of vinyl tape until a vinyl tape layer thickness of twice the original conductor insulation thickness is achieved. If splice or tap is below 3 feet above the finished grade, the tape or splice shall have a final outer coating or insulating resin. Splices must be pre-approved by the Engineer.
- J. Furnish and install power distribution blocks as required for terminating conductors at their load connection point with conductors of smaller size. Install power distribution blocks with the number of poles and sizes needed for connecting the phase, neutral, and ground conductors.
- K. Tighten all screws and terminal bolts using torque type wrenches and/or drivers to tighten to the inch-pound requirements of the NEC and UL.
- L. Use crimp connectors on all stranded conductors.
- M. Soldered mechanical joints insulated with tape will not be acceptable.
- N. SINGLE CONDUCTORS: Sufficient wire shall be left at outlets to make connections to equipment without straining. Light switches and receptacles shall be connected with pig-tails and crimp-on connectors.

### 3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test conductors feeding the critical equipment and services for compliance with requirements.
    - a. Perform each visual and mechanical inspection and electrical tests stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.

3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
4. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION**

## **26 05 23 CONTROL-VOLTAGE ELECTRICAL POWER CABLES**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment, and incidentals necessary to install 600-volt wires and cables. Electrical Work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical."
- B. Work shall include building wire, cable, wiring connections and terminations, and modular wiring systems.

#### **1.02 SUMMARY**

- A. Section Includes:
  - 1. Low-voltage control cabling.
  - 2. Control-circuit conductors.

#### **1.03 DEFINITIONS**

- A. When used in this Section, the terms listed below will be defined as follows:
  - 1. EMI: Electromagnetic interference.
  - 2. Low-Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control and signaling power-limited circuits.
  - 3. UTP: Unshielded twisted pair.

#### **1.04 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Shop Drawings: For each type of product.

#### **1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of NETA or nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

### **2.00 PRODUCTS**

#### **2.01 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### **2.02 BACKBOARDS**

- A. Description: Plywood, fire-retardant treated, 3/4 inch by 48 inches by 96 inches.
- B. Painting: Paint plywood on all sides and edges with alkyd paint.

## 2.03 LOW-VOLTAGE CONTROL CABLE

### A. Paired Cable: NFPA 70, Type CMG.

1. Individually and overall shielded one pair, twisted, No. 18 AWG, stranded ({19x30} {7x28}) tinned-copper conductors with 0.021-inch extruded PVC; 0.004-inch nylon insulation twisted into pairs, stranded into a core and enclosed by a non-hygroscopic core tape, 100 percent coverage, helically wound, aluminum foil shield, and drain wire. Pairs shall be black/red or black/white numbered. Cables shall be 600 volts in accordance with NEC-725 and IEEE 383 and shall be suitable for wet location.
2. Shielded.
3. Extruded PVC jacket minimum 0.050.
4. Flame Resistance: Comply with UL 1685.

## 2.04 CONTROL-CIRCUIT CONDUCTORS

### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. General Cable; General Cable Corporation.
2. Southwire Company.
3. Alpha.
4. Okonite.
5. Belden.
6. Houston Wire and Cable.

### B. General:

1. Wires and cables shall be soft-drawn, annealed copper with a conductivity of not less than that of 98 percent pure copper, UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 degrees Celsius in dry locations and in wet locations.
2. Control, signal and instrumentation circuits and as specifically indicated on the Drawings the minimum conductor permitted is #12.

### C. Single Conductor Cables: Conductor with thermoplastic insulation rated at 600 volts and insulated with type XHHW-2 insulation. Wire shall be water tank tested and approved as machine tool wire, in accordance with National Machine Tool Builders Association.

### D. Class 1 Control Circuits: Stranded copper, XHHW-2, complying with UL 44 in raceway.

### E. Class 2 Control Circuits: Stranded copper, XHHW-2, complying with UL 44 in raceway.

### F. Class 3 Remote-Control and Signal Circuits: Stranded copper, XHHW-2, complying with UL 44 in raceway.

## 2.05 SOURCE QUALITY CONTROL

### A. Testing Agency: Engage a qualified testing agency to evaluate cables.

- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.00 EXECUTION**

#### **3.01 EXAMINATION**

- A. Test cables on receipt at the Site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

#### **3.02 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
  - 1. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
  - 2. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
  - 3. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
  - 5. Do not install bruised, kinked, scored, deformed, or abraded cable.
  - 6. Remove and discard cable if damaged during installation and replace it with new cable.
  - 7. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.
  - 8. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
  - 9. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
- C. Balanced Twisted Pair Cable Installation:
  - 1. Comply with TIA-568-C.2.
  - 2. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
  - 1. Install wiring in raceways.
  - 2. Use insulated spade lugs for wire and cable connection to screw terminals.

3. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment or Circuit Rating Between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.

### 3.03 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No. 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No. 12 AWG.

### 3.04 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

### 3.05 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.
- C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire shall have a unique tag.

### 3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1.
  2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.07 PREPARATION

- A. Completely swab raceway system before installing conductors. Do not use cleaning agents and lubricants which have a deleterious effect on the conductors or their insulation.

### 3.08 INSTALLATION

#### A. General:

1. Conductors shall be continuous from terminal block to terminal block without splices.
2. Condulet type fittings shall not contain splices. No splicing of conductors shall be performed in any below ground structure.
3. If rejected, the cables shall be removed, discarded, replaced, reinstalled and re-terminated at the Contractor's expense.
4. Grouping conductors together into one conduit shall not be allowed where the Drawings indicate the conductors to be placed in separate conduits. Each home run shown on the Drawings shall be in its own conduit.
5. Properly support cables in accordance with the NEC and manufacturer's recommendations in all raceways. Provide strain relief as required.
6. The cable shall not be bent to a radius no smaller than the manufacturer cable's minimum bending radius.
7. All terminated conductors shall be labeled as specified prior to testing and final terminations being done. Any conductor that is de-terminated for any reason shall be re-tested. All associated controls, if tested before, shall be re-tested following final re-termination.

#### B. Paired Shielded and Triad Shielded Cable:

1. Ground paired shielded and triad shielded cables at the instrument panel or starter end only and insulate from ground elsewhere.
2. The shield shall be continuous for the entire run.
3. The paired shielded and triad shielded cable shall not be laced with or placed in the same conduit with power cables and control cables.

4. The shield of pair shielded cable and triad shielded cable shall only be broken when the conductors are terminated on terminal strips.
  5. Each conductor and shield shall be landed on its own terminal. Double terminations of any conductor or shield shall not be allowed.
- C. Ground Conductors:
1. Conduits and other raceway shall contain an insulated equipment grounding conductor whether the raceway is metallic or not.
  2. Conduits, cabinets, and other equipment shall be properly grounded in accordance with National Electrical Code requirements.
  3. Where ground wire is exposed to mechanical damage, install wire in rigid aluminum conduit.
  4. Bond each end of each of the conduit to the ground system. Make connections to equipment with solderless connections.

**END OF SECTION**



## **26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment, and incidentals necessary to install a complete grounding system in strict accordance with Article 250 of the National Electrical Code (NEC) as shown on the Drawings or as specified herein. Electrical Work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical."

#### **1.02 SUMMARY**

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Ground bonding common with lightning protection system.
  - 3. Foundation steel electrodes.

#### **1.03 SUBMITTALS**

- A. Submittal shall be in accordance with Section 01 33 00 "Submittal Procedures" and shall include:
  - 1. Product Data: For each type of product indicated.
  - 2. Test wells.
  - 3. Ground rods.
  - 4. Ground Conductors.
  - 5. Connectors.
  - 6. Grounding arrangements and connections for separately derived systems.
  - 7. Qualification Data: For testing agency and testing agency's field supervisor.
  - 8. Field quality-control reports in accordance with Section 26 01 26 "Testing of Electrical Systems."

#### **1.04 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

### **2.00 PRODUCTS**

## 2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burndy; Brand of Hubbell Electrical Systems.
  - 2. ERICO ; brand of nVent Electrical plc.
  - 3. Harger Lightning & Grounding.
  - 4. ILSCO.
  - 5. O-Z/Gedney; a brand of Emerson Electric Company.
  - 6. Thomas & Betts Corporation, A Member of the ABB Group.

## 2.03 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.04 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B3.
  - 2. Stranded Conductors: ASTM B8.
  - 3. Tinned Conductors: ASTM B33.
  - 4. Bonding Cable: 28 kcmil.
  - 5. Bonding Conductor: No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## 2.05 CONNECTORS

- A. Listed and labeled by a NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.

## 2.06 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

## 2.07 MISCELLANEOUS

- A. Conduit Ground Fittings: Fittings for bonding ground cable to the conduit shall be Thomas & Betts No. 3951 series.
- B. Ground Rod Boxes: Precast Box with cast iron lid. Lid shall read "ground rod". H-10 rated boxes shall be Brooks Precast Model "3-RT" or approved equal. Ground rod boxes located in driveway areas shall have an AASHO HS-20 rating by ALT Fabrication Item #3114 or approved equal.
- C. Exothermic Welding Process: CADWELD MATERIALS – as manufactured by ERICO products or approved equal.

# 3.00 EXECUTION

## 3.01 PROCESSES

- A. All grounding system connections to building steel and ground rods shall be exothermically welded including all cable connections, and cable steel terminations. The use of mechanical type connections is not acceptable.
- B. Any concealed connection (buried, encased in concrete, or otherwise sealed) shall be done only with exothermic welds.
- C. All materials involved must be from the same sources to insure compatibility. Connections made from this process shall meet the requirements of IEEE Standards 80 and 837 and as listed in MIL 419 and other standards, National Electrical Code, etc.

## 3.02 GROUNDING SYSTEM

- A. Provide a complete grounding system that includes all connections and the testing of ground rods, ground cables, ground buses, conduits, fittings, anchor supports, thermite process materials and equipment and other materials required for a complete installation. Grounding system shall be installed and sized in accordance with the National Electrical Code.

### 3.03 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, **No. 2/0** AWG minimum.
  - 1. Bury at least 30 inches below grade.
  - 2. Duct-Bank Grounding Conductor: Place conductor on top of duct bank prior to back filling above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted/clamp type connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated. Exothermically welded connectors.
  - 3. Connections to Ground Rods at Test Wells: Exothermically welded connectors. Bolted connectors.
  - 4. Connections to Structural Steel: Exothermically welded connectors.
  - 5. Connections to Equipment: NEMA ground pads and insulated jumpers.
  - 6. Connections to Ground Pad: Exothermic.
  - 7. The use of “pig tails” for connections to ground loops or equipment shall not be allowed. Welded connectors.

### 3.04 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### 3.05 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 and NFPA 70 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or

handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors' level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

### 3.06 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-inch by 2-inch by 12-inch grounding bus.
- G. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

- H. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- I. Metallic Fences: Comply with requirements of IEEE C2.
  - 1. Grounding Conductor: Bare copper, not less than **No. 8** AWG.
  - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
  - 3. Barbed Wire: Strands shall be bonded to the grounding conductor.

### 3.07 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Ground Rods: Drive rods until tops are 6 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. For grounding electrode system, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through open bottom of Ground Rod Test Well. Ground Rod Box shall be at least 6 inches deep, with cover.
  - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of pedestal base.
1. Install copper conductor not less than **No. 2/0** AWG for ground ring and for taps to building steel.
  2. Bury ground ring not less than 24 inches from building's foundation.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect by the usual steel tie wires or exothermic welding to create the required length.
1. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- I. Ground electrical Work in accordance with the National Electrical Code Article 250 and local codes.
- J. Install ground cables continuously between connections. Splices shall not be permitted, except where indicated on the Drawings. Where ground cables pass through floor slabs, buildings, etc., and when not in metallic enclosures, provide a sleeve of approved, non-metallic materials.
- K. Install a green-colored, equipment grounding conductor in raceways. Size conductors in accordance with NEC Article 250.
- L. Where ground wire is directly buried in earth or concrete, use standard bare copper cable, in all other cases install a green-colored insulation, equipment grounding conductor in accordance with Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables." Size conductors in accordance with NEC Article 250. Provide grounding conductors as required per the NEC.
- M. Metal conduits stubbed up into switchgear, motor control center or other electrical equipment shall be terminated with insulated grounding bushings and connected to the equipment ground bus. Size the grounding wire in accordance with applicable sections of the National Electrical Code.
- N. Grounding extensions to an existing stubbed-up grounding conductor shall be exothermic weld connections.

- O. Liquid tight flexible metal conduit in sizes 1-1/2 inches or larger shall have bonding jumpers. Bonding jumpers shall be external, run in parallel (not spiraled) and fastened with plastic tie wraps. Contractor shall provide bonding jumpers sized in accordance with the National Electrical Code.
- P. All equipment enclosures, motor and transformer frames, conduit systems, cable armor, exposed structural steel and all other equipment and materials required by the NEC to be grounded, shall be grounded, and bonded in accordance with the NEC. Provide grounding and bonding jumpers as required per the NEC.
- Q. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250.
- R. Where exothermic bonding is used, molds shall be of the appropriate size for the wire and rod used. All bonds shall remain exposed for inspection of the Owner's representative.
- S. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of #12 wire with green-colored insulation to connect to the grounding terminal at the receptacle.
- T. A ground pad shall be installed in concrete foundations for connections to equipment and the grounding system. Flat plate all copper alloy Erico CADWELD B164-2Q or approved equal. Connections between the ground pad and ground cables shall be an exothermic weld.
  - 1. Transformer Pads: Provide a ground pad in the concrete pad. Provide a #4/0 bare copper to the grounding system. Provide two-hole spade terminals connected to a #4/0 bare copper conductor at each end and connect to the transformer enclosure and to the ground pad.
  - 2. Motor Grounding: Provide a ground pad in the concrete slab. Provide a #4/0 bare copper to the grounding system. Provide two-hole spade terminals connected to a #4/0 bare copper conductor at each end and connect to the motor enclosure and to the ground pad and to the pump frame.
  - 3. The use of "pig tails" for connections to ground loops or equipment shall not be allowed.

### 3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Testing shall be in accordance with Section 26 01 26 "Testing of Electrical Systems" and the latest version of NETA Acceptance Testing Specification.
- B. Tests and Inspections:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.
  - 3. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.



4. Use Biddle Direct Reading Earth Resistance Tester or equivalent to measure resistance to ground of the system. Perform testing in accordance with the test instrument manufacturer's recommendation using the fall of potential method.
  5. All test equipment provided under this section shall be approved by the Engineer.
  6. Resistance to ground testing shall be performed during dry season when the ground is dry. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground. The Contractor shall test the grounding system at each ground rod shown on the Drawings.
  7. Testing shall be performed before energizing the distribution system.
  8. A separate test shall be conducted for each building or system.
  9. Notify the Engineer immediately if the resistance to ground for any building or system is greater than 5 ohms. Provide additional ground rods and conductors as required to bring the resistance to 5 ohms.
  10. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than 2 full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  11. Prepare dimensioned drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
  5. Substations and Pad-Mounted Equipment: 5 ohms.
  6. Manhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner/Engineer promptly and include recommendations to reduce ground resistance.

**END OF SECTION**

## **26 05 29      HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **1.00      GENERAL**

#### **1.01      WORK INCLUDED**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.02      SUMMARY**

- A. Section Includes:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### **1.03      SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Product Data: For each type of product.
    - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
      - 1). Hangers.
      - 2). Steel slotted support systems.
      - 3). Nonmetallic support systems.
      - 4). Trapeze hangers.
      - 5). Clamps.
      - 6). Turnbuckles.
      - 7). Sockets.
      - 8). Eye nuts.
      - 9). Saddles.
      - 10). Brackets.
    - b. Include rated capacities and furnished specialties and accessories.

#### **1.04      QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M.
  - 2. AWS D1.2/D1.2M.

## **2.00 PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Management," to design hanger and support system.
  - 1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

### **2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. B-line, an Eaton business.
    - c. ERICO International Corporation.
    - d. Flex-Strut Inc.
    - e. GS Metals Corp.
    - f. G-Strut.
    - g. Thomas & Betts Corporation, A Member of the ABB Group.
    - h. Unistrut; Part of Atkore International.
  - 2. Material: Stainless Steel, Type 304.
  - 3. Channel Width: 1-5/8 inches.
  - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Stainless-steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1). Hilti, Inc.
  - 2). ITW Ramset/Red Head; Illinois Tool Works, Inc.
  - 3). MKT Fastening, LLC.
  - 4). Simpson Strong-Tie Co., Inc.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1). B-line, an Eaton business.
    - 2). Empire Tool and Manufacturing Co., Inc.
    - 3). Hilti, Inc.
    - 4). ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - 5). MKT Fastening, LLC.
  3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A325.
  6. Toggle Bolts: Stainless-steel springhead type.
  7. Hanger Rods: 304 Threaded stainless steel.

## 2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## 3.00 EXECUTION

### 3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 3/8 inch in diameter.

- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

- 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

### 3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, RMCs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 pounds.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 5. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.04 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-In-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

**END OF SECTION**

## **26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install a complete conduit system for each type of electrical system. Electrical Work shall be in accordance with Division 26.
- B. Furnish labor, materials, equipment and incidentals necessary to install concrete electrical manholes and pull boxes, as specified and indicated on the Drawings. Manhole sizes shown on the Drawings are the minimum size allowed. Contractor shall be responsible for sizing all manholes and pull boxes in accordance with the latest edition of the National Electrical Code (NEC), Article 370 and relevant sections of the NEC. Contractor shall be responsible for setting elevations at manhole and cable entry locations to meet the intent of the Contract Documents.
- C. Contractor shall be responsible for sizing all pull boxes and junction boxes per the NEC Article 314 and all other relevant sections of the NEC. Electrical Work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical".

#### **1.02 SUMMARY**

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Nonmetal conduits, tubing, and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Nonmetal wireways and auxiliary gutters.
  - 5. Surface raceways.
  - 6. Boxes, enclosures, and cabinets.
  - 7. Handholes and boxes for exterior underground cabling.

#### **1.03 DEFINITIONS**

- A. ARC: Aluminum rigid conduit.
- B. LFMC: Liquidtight flexible metallic conduit.
- C. RNC: Rigid nonmetallic conduit.

#### **1.04 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.



2. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
3. Manholes, Pull and Junction Boxes Sizing Calculations: Detailed calculations shall be submitted to the Engineer with the manholes, pull and junction boxes' initial submittal. Submittals submitted without sizing calculations shall not be accepted.

## **2.00 PRODUCTS**

### **2.01 METAL CONDUITS, TUBING, AND FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. AFC Cable Systems; a part of Atkore International.
  2. Allied Tube & Conduit; a part of Atkore International.
  3. Anamet Electrical, Inc.
  4. Electri-Flex Company.
  5. FSR Inc.
  6. O-Z/Gedney; a brand of Emerson Industrial Automation.
  7. Picoma Industries, Inc.
  8. Republic Conduit.
  9. Robroy Industries.
  10. Calbond.
  11. Southwire Company.
  12. Thomas & Betts Corporation, A Member of the ABB Group.
  13. Western Tube and Conduit Corporation.
  14. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  1. Comply with NEMA RN 1, UL 6 ANSI C80.1.
  2. Exterior Coating Thickness: 0.040 inches, minimum.
- E. PVC-Coated Aluminum Conduit: PVC-coated.
  1. Comply with UL 6A.
  2. Exterior Coating Thickness: 0.040 inch, minimum.
- F. LFMC: Flexible aluminum conduit with PVC jacket.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for Rigid Aluminum:
  - a. Material: Aluminum.
    - 1). Type: Form 7.
2. Fittings for PVC Coated Rigid Aluminum:
  - a. Material: PVC Coated Cast Aluminum.
  - b. Type: Form Form 7.
  - c. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inches, with overlapping sleeves protecting threaded joints.
3. Fittings for PVC Coated Rigid Steel:
  - a. Material: PVC Coated Rigid Steel
  - b. Type: Form 7.
- H. Expansion Fittings: PVC, aluminum, or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper, Crouse Hinds XJG 4 inches or equal with bonding jumper for aluminum or steel. Where expansion/deflection fitting is specified on the Drawings, provide Crouse Hinds XJGD or equal.
- I. Insulated Grounding Bushings: Threaded bushings, O-Z Type ABLG with lay-in means of grounding conduit.
- J. Fittings for LFMC:
  1. Fittings for aluminum LFMC shall be aluminum with reinforced sealing gaskets with Thomas and Betts stainless steel retaining ring, external grounding lugs, and insulated throat. Fittings shall be Emerson STB-L or equal.
  2. Fittings for steel LFMC shall be steel with reinforced sealing ring, external grounding lug, and insulated throat. Fittings shall be Emerson STB-L or equal.
- K. Joint Compound for ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.
  1. Aluminum Conduit: Penetrox A-13 or approved equal.
    - a. UL Listed.
    - b. Compatible with insulating materials such as rubber, or polyethylene.
    - c. Rated for all voltages.

## 2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. AFC Cable Systems; a part of Atkore International.
  2. Anamet Electrical, Inc.

3. Arnco Corporation.
  4. CANTEX INC.
  5. CertainTeed Corporation.
  6. Condux International, Inc.
  7. Electri-Flex Company.
  8. Kraloy.
  9. Lamson & Sessions.
  10. Niedax Inc.
  11. RACO; Hubbell.
  12. Thomas & Betts Corporation, A Member of the ABB Group.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Rigid HDPE: Comply with UL 651A.
- E. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

## 2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-line, an Eaton business.
  2. Hoffman; a brand of Pentair Equipment Protection.
  3. MonoSystems, Inc.
  4. Square D.
- B. Description:
1. Sheet metal, complying with UL 870 and NEMA 250, Type 4X 304 stainless steel otherwise indicated, and sized according to NFPA 70.
  2. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Flanged-and-gasketed type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.
- F. Wireways shall come with a threaded grounding post welded to the enclosure used for grounding.

## 2.04 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allied Moulded Products, Inc.
  - 2. Hoffman; a brand of Pentair Equipment Protection.
  - 3. Lamson & Sessions.
  - 4. Niedax Inc.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

## 2.05 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by the Engineer.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. MonoSystems, Inc.
    - c. Panduit Corp.
    - d. Wiremold / Legrand.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Engineer from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated.
    - b. MonoSystems, Inc.
    - c. Panduit Corp.
    - d. Wiremold / Legrand.

## 2.06 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Adalet.
  - 2. Crouse-Hinds, an Eaton business.
  - 3. EGS/Appleton Electric.
  - 4. Erickson Electrical Equipment Company.
  - 5. FSR Inc.
  - 6. Hoffman; a brand of Pentair Equipment Protection.
  - 7. Hubbell Incorporated.
  - 8. Kraloy.
  - 9. Milbank Manufacturing Co.
  - 10. MonoSystems, Inc.
  - 11. Oldcastle Enclosure Solutions.
  - 12. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 13. RACO; Hubbell.
  - 14. Robroy Industries.
  - 15. Spring City Electrical Manufacturing Company.
  - 16. Stahlin Non-Metallic Enclosures.
  - 17. Thomas & Betts Corporation, A Member of the ABB Group.
  - 18. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
  - 1. Outlet Boxes for Rigid Aluminum:
    - a. Material: Aluminum.
      - 1). Type: Form 7.
  - 2. Outlet Boxes for PVC Coated Rigid Aluminum:
    - a. Material: PVC Coated Cast Aluminum.
    - b. Type: Form 7.
    - c. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inches, with overlapping sleeves protecting threaded joints.

3. Outlet Boxes for PVC Coated Rigid Steel:
  - a. Material: PVC Coated Rigid Steel.
  - b. Type: Form 7.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 pounds. Outlet boxes designed for attachment of luminaires weighing more than 50 pounds shall be listed and marked for the maximum allowable weight.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4X with continuous-hinge cover with flush latch unless otherwise indicated.
  1. Metal Enclosures: 304 stainless steel. Steel, finished inside and out with manufacturer's standard enamel.
  2. Interior Backplane Panels: Steel; all sides finished with manufacturer's standard enamel.
  3. Enclosures shall include a grounding kit.
- L. Cabinets:
  1. NEMA 250, 304 stainless steel galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.
  6. Cabinet shall include a grounding kit.

## 2.07 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
  1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Manholes and Concrete Pullboxes:

1. Acceptable Manufacturers; Precast: Precast concrete products shall comply with the Specifications and shall be produced by the following manufacturers:
  - a. Brooks Products.
  - b. American Industrial Precast Products.
  - c. Dalworth Quickset Co.
  - d. Old Castle.
  - e. No Equal.
2. Acceptable Manufacturers; Castings: Metal castings shall comply with the Specifications and shall be produced by the following manufacturers:
  - a. McKinley Iron Works, Fort Worth, TX.
  - b. Neenah Foundry, Neenah, WI.
  - c. No equal.
3. Design Criteria: Concrete for precast concrete shall obtain a compressive strength of 4000 psi minimum at 28 days, and shall be an air entrained mix of the manufacturer's standard mix design.
4. Standards:
  - a. The applicable provisions of the following standards shall apply as if written here in their entirety:
    - 1). AASHTO H 20 — Standard Specifications for Highway Bridges.
    - 2). ANSI/ASTM A-15 — Zinc Coating (Hot Dipped) on Iron and Steel Hardware.
    - 3). ANSI/ASTM A-569 — Steel, Sheet and Strip, Carbon (0.15% Maximum), Hot Rolled, Commercial Quality.
    - 4). ASTM A-48 — Gray Iron Castings.
    - 5). ASTM A-123 — Zinc (Hot Galvanized) Coatings on Products fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.
5. Materials:
  - a. Manhole Frames and Covers: Class 30B gray cast iron conforming to ASTM A48; machine finished with flat bearing surfaces.
  - b. Sump Covers: Class 30B gray cast iron conforming to ASTM A48.
  - c. Pulling Irons: 316 stainless steel bar with 7/8-inch diameter forming a triangle of 9 inches per side when set; galvanized according to ANSI/ASTM A153 for irregularly shaped articles.
  - d. Cable Rack Inserts: 316 stainless steel channel inserts with a minimum load rating of 800 pounds; length to match cable rack channel.
  - e. Cable Rack Channel: 4-inch by 1-1/2-inch by 3/16-inch 316 stainless steel channel wall bracket, 48 inches long, with cable rack arm mounting slots on 8-inch centers.

- f. Cable Racks: 2-1/2-inch by 14-inch 316 stainless steel channel with high glazed, wet process porcelain insulators conforming to ANSI/ASTM A569.
  - g. Ground Rod: 3/4-inch by 10-foot copper clad steel, installed in the floor of the manhole, and all metallic cable racks, irons, etc. grounded (to the ground rod). Ground rod may be field installed, but floor penetration shall be sealed against the entrance of water under positive head.
  - h. Joint Sealant: Flexible plastic gasket of flexible butyl resin sealant.
  - i. Dampproofing: Sonneborn, Div. of ChemRex, Inc. or approved equal.
    - 1). Bituminous Dampproofing:
      - a). Cold-Applied, Emulsified-Asphalt Dampproofing:
        - (1). Brush and Spray Coats: ASTM D1227, Type III, Class 1.
    - 2). Miscellaneous Materials:
      - a). Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
6. Mixes:
- a. Concrete and reinforcing shall be in accordance with Section 03 30 00 "Cast-In-Place Concrete."
- C. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. NewBasis.
    - d. Oldcastle Precast, Inc.
    - e. Quazite: Hubbell Power Systems, Inc.
    - f. Synertech Moulded Products.
  - 2. Standard: Comply with SCTE 77.
  - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
  - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 6. Cover Legend: Molded lettering, "ELECTRIC" or "CONTROLS".
  - 7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.



- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. NewBasis.
    - d. Nordic Fiberglass, Inc.
    - e. Oldcastle Precast, Inc.
    - f. Quazite: Hubbell Power Systems, Inc.
    - g. Synertech Moulded Products.
  - 2. Standard: Comply with SCTE 77.
  - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
  - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 6. Cover Legend: Molded lettering, "ELECTRIC."
  - 7. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.08 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

## 3.00 EXECUTION

### 3.01 CONDUIT INSTALLATION SCHEDULE

- A. Conduit types shall be installed in accordance with the following schedule:
  - 1. Buried or Concrete Encased Conduit: Schedule 40 PVC, concrete encased unless noted otherwise. Conduit below grade shall not be smaller than 2 inches.
    - a. Elbows 2 Inches and Larger: PVC coated ARC.
    - b. Elbows Below 2 Where Allowed: PVC Coated ARC.

2. Above Grade Non Concealed Conduit: ARC unless noted otherwise.
  3. PVC Coated Rigid Aluminum Conduit: Shall be used for conduit stub-ups through concrete and concrete wall penetrations.
  4. Rigid Aluminum Conduit: May be used in all locations. PVC coated rigid aluminum conduit shall be used in corrosive environments or where in contact with concrete.
  5. Concealed Conduit (Through Concrete or Masonry), Aboveground: PVC coated ARC.
  6. Liquid Tight Flexible Metallic Conduit: Shall only be used to equipment in non-hazardous locations not subject to physical damage or excessive temperatures, requiring vibration isolation unless otherwise indicated, 6 feet maximum length. The bending radius shall be in accordance with Chapter 9, Table 2 of the NEC and shall not deform or alter the flex jacket.
  7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  8. Boxes and Enclosures, Aboveground: NEMA 250, NEMA 4X 304 stainless steel.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: ARC.
  2. Exposed and Subject to Severe Physical Damage: ARC. Raceway locations include the following:
    - a. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - b. Mechanical rooms.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  4. Damp or Wet Locations: ARC.
  5. Boxes and Enclosures: NEMA 250, 4X 304 stainless steel.
- C. Minimum Raceway Size:
1. Exposed 3/4 inch for light fixture whips, 3/4 inch trade size.
  2. Underground: 2 inches in duct banks, 1-inch independent conduits for power to light poles.
- D. All instrumentation cables – 4-20mA cables, or manufactured supplied cables – those that are associated with the level transmitters, flow meters, etc. shall be routed in PVC coated rigid steel conduit in underground duct banks.
- E. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Aluminum Conduit: Use threaded rigid aluminum conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  3. PVC Externally Coated, Rigid Aluminum Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing

conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

4. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  5. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- F. Where raceways are installed for such circuits and pass through concrete, install PVC coated rigid aluminum extending 6 inches past the top of the concrete slab where conduit does not terminate in a floor mounted enclosure.
- G. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- H. Install surface raceways only where indicated on the Drawings.
- I. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg. F.

### 3.02 CONDUIT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on the Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Use the conduit route where shown on the Drawings. Route conduits that do not have a specified route in the most direct path between the two points, i.e. home runs shown with an arrow symbol. Route conduits parallel to building lines. Concealed conduits on the Drawings shall be below grade, within walls, or above ceilings.
- C. Route conduit through roof openings for piping and ductwork where possible. Otherwise, route conduit through the roof with pitch pocket. Conduit shall not penetrate ductwork. Exposed conduit shall not be installed on the roof without the Engineer's prior approval.
- D. Install conduit at elevations which maintain headroom, and at locations which avoid interference with other Work requiring grading of pipe, the structure, finished walls, etc. Avoid crossing other Work. Conduits shall not be placed in close proximity to equipment, systems, and service lines. Maintain a minimum of 3 inches of separation, except in crossing which shall be a minimum of 1 inch. Conduits shall not be installed/concealed in water bearing walls.
- E. Conduits in buildings shall be exposed on unfinished ceilings and basements, as shown on the Drawings. Rigidly support conduits to the building structures using hardware bolted or screwed to the structure. The mounting hardware shall not mount the conduit directly on concrete walls and ceilings, but shall space the conduit away from the surfaces using mineralac-type hardware, strut channel clamps, or one hole straps with clamp backs.
- F. Group conduit in parallel runs where practical. Use a conduit rack constructed of channels with conduit straps or clamps. Provide space for an additional 25 percent conduit.
- G. Parallel runs of conduit shall have bends and offsets made at the same point such that the angle of bend is the same in each conduit and the conduits remain parallel throughout the

run. Conduits not installed in this manner shall be removed and reinstalled at the Contractor's expense. Conductors that are installed shall be removed and replaced at the Contractor's expense.

- H. Conduits installed in parallel shall be arranged such that crossings are eliminated.
- I. Nuts, bolts, concrete anchor bolts and other metallic fasteners shall be 304L stainless steel.
- J. Install conduit with threaded couplings and other threaded fittings. Threadless, or clamp type fittings shall not be used on metallic conduit. Rigid aluminum conduit shall have each set of threads coated with an oxidation inhibitor, IlSCO, De-Ox, ITT Noalox, Blackburn Contax or approved equal.
- K. Use suitable conduit caps to protect installed conduit against entry of dirt and moisture. The use of duct tape or any other tape shall be prohibited.
- L. Use watertight hubs to fasten conduit to metal boxes, etc. in wet or damp locations per the National Electrical Code.
- M. Provide at least 1/4 inch air space between the back of boxes, equipment and the wall.
- N. Size conduits as required by the National Electrical Code for the number and sizes of wires to be drawn into the conduit.
- O. Conduits terminating inside an air conditioned space from outside shall be sealed to prevent moisture/condensation from entering the enclosure.
- P. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- Q. Where applicable, aluminum conduit, straps, and struts shall not be in direct contact with concrete. Provide a neoprene washer between the two materials.
- R. PVC conduit shall not be installed above grade level, above concrete slab level, or for any exposed installations unless specified.
- S. Conduit system shall be swabbed clean prior to installation of conductors.
- T. Ground conduits in accordance with the National Electrical Code and Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- U. Install manufactured PVC coated aluminum conduit elbows for stub-ups at poles and equipment and at building entrances through floor. Encase elbows for stub-up ducts throughout length of elbow.]
- V. Complete raceway installation before starting conductor installation.
- W. Cut conduit perpendicular to the length. For conduits 2 inches trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- X. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- Y. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- Z. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 6 inches of changes in direction or where conduit penetrates through a floor, wall, or transitions from

underground. Conduits transitioning from underground to be supported by a structure shall include an expansion fitting before the conduit is strapped at its first conduit support.

- AA. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- BB. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- CC. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-pound tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- DD. Install conduit drain assemblies in outside or underground conduits to provide for draining.

### 3.03 CONDUITS THROUGH CONCRETE:

- A. Conduit shall not be placed horizontally in a concrete floor slab or a beam without the Engineer's written approval.
- B. Conduit stubbed-up through concrete and under free standing enclosures located indoors/outdoors, in an electrical room, etc., such as a motor control center, shall include an insulated throat grounding bushing threaded to the conduit termination. End bell shall be installed flush with the finished floor. No fiberglass shall be exposed to daylight or be installed such that any portion is out of concrete housekeeping pad or duct bank. Contractor shall properly tape PVC coated aluminum conduit where it transitions to PVC conduit in underground concrete encased duct banks so that no aluminum conduit is in contact with concrete encasement. Tape shall be manufactured by Scotch or approved equal. Coordinate with tape manufacturer for type of tape to use for the installation.
- C. Conduit passing through concrete shall be PVC coated aluminum. Conduit shall extend 6 inches above concrete transition.
- D. Where conduit transitions from below concrete into a duct bank, the conduit shall be PVC coated aluminum to the elbow.
- E. Conduit extending into concrete shall not be closer than 3 inches from adjacent conduit and shall not be closer than 1 inch from any reinforcement bars.
- F. Where conduits stub up through a floor slab from below finished floor level for multi-level structures, install a threaded fitting with PVC plug so that the top of the fitting is flush with the concrete or finished floor surface.

### 3.04 RACEWAYS EMBEDDED IN SLABS

- A. Run conduit larger than 1 inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
- B. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- C. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.

- D. Do not embed threadless fittings in concrete unless specifically approved by the Engineer for each specific location.

### 3.05 SURFACE RACEWAY INSTALLATION

- A. Install surface raceway with a minimum 2 inches radius control at bend points.
- B. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

### 3.06 EXPANSION FITTING INSTALLATION

- A. Expansion Fittings:
  - 1. Expansion fittings used with aluminum conduit shall be installed in the following locations:
    - a. At construction joints.
    - b. In conduit runs longer than 100 feet.
    - c. Transitions from underground to above elevation (exposed).
  - 2. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg. F and that has straight-run length that exceeds 100 feet.
  - 3. Install expansion fittings at all locations where conduits, concealed or surface mount, cross building, structure, construction and seismic expansion joints.
  - 4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
  - 5. Acceptable expansion/deflation fittings made of neoprene in outdoor applications shall have aluminum lagging over the neoprene held in place with stainless steel tie-wraps.

### 3.07 LIQUID TIGHT FLEXIBLE CONDUIT INSTALLATION

- A. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC in damp or wet locations not subject to severe physical damage.

### 3.08 JUNCTION BOX AND PULL BOX INSTALLATION

- A. Mount boxes at heights indicated on the Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

- B. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- C. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- D. Locate boxes so that cover or plate will not span different building finishes.
- E. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- F. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- G. Set metal floor boxes level and flush with finished floor surface.
- H. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- I. Drilling holes in boxes to support the box shall not be allowed.

### 3.09 INSTALLATION OF UNDERGROUND CONDUIT

- A. Concrete Encased Conduit:
  - 1. Duct banks routed below building slabs or any equipment pad shall be steel reinforced concrete encased.
  - 2. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6 inches in nominal diameter.
  - 3. Install backfill as specified in Section 31 23 33 "Trenching and Backfilling."
  - 4. After installing conduit and concrete, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
  - 5. At the transition from underground and or from concrete, protect conduit from mechanical damage by extending PVC coated rigid aluminum conduit a maximum of 12 inches and a minimum of 4 inches into the earth or concrete at the transition.
  - 6. Contractor shall properly tape PVC coated aluminum conduit where it transitions to PVC conduit in underground concrete encased duct banks so that no aluminum conduit is in contact with concrete encasement. Tape shall be manufactured by Scotch or approved equal. Coordinate with tape manufacturer for type of tape to use for the installation.
    - a. Couple PVC coated aluminum conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
  - 7. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

8. For installation of conduits to be used by electric utility, coordinate with the utility for exact requirements.
9. Conduit which is below the finished grade shall be PVC Schedule 40, except where indicated on the Drawings or noted otherwise.
10. Where underground conduits are routed under a concrete slab on grade and brought up under the slab, the duct bank reinforcing steel shall be tied into the slab.
11. Bury underground conduit a minimum of 18 inches deep to the top of the concrete encasement for 600-volt duct banks and 24 inches deep to the top of the concrete encasement for 5 kV, 15 kV, or 25 kV and as shown on the Drawings, whichever is greater. Backfill buried conduit banks with material which is free from large rock, paving material, or large angular substance.
12. Install underground conduit with the conduit duct bank dimensions shown on the Drawings. Adhere to conduit spacing by using spacers at intervals to ensure that proper spacings are maintained.
13. The concrete shall be red in color. Apply dye in concrete truck, sprinkling dye on top of the duct bank after concrete placement is prohibited. Place 3-inch CMU blocks under rebar cage to suspend rebar off of the bottom of the trench so that it does not contact the soil and is completely encased in the concrete envelope when concrete is placed.
14. Underground conduits terminating in a vault or below grade structure shall first turn up at least 3 feet above the structure top slab and terminate in a junction box. Only then shall a conduit penetrate the structure and go directly into the structure.
15. Grade underground and outdoor conduits to drain free of condensation and moisture. Provide for automatic draining at lowpoints. Install horizontal runs of conduit to provide a natural drain for condensation without pockets or traps where moisture may collect.
16. Underground conduits shall drain to an underground structure with a floor drain, such as a manhole.
17. Underground 2 inches and larger conduit bends shall have a long sweep bend radius.
18. Contractor shall install duct bank spacers a minimum of every 5 feet.
19. Conduit shall slope uniformly at not less than 4 inches per 100 feet, or more than 60 inches per 100 feet unless indicated otherwise on the Drawings or approved by the Engineer. Arrange duct banks to drain into manholes with no low pockets in the duct runs. The electrical contractor shall coordinate with the Contractor and the Drawings on the proposed grades for the Site.

### 3.10 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.



- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.11 SIZING AND INSTALLATION OF WIREWAYS, PULL BOXES AND JUNCTION BOXES

- A. Contractor shall be responsible for providing and sizing all wireways, pull boxes and junction boxes per the National Electrical Code (NEC) Article 314 and all other relevant sections of the NEC.
- B. Install Products in accordance with manufacturer's instructions.
- C. Use screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
- D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- E. Wireway Supports: Per manufacturer's recommendations. Contractor shall support the wireway rigidly to the building structures using hardware bolted or screwed to the structure. Supporting wireways from corrugated metal structures shall not be allowed.
- F. Close ends of wireway and unused conduit openings.
- G. Use separate pull boxes and junction boxes for electric power, control and communication systems.
- H. Install pull boxes in interior conduit at not more than 100 feet apart when conduit runs are not broken by junction or outlet boxes.
- I. Pull and junction boxes shall be accessible and not buried.
- J. Do not install boxes back to back in walls and provide a minimum of 6 inches separation, except in acoustic-rated walls, provide 24 inches separation.
- K. Support boxes independently of conduit except for cast boxes that is connected to two rigid metal conduits, both supported within 12 inches of box.
- L. Box shall be mounted using mounting lugs. Drilling through the box to mount is prohibited. Any box drilled to mount will be rejected and shall be removed and replaced at the Contractor's expense.

### 3.12 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- C. Cut sleeves to length for mounting flush with both surfaces of walls.

- D. Extend sleeves installed in floors 2 inches above finished floor level.
- E. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- F. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- G. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint.
- H. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

### 3.13 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

### 3.14 CONDUIT TERMINATIONS

- A. Conduit terminations at enclosures shall maintain the NEMA rating of the enclosure. Conduit terminations damaging enclosures shall not be permitted. Damaged enclosures will not be accepted and shall be replaced at the Contractor's expense.
- B. Use grounding myers hubs for termination of conduits into enclosures.
- C. Locknut termination of conduits shall not be used on this Project except where liquid tight fittings require locknuts to maintain UL listings. Locations utilizing liquid tight fittings shall include a stainless steel banded sealing gasket. Damaged bands or gaskets due to overtightening shall be replaced by the Contractor.
- D. For exterior, wet locations, and where conduit enters from exterior or wet locations, conduit terminations shall not penetrate the top of NEMA 4X, NEMA 7 and NEMA 3R enclosures. Enclosures with top penetrations shall be removed and replaced with conduits re-routed for side or bottom penetration at the Contractor's expense. If conductors have been installed and are too short to accommodate the re-routed conduit, then they shall be removed and replaced at the Contractor's expense.
- E. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- F. Use suitable conduit caps to protect installed conduit against entry of dirt and moisture. The use of duct tape or any other tape shall be prohibited.
- G. Conduits terminating inside an air conditioned space from outside shall be sealed to prevent moisture/condensation from entering the enclosure.
- H. Where locknuts are allowed, do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

- I. Install raceways square to the enclosure and terminate at enclosures with Myers hubs. Install Myers hub hand tight plus 1/4 turn more.

### 3.15 JUNCTION BOX INSTALLATION

- A. Junction boxes shall be installed so they are accessible from the front.
- B. Junction boxes shall have terminal strips/distribution blocks for splicing conductors where approved by the Engineer or as shown/specified on the Drawings. Terminal strips shall be manufactured by Allen-Bradley, Phoenix Contact or approved equal. Distribution blocks shall be per Section 26 05 19.01 "Wire Connections and Devices." No top entry in junction boxes with a terminal strip.
- C. Use watertight hubs to fasten conduit to metal boxes, etc. in wet or damp locations per the National Electrical Code.
- D. Metallic Junction boxes shall be grounded with NEC approved grounding fasteners and by means allowed by the enclosure manufacturer. Enclosures drilled for grounding fasteners that do not meet code shall be replaced at the cost of the Contractor.

**END OF SECTION**

## **26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels, including arc-flash warning labels.
  - 8. Miscellaneous identification products.

#### **1.03 SUBMITTALS**

- A. Product Data: For each type of product.
- B. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

### **2.00 PRODUCTS**

#### **2.01 PERFORMANCE REQUIREMENTS**

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. Raceways and Cables Carrying Circuits at More Than 600 V:
  - 1. Black letters on an orange field.
  - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- C. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.03 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Champion America.
  - c. emedco.
  - d. Grafoplast Wire Markers.
  - e. LEM Products Inc.
  - f. Marking Services, Inc.
  - g. Panduit Corp.
  - h. Seton Identification Products.
- C. Snap-Around Labels for Raceways and Cables Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceways they identify, and that stay in place by gripping action.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Marking Services, Inc.
    - c. Panduit Corp.
    - d. Seton Identification Products.

D. Self-Adhesive Labels:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. A'n D Cable Products.
  - b. Brady Corporation.
  - c. Brother International Corporation.
  - d. emedco.
  - e. Grafoplast Wire Markers.
  - f. Ideal Industries, Inc.
  - g. LEM Products Inc.
  - h. Marking Services, Inc.
  - i. Panduit Corp.
  - j. Seton Identification Products.
2. Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
  - a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized to fit the cable diameter, such that the clear shield overlaps the entire printed legend.
3. Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
  - a. Nominal Size: 3.5-by-5-inch.
4. Marker for Tags: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

2.04 BANDS AND TUBES

- A. Snap-Around, Color-Coding Bands for Raceways and Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Marking Services, Inc.
    - c. Panduit Corp.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around cables they identify. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Panduit Corp.

## 2.05 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlton Industries, LP.
    - b. Champion America.
    - c. Ideal Industries, Inc.
    - d. Marking Services, Inc.
    - e. Panduit Corp.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. emedco.
    - d. Marking Services, Inc.
- C. Tape and Stencil for Raceways Carrying Circuits 600 V or Less: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. LEM Products Inc.
    - b. Marking Services, Inc.
    - c. Seton Identification Products.
- D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlton Industries, LP.
    - b. Seton Identification Products.

E. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Ideal Industries, Inc.
  - c. LEM Products Inc.
  - d. Marking Services, Inc.
  - e. Reef Industries, Inc.
  - f. Seton Identification Products.
2. Tape:
  - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
  - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
  - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
  - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".

- F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.06 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. emedco.
    - d. Marking Services, Inc.
    - e. Seton Identification Products.
- B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.



1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Brady Corporation.
  - b. Carlton Industries, LP.
  - c. emedco.
  - d. Grafoplast Wire Markers.
  - e. LEM Products Inc.
  - f. Marking Services, Inc.
  - g. Panduit Corp.
  - h. Seton Identification Products.
- C. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to raceway, conductor, or cable.
  1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

## 2.07 SIGNS

- A. Baked-Enamel Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  1. 1/4-inch grommets in corners for mounting.
  2. Nominal Size: 7 by 10 inches.
  3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Carlton Industries, LP.
    - b. Champion America.
    - c. emedco.
    - d. Marking Services, Inc.
- B. Metal-Backed Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal Size: 10 by 14 inches.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Champion America.
    - c. emedco.

d. Marking Services, Inc.

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend with black letters on white face.
2. Thickness:
  - a. For signs up to 20 sq. inches, minimum 1/16 inch thick.
  - b. For signs larger than 20 sq. inches, 1/8 inch thick.
3. Punched or drilled for mechanical fasteners.
4. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Carlton Industries, LP.
  - c. emedco.
  - d. Marking Services, Inc.

2.08 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Ideal Industries, Inc.
  2. Marking Services, Inc.
  3. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
  1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 deg F according to ASTM D638: 12,000 psi.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
  1. Minimum Width: 3/16 inch.
  2. Tensile Strength at 73 deg F according to ASTM D638: 12,000 psi.
  3. Temperature Range: Minus 40 to plus 185 deg F.
  4. Color: Black.

## 2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## 3.00 EXECUTION

### 3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.
- I. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- J. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

### 3.03 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30A and 120V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

1. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
  - a. "EMERGENCY POWER."
  - b. "POWER."
  - c. "UPS."
- B. Power and Control Cable Identification: All markings to labels, schedules, tags or name plates shall be machine printed only. Hand printing is prohibited. Circuits shall be tagged at terminations (both ends), in pull boxes, cabinets, and enclosures as follows:
  1. Tags relying on adhesives or tape-on markers are not acceptable.
  2. Provide conductor tags for conductors No. 10 AWG and below with legible permanent sleeve of yellow or white PVC with machine printed black markings.
  3. Tags shall be imprinted with panelboard and panelboard position number (e.g. LA3-23) for conductors fed from panelboards. Other conductors shall have tags imprinted with the MCC which feeds the conductors (e.g. MCC 1).
  4. Switchlegs shall have the designation described above on their tags, plus an "S" suffix. Travelers shall have the designation described above on their tags, plus a "T" suffix.
  5. Where more than one neutral is present with a group of conductors, a tag shall be applied to each neutral indicating which phase conductors are served by each neutral (e.g. HA-2, 4, 6).
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  1. Color-Coding for Phase-and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
    - b. Colors for 120/240-V Circuits:
      - 1). Phase A: Black.
      - 2). Phase B: Red.
      - 3). Neutral: White.
      - 4). Equipment Ground Conductor: Green.
    - c. Colors for 208/120-V or 240V/120-V, 3-phase Circuits:
      - 1). Phase A: Black.
      - 2). Phase B: Red.
      - 3). Phase C: Blue.
      - 4). Neutral: White.

- 5). Equipment Grounding Conductor: Green.
- d. Colors for 480/277-V Circuits:
  - 1). Phase A: Brown.
  - 2). Phase B: Orange.
  - 3). Phase C: Yellow.
  - 4). Equipment Grounding Conductor: Green.
2. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- E. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- I. Conduit Identification Plate: A conduit identification plate shall be installed on all power, control and instrumentation conduits at the end of each run and at the conduit ends inside intermediate junction and pull boxes, manholes, handholes, etc.
  1. Conduit plates shall be installed before conductors are pulled into the conduits.
  2. Exact identification plate location shall be coordinated with the Owner/Engineer at the time of installation. The conduit identification tags shall identify the cable numbers as shown on the FNI plans and the "to" and "from" information.
  3. Coordinate with Owner for exact requirements for plate material and type. Provide an example to Owner/Engineer as a formal submittal for approval prior to the installation. Attach conduit identification plate with stainless steel tie wraps or stainless steel wire.

- J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
  - 1. Install underground-line warning tape for direct-buried cables and cables in raceways.
  - 2. Identifying line shall be continuous along the entire underground route.
- K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
  - 1. Comply with 29 CFR 1910.145.
- M. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power -transfer switches.
    - b. Controls with external control power connections.
- N. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
  - 1. Comply with NFPA 70E and ANSI Z535.4.
  - 2. Comply with Section 26 05 73 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
  - 3. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase the sizes of labels and letters to those appropriate for viewing from the floor.

- d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
- 2. Equipment to be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Access doors and panels for concealed electrical items.
  - d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
  - e. Enclosed switches.
  - f. Enclosed circuit breakers.
  - g. Enclosed controllers.
  - h. Push-button stations.
  - i. Contactors.
  - j. Remote-controlled switches, dimmer modules, and control devices.
  - k. Monitoring and control equipment.
  - l. UPS equipment.
  - m. Conduits.

### 3.04 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with stainless steel mechanical fasteners appropriate to the location and substrate.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- G. Painted Identification: Comply with requirements in Division 09 Painting Sections for surface preparation and paint application.

**END OF SECTION**



## 26 05 73      OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

### 1.00      GENERAL

#### 1.01      DESCRIPTION

General: This section specifies that the Contractor prepare a short circuit and protective device coordination study, load flow, motor starting study, and an arc flash hazard analysis for the electrical power system as shown on the plans for the complete electrical system at the Town of Summerfield's Elevated Storage Tank.

**No equipment provided under this contract is to be energized until the Power System Studies have been approved by the Engineer, the protective relays and breakers have been set per the Short Circuit and Protective Device Coordination Study and the arc flash labels have been installed on the equipment. No exceptions.**

Short Circuit and Protective Device Coordination Study, Arc Flash Analysis, and Load Flow Study.

The studies shall provide an evaluation of the electrical power system and the model numbers and settings of the protective relays or devices and metering or motor monitoring devices for setting by the Contractor. The Studies shall include settings for all protective relays and circuit breakers, including breakers mounted in, power meters and electric system monitoring for both devices provided under this contract and for the existing devices. The Contractor shall obtain any needed data or information for the electrical equipment from Contract Documents, various suppliers, and from conducting his own field investigations.

#### A. Scope:

1. The Contractor is responsible for providing all pertinent information necessary for the successful completion of the Short Circuit and Protective Device Coordination Study, Load Flow, and Arc Flash Analysis. All cable and raceway data, data from all new electrical equipment – motors, transformers, control panels, disconnects, and separately mounted fuses, starters or circuit breakers shall be obtained by the Contractor. Obtain all existing or new protective device information to include all present settings. The Contractor shall obtain any needed data or information from Contract Documents, various suppliers, the Electric Utility and from conducting his own field investigations. The data obtained shall be organized and submitted to the Engineer to show that all the necessary data gathering work has been done.
2. Calculations shall utilize actual X/R and three phase short circuit values obtained by the Contractor from the Electric Utility. The use of infinite bus fault current calculation is not acceptable.
3. The Contractor shall redo the Power System Studies if any changes are made during the field testing checkout and/or start-up and shall re-submit the updated study for Engineer approval.
4. Provide a complete short circuit study. Include three phase and phase-to-ground calculations. Provide an equipment interrupting or withstand evaluation based on the actual equipment and model numbers provided on this project. Generic devices are not acceptable. Normal system operating method, alternate operation, and operations that could result in maximum fault conditions shall be thoroughly addressed in the study.

- a. The study shall assume all motors operating at rated voltage with the exception that motors identified as "standby" shall not be included.
  - b. Electrical equipment bus impedance shall be assumed zero.
  - c. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the electrical equipment busses.
  - d. The Study shall be performed using actual available short circuit currents available and system impedances as obtained from the Electric Utility. An assumption of infinite bus for the purposes of the Study is not acceptable.
  - e. Study shall use actual motor X/R and subtransient reactance data obtained from equipment suppliers.
5. A protective device coordination study shall be performed to determine appropriate relay settings. The study shall include all electrical equipment provided under this contract and any up-stream equipment that has an impact on the coordination study. The study shall show transformer damage curves, cable short circuit withstand curves and motor curves. Include all variable frequency drives, disconnects, fuses, and main circuit breakers. Complete the short circuit study down to the main breaker or main lugs on all panelboards. Panelboard branch circuit devices need not be considered. The phase over current and ground-fault protection shall be included as well as settings for all other adjustable protective devices. All motor monitoring relays and protective or monitoring devices that are a part of a supplier's equipment (such as soft starters shall be included. Include the last protective device in the Electric Utility's system feeding each facility being considered.
  6. Provide Time-Current Curves on 11X17 log-log paper. Do not put more than one branch of protective devices on any one coordination curve. Include a one-line diagram and the names of each protective device in the branch. Use the names designated in the Contract Documents. Include motor and transformer damage curves, and cable short circuit withstand curves. Coordination study time-current curves (11x17 log-log type) including the instrument transformer ratios, model numbers of the protective relays, and the relay settings associated with each breaker. Organize the curves as specified here in. Ground fault time current curves shall be on a separate sheet.
  7. An equipment evaluation study shall be performed to determine the adequacy of the fault bracing of all bus from the panelboard level up to the main Switchgear or protective device. Include circuit breakers, controllers, surge arresters, busway, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.
  8. Provide arc flash hazard analysis in accordance with the applicable NFPA, ANSI, and IEEE standards.
  9. The studies shall be performed, sealed, and signed by a Registered Professional Engineer licensed in the state of North Carolina.
  10. Any problem areas or inadequacies in the equipment shall be promptly brought to the Engineer's attention.
  11. Use industry standard short circuit software, SKM CAPTOR and DAPPER or an equal approved by the Engineer.

12. The report shall include a comparison of short circuit duties of each bus to the interrupting capacity of the equipment that is protecting that bus.
13. The report shall include all data that was used as input to the report. This data shall include cable impedance, conduit type, source impedance, equipment ratings, motor X/R and subtransient reactance data, etc.
14. Provide and program all settings for all power meters, motor protection relays, feeder protection relays, etc.
15. The Contractor shall coordinate with the Utility (Duke Energy) for electrical data required for the studies.

#### 1.02 REFERENCES

- A. This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

| <u>Reference</u> | <u>Title</u>                                                                                    |
|------------------|-------------------------------------------------------------------------------------------------|
| IEEE 141         | Recommended Practice for Electric Power Distribution for Industrial Plants                      |
| IEEE 242         | Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems |
| NFPA 70E         | Handbook for Electrical Safety in the Workplace                                                 |
| IEEE 1584        | IEEE Guide for Performing Arc-Flash Hazard Calculations                                         |
| NEC              | National Electrical Code                                                                        |

#### 1.03 SCHEDULE

- A. The report shall be provided to the Engineer NO LATER THAN 60 days before the equipment is shipped to the Work site. SHIPMENT AND DELIVERY OF EQUIPMENT WILL NOT BE ACCEPTED AT THE JOBSITE UNTIL THE STUDY HAS BEEN COMPLETED, SUBMITTED AND APPROVED BY THE ENGINEER.
- B. Provide a preliminary short circuit and motor starting study 30 days prior to first submittal being provided by the Contractor.

#### 1.04 SUBMITTAL PROCEDURES

Submittal Procedures shall be in accordance with Section 01 30 00, "Document Management" and shall include:

- A. Shop Drawings:
  1. Short Circuit and Protective Device Coordination Study. Time current curves shall be on 11x17 log-log type paper. The 11x17 paper with the TCC shall also include a one-line diagram for the branch that the TCC on that sheet corresponds with. The Contractor can provide time current curves on 8 ½ x 11 log-log type paper as a supplement but not as a replacement.

2. Provide a list of all recommended settings for all power meters, motor protection relays, feeder protection relays, circuit breakers, etc.
3. Load Flow Study
4. Motor Starting Study
5. Contractor to coordinate with the starter manufacturers for all data required to perform the motor starting analysis. The preliminary starting analysis shall determine the maximum inrush allowed when starting the motor to not drop out the loads under the worst operating conditions.
6. Arc Flash Hazard Analysis
  - a. Provide a color copy of project specific Arc Flash labels for each panelboard, switchboard, switchgear, disconnect, VFDs, starters, transfer switches.
  - b. Provide a copy of the one-line diagrams color-coded to show the incident ranges at each bus. The one-lines shall be on 11x17 paper.
    - 1). The one-line shall also include the information specified in section 2.04 below.
- B. After the report and one-line has been approved, provide a color copy in PDF format of the finalized 11x17 one-line diagram to the Contractor for the Contractor's use to frame in the electrical room as specified in section 26 05 00, "Common Work Results for Electrical". The one-line shall reflect all changes made including but not limited to changes made during construction
- C. The Contractor to redo the Power System Studies if any changes are made during the field testing checkout and/or start-up. The Contractor to re-submit the Power System Studies for Engineer Approval. The Studies shall include an updated copy of the color copy Arc Flash Labels.
- D. A CD with all SKM input files and a PDF of all output files is required for both the preliminary and final power system studies Submittal Procedures.
  1. Two Software copies of actual power systems computer program project data files burned in on a CD. The Contractor to provide an electronic copy on a CD-ROM of all files used to develop the electrical system model in the power system analysis program and all files for the written study analysis and summary data tables. For instance, if SKM software is used for the power system studies, then the SKM files shall be burned in on a CD-ROM and provided to the Owner/Engineer. This shall include any library files used for circuit breakers, fuses, etc. for the power system analysis.

## **2.00 EXECUTION**

### **2.01 GENERAL**

- A. Provide a short-circuit and protective device coordination study load flow and motor starting study, and arc flash hazard analysis on the electrical power distribution system, as specified. The studies shall be performed in accordance with IEEE Standards 141 and 242, IEEE 1584, ANSI, and the NEC and shall utilize the ANSI method of short circuit analysis in accordance with ANSI C37.010. The studies shall be performed using actual equipment data for all equipment. The coordination studies shall use the data from the manufacturer of protective devices.

## 2.02 QUALIFICATIONS

- A. The studies shall be performed by a consultant who is regularly engaged in power system studies. A Licensed Professional Engineer with proficiency in electrical power engineering shall conduct the studies and shall seal and sign the studies. The Professional Engineer shall be licensed to practice engineering in the State of North Carolina. A study submitted without a Professional Engineer's seal will not be reviewed and returned Not Approved, Revise & Resubmit. **EQUIPMENT MANUFACTURERS SHALL NOT BE ALLOWED TO PERFORM THE STUDIES, NO EXCEPTIONS.**

## 2.03 SHORT CIRCUIT STUDY

- A. The Contractor is responsible for obtaining and verifying all data needed to perform the study.
- B. As a minimum, each short circuit study shall include the following:
  - 1. One-Line Diagram:
    - a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.
    - b. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.
    - c. Power and voltage ratings, impedance, primary and secondary connections of all transformers. Use the ratings (i.e. Impedance, X/R, etc.) of the actual transformers being provided where available.
    - d. Type, manufacturer, and ratio of all instrument transformers energizing each relay.
    - e. Nameplate ratings of all motors with their subtransient reactances. Transient reactances of synchronous motors. Obtain data on the actual equipment being provided. Generic or average data numbers are not acceptable.
    - f. Sources of short circuit currents such as utility ties, synchronous motors, and induction motors. Provide short circuit studies using each source of power separately. The study shall determine if there is sufficient short circuit current to adequately cause interruption of a protective device using the weaker power source (typically local generation) and shall determine if the equipment can safely interrupt the fault if the greater power source is connected. Additional short circuit calculations shall include emergency as well as normal switching conditions as well as normal and emergency power sources described here in.
      - 1). Show short circuit calculations listing short circuit levels at each bus. Provide the same data in tabular form.

- g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc. shall be included.
  - h. The time-current setting of existing adjustable relays and direct-acting trips, if applicable.
  - i. One-Line showing available fault current at each bus all the way down to the 120/240V and 208Y/120V panelboards.
2. Impedance Diagram:
- a. Available MVA or impedance from the utility company.
  - b. Local generated capacity impedance.
  - c. Bus impedance.
  - d. Transformer and/or reactor impedances.
  - e. Cable impedances.
  - f. Equipment impedances.
  - g. System voltages.
  - h. Grounding scheme (resistance grounding, solidly grounding, or no grounding).
  - i. Motor contribution assuming the new and existing motors as shown on the plans all running at the same time.
3. Calculations:
- a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
  - b. Calculate the maximum and minimum fault currents.
  - c. A discussion section evaluating the adequacy or inadequacy of the equipment method of calculation and formulas used such that all calculations can be verified manually by the Engineer, with recommendations as required for improvements to the system.
  - d. Any inadequacies shall be called to the attention of the Engineer and recommendation made for improvements.

## 2.04 PROTECTIVE DEVICE COORDINATION STUDY

- A. As a minimum, the coordination study for the power distribution system shall include the following on 5-cycle, log-log graph paper:
  - 1. The time-current coordination analysis shall be performed with aid of a digital computer.
    - a. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing, but still maintain a low incident energy level. Where selectivity cannot be achieved, the Engineer shall be notified as to the cause.

2. Time-current curves for each device shall be positioned to provide for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, the Engineer shall be notified as to the cause.
3. Time-current curves and points for cable and equipment damage.
4. Circuit interrupting device operating and interrupting times.
5. Indicate maximum fault values on the graph.
6. Sketch of bus and breaker arrangement.

## 2.05 ARC FLASH HAZARD ANALYSIS

- A. The study shall be performed in accordance with the NEC and all applicable OSHA, ANSI, and IEEE standards.
- B. The Contractor to adjust all adjustable time-current devices such that the trip settings lower the arc flash exposure and minimizing the clearing time. However, the Contractor to adjust the time-current devices to avoid nuisance tripping.
- C. The Contractor to utilize fault current values from the short circuit analysis to determine the Incident energy, limited approach boundary, restricted approach boundary, prohibited approach boundary and appropriate PPE required.
- D. The Contractor to provide project specific arc-flash labeling. The arc-flash labeling shall be placed on the outside of the cover of the combination motor starters, disconnects, and all electrical panels, etc. such that it can be read without opening the electrical equipment. Mount arc-flash labels a maximum of 6'-6" AFF, include the housekeeping pad in the mounting height. The Contractor to provide arc-flash labeling on all existing panelboards, switchboards, distribution panel, etc. where breakers are added or work is performed in or on the electrical equipment.
- E. Arc Flash Labels shall be chemical resistant, UV resistant, water resistant, scratch resistant, and made of 3.0 mil vinyl tape as manufactured by DuraLabel, Brady or approved equal. The lettering shall be performed by thermal transfer print.
  1. Arc Flash labels and label lettering shall be sized large enough to be legible at a distance outside the hazard area.
  2. Arc Flash Labels shall be placed on the door(s) of the room if the hazard area reaches or extends beyond the electrical room door(s).
  3. The arc flash label shall include a DANGER header when the incident energy is above 40cal/cm<sup>2</sup>, and a WARNING header for all other incident energy levels.
- F. To ensure a safe workplace, and that the labeling meets NEC, OSHA, IEEE, and NFPA requirements, use specialized arc flash software to calculate protection boundaries. These protection boundaries shall include the Flash Protection Boundary, Limited Approach Boundary, Restricted Approach Boundary, and the Prohibited Approach Boundary.
- G. Arc-flash label shall be provided all the way down to the 120/240V panelboards.

- H. The arc-flash analysis shall be based on calculated fault from the Short Circuit Study at each respective bus. The arc-flash software program shall be used to calculate the available arcing fault at each bus in the system, the resultant flash protection boundary based on the applicable protective device operating times and the associated incident energy that workers may be exposed to at the specified working distances.
- I. The report shall include the following information: Arc-flash evaluation table, arc-flash and shock hazard label definitions, arc-flash evaluation information, arc-flash and shock hazard labels and definitions of terms used in the arc-flash hazard analysis.
- J. Arc Flash labels shall be similar to the following example:

|  <b>WARNING</b> |                                               |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <b>Arc Flash and Shock Hazard</b>                                                                |                                               |
| <b>Appropriate PPE Required</b>                                                                  |                                               |
| <b>13 inch</b>                                                                                   | Flash Hazard Boundary                         |
| <b>0.67</b>                                                                                      | cal/cm <sup>2</sup> Flash Hazard at 18 inches |
| <b>3</b>                                                                                         | PPE Category                                  |
| <b>480 VAC</b>                                                                                   | Shock Hazard when cover is removed            |
| <b>0</b>                                                                                         | Glove Class                                   |
| <b>42 inch</b>                                                                                   | Limited Approach                              |
| <b>12 inch</b>                                                                                   | Restricted Approach                           |
| <b>10.692 kA</b>                                                                                 | Calculated Available Fault Current            |
| <b>Equip. ID: Panel LP1</b>                                                                      |                                               |
| <b>Protected By: 125A CB: TX1 (480V MCC1)</b>                                                    |                                               |
| <b>Study Date: May 4, 2016</b>                                                                   |                                               |
| <b>Upstream Protective Device: Panel HP1 Circuit 1,3,5</b>                                       |                                               |

## 2.06 LOAD FLOW STUDY

- A. SCOPE: Determine the active and reactive power, voltage, current, and power factor throughout the electrical system. Provide an analysis of all possible operating scenarios.
- B. PROCEDURE: The load flow study shall be performed in accordance with the recommended practices and procedures set forth in IEEE 399.
- C. STUDY REPORT: Results of the load flow study shall be summarized in a final report containing the following items:
  - 1. Basis, description, purpose, and scope of the study.
  - 2. Tabulation of data used to model the system components and a corresponding one-line diagram.
  - 3. Description of scenarios evaluated and the basis of each.
  - 4. Tabulation of power and current flow versus equipment ratings. The tabulation shall identify percentage of rated load and the scenario for which the percentage is based. Overloaded equipment shall be clearly noted.



5. Tabulation of system voltage versus equipment ratings. The tabulation shall identify percentage of rated voltage and the scenario for which the percentage is based. Voltage levels outside the ranges recommended by equipment manufacturers, IEEE C84.1 or other appropriate standards shall be clearly noted.
6. Tabulation of system real and reactive power losses with area of concern clearly noted.
7. Provide One-line showing voltage at major busses down to the and 120/240V panelboards.
8. Conclusions and recommendations.

## 2.07 MOTOR STARTING STUDY

- A. The motor starting study shall provide an evaluation of the electrical power system when starting the motors for all operating scenarios indicated below. The motor starting study shall evaluate all different possible operating scenarios under the worst-case starting conditions. The Contractor to coordinate with the electrical equipment manufacturers and obtain all information required to perform the motor starting analysis. The preliminary starting analysis shall determine the maximum inrush allowed when starting the motors to not drop out the site loads under the worst operating conditions.
- B. Scope:
  1. Contractor to provide a motor starting/load flow study for the work performed at the site. The study shall evaluate all possible operating scenarios.
    - a. Operating Scenarios that shall be included in the study are listed in paragraph 2.03.
    - b. See electrical plans for detailed one-line diagram of the electrical distribution system. The Contractor to coordinate with the Local Utility and Owner for all voltage flicker requirements and is responsible for obtaining all pertinent data from the Local Utility/Owner and other equipment manufacturers to perform the study.
  2. Contractor to obtain any information required for the motor starting/load flow study including utility available fault current, utility system impedance, motor data (i.e., sub transient reactance, etc.), transformer data (i.e. impedance, X/R, etc.), cable data, etc.
  3. The study shall be submitted to the Engineer and approved prior to final approval of the electrical equipment shop drawings and release of any electrical equipment for manufacturing.
  4. The study shall include as a minimum the following:
    - a. Single line diagram showing voltage at all major busses down to the 120/240V panelboards.
    - b. Bus Voltage and power flow
    - c. Information on the computer program used for the study and also shall include a general discussion of the procedure, items, and data considered in preparing the study.
    - d. Description and analysis of all results.
    - e. Suggested changes to the equipment selection that will result in improved system performance.

5. The study shall be performed, sealed and signed by a Registered Professional Engineer licensed in the state where the electric equipment is to be installed.

**END OF SECTION**

## **26 09 23 LIGHTING CONTROL DEVICES**

### **1.00 GENERAL**

#### **1.01 SCOPE**

- A. Lighting control manufacturer shall be responsible to review the Drawings and verify the layout of devices required for lighting controls meets the intent of the design for daylight-harvesting. Manufacturer recommended modifications shall be addressed with the Engineer prior to bidding. Approved recommended modifications shall be incorporated in the Contract Documents by the Contractor at no additional cost to the Owner.
- B. Provide lighting controls as required by the Drawings and Specifications.

#### **1.02 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Materials and Work not listed in Section 26 09 23 "Lighting Control Devices" shall be in accordance with Division 26 Specifications.

#### **1.03 SUMMARY**

- A. This Section includes the following lighting control devices:
  - 1. Outdoor and indoor photoelectric switches.
  - 2. Lighting contactors.
- B. Related Sections include the following:
  - 1. Division 26 Section "Wiring Devices" for manual light switches.

#### **1.04 DEFINITIONS**

- A. LED: Light-emitting diode.

#### **1.05 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Product cut sheets.
  - 2. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

#### **1.06 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## **2.00 PRODUCTS**

### **2.01 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
  - 1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
  - 2. Time Delay: 15-second minimum, to prevent false operation.
  - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
  - 4. Mounting: Base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

### **2.02 LIGHTING CONTACTORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allen-Bradley/Rockwell Automation.
  - 2. Eaton Electrical Inc.; Cutler-Hammer Products.
  - 3. GE Industrial Systems; Total Lighting Control.
  - 4. Hubbell Lighting.
  - 5. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 6. Square D; Schneider Electric.
  - 7. TORK.
  - 8. Watt Stopper (The).
- B. Description: Electrically operated and mechanically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
  - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  - 3. Enclosure: Comply with NEMA 250.
    - a. Indoor: NEMA 12
    - b. Outdoor: NEMA 4X

4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

## 2.03 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Class 1 Control Cable: Multi conductor cable with stranded -copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## 3.00 EXECUTION

### 3.01 INSTALLATION

- A. Contactors: Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.
- B. Photoelectric Switch: Furnish and install photocells where indicated on the plans. Cells shall face a northerly direction.

### 3.02 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" and Division 26 "Low-Voltage Electrical Control Conductors and Cables." Minimum conduit size shall be 3/4 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Wire nuts, butt splicing, and soldering are not allowed.

### 3.03 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
  1. Identify controlled circuits in lighting contactors.
  2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label contactors with a unique designation.

### 3.04 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective Work.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

**END OF SECTION**

## 26 22 13 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

### 1.00 GENERAL

#### 1.01 SUMMARY

##### A. Section Includes:

1. Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 500 kVA.

#### 1.02 SUBMITTALS

##### A. Shop Drawings:

1. For each type of product.
  - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
  - b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
4. Include project specific wiring diagrams.

##### B. Field Quality-Control Submittals:

1. Field quality-control reports.

#### 1.03 STANDARDS

- ##### A. The applicable provisions of the following standards shall apply as if written here in their entirety:

|                  |                                                                                                                                            |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| ANSI/IEEE C57.96 | Distribution and Power Transformers, Guide for Loading Dry-Type appendix to ANSI C57.12 standards                                          |
| ANSI/IEEE C89.2  | Dry Type Transformers for General Applications                                                                                             |
| IEEE C57.12.01   | General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and / or Resin-Encapsulated Windings |
| IEEE C57.12.91   | Test Code for Dry-Type Distribution and Power Transformers                                                                                 |
| UL 506           | Specialty Transformers                                                                                                                     |
| NEMA/ANSI ST20   | Dry type transformers for General Applications                                                                                             |
| IEEE             | Institute of Electrical and Electronic Engineers                                                                                           |

|                |                                                                       |
|----------------|-----------------------------------------------------------------------|
| NEMA TR1       | Transformers, Regulators and Reactors                                 |
| NEMA TP-1 2002 | Guide for Determining Energy Efficiency for Distribution Transformers |

## 2.00 PRODUCTS

### 2.01 MANUFACTURERS

#### A. Approved Manufacturers:

1. ABB by GE.
2. Eaton.
3. Siemens.
4. Square D.
5. No approved equal.

#### B. Source Limitations: Obtain each type of transformer from single source from single manufacturer.

### 2.02 DRY TYPE DISTRIBUTION TRANSFORMERS

#### A. Comply with NFPA 70, and list and label as complying with UL 1561.

#### B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume must allow efficient transformer operation at 10 percent above nominal tap voltage.
3. Grounded to enclosure.

#### C. Coils: Continuous windings without splices except for taps.

1. Coil Material: Copper.
2. Internal Coil Connections: Brazed type.
3. Terminal Connections: Welded.

#### D. Encapsulation: Transformers smaller than 30 kVA must have core and coils completely resin encapsulated.

#### E. Enclosure: Totally enclosed, nonventilated.

1. Core and coil must be encapsulated within resin compound using vacuum-pressure impregnation process to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Environmental Protection:
  - a. Outdoor: UL 50E, Type 4X.



- F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with maximum of 150 deg C rise above 40 deg C ambient temperature.
- J. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.
- K. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible copper grounding conductor sized in accordance with applicable NEMA, IEEE, or ANSI standards.
- L. Electrostatic Shielding: Windings must have independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
  - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
  - 2. Include special terminal for grounding shield.
- M. The average audible sound level shall not exceed 50 DB for transformers rated at 75 KVA and below, nor 60 DB for transformers rated above 75 KVA, when measured in accordance with IEEE C57.12.91.

### **3.00 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place. Maximum ground resistance must be 5  $\Omega$  at location of transformer.
- E. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. Locations:
  - 1. Electrical Contractor to verify proper location for the unit.

2. The transformer shall be installed in a location where the sides with ventilated openings are a minimum distance of 6 inches from noncombustible structures or equipment to ensure adequate air circulation.
- B. Install transformers level and plumb on concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.
- E. Remove shipping bolts, blocking, and wedges.

### 3.03 CONNECTIONS

- A. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

### 3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Tests and Inspections:
  1. Small (Up to 167 kVA Single-Phase or 500 kVA Three-Phase) Dry-Type Transformer Field Tests:
    - a. Visual and Mechanical Inspection.
      - 1). Inspect physical and mechanical condition.
      - 2). Inspect anchorage, alignment, and grounding.
      - 3). Verify that resilient mounts are free and that shipping brackets have been removed.
      - 4). Verify that unit is clean.
      - 5). Perform specific inspections and mechanical tests recommended by manufacturer.
      - 6). Verify that as-left tap connections are as specified.
      - 7). Verify presence of surge arresters and that their ratings are as specified.

b. Electrical Tests:

- 1). Measure resistance at windings, taps, and bolted connections.
- 2). Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: value of index may not be less than 1.0.
- 3). Perform turns-ratio tests at tap positions. Test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
- 4). Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

E. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested components.

F. Nonconforming Work:

1. Transformer will be considered defective if it does not pass tests and inspections.
2. Remove and replace units that do not pass tests or inspections and retest as specified above.

G. Assemble and submit test and inspection reports.

### 3.05 ADJUSTING

A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare written report recording output voltages and tap settings.

### 3.06 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

B. Repaint scratched or marred exterior surfaces to match original finish.

### 3.07 MAINTENANCE

A. Infrared Scanning: Two months after Substantial Completion, perform infrared scan of transformer connections.

1. Use infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform two follow-up infrared scans of transformers, one at 4 months and another at 11 months after Substantial Completion.

3. Prepare certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

**END OF SECTION**

## **26 24 16 PANELBOARDS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.02 SUMMARY**

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Load centers.

#### **1.03 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.
- B. GFEP: Ground-fault equipment protection.
- C. HID: High-intensity discharge.
- D. MCCB: Molded-case circuit breaker.
- E. SPD: Surge protective device.
- F. VPR: Voltage protection rating.

#### **1.04 ACTION SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Product Data: For each type of panelboard and shall include:
    - a. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
    - b. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
  - 2. Shop Drawings: For each panelboard and related equipment.
    - a. Include dimensioned plans, elevations, sections, weight and details.
    - b. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
    - c. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks and NEMA rating.
    - d. Detail bus configuration, current, and voltage ratings.

- e. Short-circuit current rating of panelboards and overcurrent protective devices.
- f. Include evidence of Nationally Recognized Testing Laboratories (NRTL) listing for series rating of installed devices.
- g. Include evidence of NRTL listing for SPD as installed in panelboard.
- h. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- i. Include wiring diagrams for power, signal, and control wiring.
- j. Key interlock scheme drawing and sequence of operations.
- k. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 33 04 "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Use panelboards manufactured and tested in accordance with NEMA PB 1.
- E. Provide circuit breakers that are manufactured and tested in accordance with NEMA AB 1 and Federal Specification FS-W-C-375.
- F. Comply with NFPA 70.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 watts per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

## 1.08 FIELD CONDITIONS

### A. Environmental Limitations:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - a. Ambient Temperature: Not exceeding -22 deg. F to +104 deg. F.
  - b. Altitude: Not exceeding 6600 feet.

### B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

## 1.09 WARRANTY

### A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

### B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

1. SPD Warranty Period: 5 years from the date of Substantial Completion.

## 2.00 PRODUCTS

### 2.01 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

#### A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

#### B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### C. Comply with NEMA PB 1.

#### D. Comply with NFPA 70.

#### E. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.
  - a. Outdoor Locations: NEMA 250, Type 4X, 304 stainless steel.
2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
4. Finishes:
  - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

- b. Back Boxes: Same finish as panels and trim.
- F. Incoming Mains:
  - 1. Location: Bottom.
- G. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on the Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on the Drawings. Do not mount neutral bus in gutter.
  - 5. Split Bus: Vertical buses divided into individual vertical sections.
- H. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- I. Panelboard Short-Circuit Current Rating: Fully rated system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
  - 1. Panelboards rated 240 volts or less shall have short-circuit ratings as shown on the Drawings, but not less than 10,000 amps RMS symmetrical.
  - 2. Panelboards rated above 240 volts and less than 600 volts shall have short-circuit ratings as shown on the Drawings, but not less than 14,000 amps RMS symmetrical.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
  - 1. Panelboards and overcurrent protective devices rated 240 volts or less shall have short-circuit ratings as shown on the Drawings, but not less than 10,000 amps RMS symmetrical.
  - 2. Panelboards and overcurrent protective devices rated above 240 volts and less than 600 volts shall have short-circuit ratings as shown on the Drawings, but not less than 14,000 amps RMS symmetrical.



## 2.02 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

## 2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. General Electric Company; GE Energy Management - Electrical Distribution.
  - 3. Siemens Energy.
  - 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: As indicated on panel schedule.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Column-Type Panelboards:
  - 1. Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.
  - 2. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.
- G. SPD:
  - 1. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
  - 2. Protection modes and UL 1449 3rd edition VPR for grounded wye circuits with 480Y/277V, 208Y/120V, three-phase, four-wire circuits shall be as follows:
    - a. Line to Neutral, Line to Ground, Neutral to Ground: 1200 V for 480Y/277V and 800 V for 208Y/120V.
    - b. Line to Line: 2000 V for 480Y/277V and 1200 V for 208Y/120V.
  - 3. SCCR: Equal to the SCCR of the panelboard in which installed.
  - 4. Nominal Rating: 22 kA.

## 2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. General Electric Company; GE Energy Management - Electrical Distribution.

3. Siemens Energy.
  4. Square D; by Schneider Electric.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 amps and larger.
  2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  4. Subfeed Circuit Breakers: Vertically mounted.
  5. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

## 2.05 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door, complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems".
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory:
  1. Create a computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover, to indicate installed circuit loads after balancing panelboard loads; incorporate the Owner's final room designations. Obtain approval before installing. Hand written directories are not acceptable.
  2. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## 2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

### **3.00 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
  - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-In-Place Concrete."
  - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.
- I. Mount surface-mounted panelboards to steel slotted supports 1-1/4 inches in depth. Orient steel slotted supports vertically.
- J. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

- K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- L. Install filler plates in unused spaces.
- M. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

### 3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

### 3.04 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Perform optional tests. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

- 1). Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Engineer of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Engineer. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

### 3.06 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

## END OF SECTION

## **26 27 26      WIRING DEVICES**

### **1.00      GENERAL**

#### **1.01      WORK INCLUDED**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.02      SUMMARY**

- A. Section Includes:
  - 1. Straight-blade convenience, hospital-grade, receptacles.
  - 2. GFCI receptacles.
  - 3. Toggle switches.
  - 4. Wall plates.

#### **1.03      DEFINITIONS**

- A. Abbreviations of Manufacturers' Names:
  - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
  - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
  - 3. Leviton: Leviton Mfg. Company, Inc.
  - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. SPD: Surge protective device.

#### **1.04      SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Product Data: For each type of product.
  - 2. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
  - 3. Field quality-control reports.
  - 4. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

### **2.00      PRODUCTS**

## 2.01 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.

## 2.02 STRAIGHT-BLADE RECEPTACLES

- A. Duplex Convenience Receptacles:
  - 1. 125 volts, 20 amps; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
- B. Hospital-Grade, Duplex Convenience Receptacles:
  - 1. 125 volts, 20 amps; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement SD, and FS W-C-596.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  - 3. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
- C. Isolated-Ground, Duplex Convenience Receptacles:
  - 1. 125 volts, 20 amps; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.

- d. Pass & Seymour/Legrand (Pass & Seymour).
- 3. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Tamper-Resistant Convenience Receptacles:
  - 1. 125 volts, 20 amps; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  - 3. Description: Labeled and complying with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

## 2.03 GFCI RECEPTACLES

- A. General Description:
  - 1. 125 volts, 20 amps, straight blade, feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
- C. Hospital-Grade, Duplex GFCI Convenience Receptacles: Comply with UL 498 Supplement SD.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.



d. Pass & Seymour/Legrand (Pass & Seymour).

## 2.04 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 Volts, 20 Amps:

1. Weatherproof Switches: Fitted with single switch as specified, and weather proof cover with spring door cover; grey in color for all areas. Switch ratings shall be as identified below for the number of poles required.
2. Motor Rated Switches: HP rated switches approved for motor control or disconnect service when controlling or disconnecting motor loads in excess of 1/4 HP; 20-amp switches for loads exceeding 10 amps.
3. Single-Pole:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1). Eaton (Arrow Hart).
    - 2). Hubbell Incorporated; Wiring Device-Kellems.
    - 3). Leviton Manufacturing Co., Inc.
    - 4). Pass & Seymour/Legrand (Pass & Seymour).
4. Two-Pole:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1). Eaton (Arrow Hart).
    - 2). Hubbell Incorporated; Wiring Device-Kellems.
    - 3). Leviton Manufacturing Co., Inc.
    - 4). Pass & Seymour/Legrand (Pass & Seymour).
5. Three-Way:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1). Eaton (Arrow Hart).
    - 2). Hubbell Incorporated; Wiring Device-Kellems.
    - 3). Leviton Manufacturing Co., Inc.
    - 4). Pass & Seymour/Legrand (Pass & Seymour).
6. Four-Way:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1). Eaton (Arrow Hart).

- 2). Hubbell Incorporated; Wiring Device-Kellems.
- 3). Leviton Manufacturing Co., Inc.
- 4). Pass & Seymour/Legrand (Pass & Seymour).

C. Pilot-Light Switches:

1. 120/277 volts, 20 amps.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. Eaton (Arrow Hart).
  - b. Hubbell Incorporated; Wiring Device-Kellems.
  - c. Leviton Manufacturing Co., Inc.
  - d. Pass & Seymour/Legrand (Pass & Seymour).
3. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

2.05 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
  1. Plate-Securing Screws: Metal with head color to match plate finish.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

**3.00 EXECUTION**

3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-amp circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right. Note to Specifier: Recommendation in subparagraph below is made in IEEE 602.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

### 3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.03 IDENTIFICATION

- A. Comply with Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.04 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 volts.
  - 2. Percent Voltage Drop Under 15-Amp Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 ounces.
- E. Wiring device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

### END OF SECTION

## **26 28 16      ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

### **1.00      GENERAL**

#### **1.01      WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install disconnects. Electrical Work shall be in accordance with Division 26 Specifications.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### **1.02      SUMMARY**

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Shunt trip switches.
  - 4. Molded-case circuit breakers (MCCBs).
  - 5. Molded-case switches.
  - 6. Enclosures.
- B. Related Requirements:
  - 1. Section 01 33 04 "Operation and Maintenance Data."

#### **1.03      DEFINITIONS**

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### **1.04      SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250 Type 4X 304 stainless steel.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other Work.

2. Include wiring diagrams for power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 01 33 04 "Operation and Maintenance Data," include the following:
    - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
- F. Spares: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  2. Fuse Pullers: Two for each size and type.

#### 1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
  1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

#### 1.06 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 130 deg F.
  2. Altitude: Not exceeding 6600 feet.

#### 1.07 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: One year(s) from date of Substantial Completion.

### 2.00 PRODUCTS

#### 2.01 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

## 2.02 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. GE/ABB Inc.
  - 2. Eaton.
  - 3. SIEMENS Industry, Inc.; Energy Management Division.
  - 4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty:
  - 1. Single throw.
  - 2. Three pole.
  - 3. 600 VAC.
  - 4. 1200 amps and smaller.
  - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
  - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
  - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
  - 7. Service-Rated Switches: Labeled for use as service equipment.

## 2.03 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. GE/ABB Inc.

3. SIEMENS Industry, Inc.; Energy Management Division.
  4. Square D; by Schneider Electric.
- B. Type HD, Heavy-Duty, Three-Pole, Single-Throw, 600-VAC, 1200 Amps and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
  4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  5. Hookstick Handle: Allows use of a hookstick to operate the handle.
  6. Lugs: Mechanical type, suitable for number, size, and conductor material.
  7. Service-Rated Switches: Labeled for use as service equipment.

#### 2.04 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
  2. GE/ABB Inc.
  3. SIEMENS Industry, Inc.; Energy Management Division.
  4. Square D; by Schneider Electric.
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.
- E. MCCBs shall be equipped with a device for locking in the isolated position.



- F. Lugs shall be suitable for 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.
- G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 amps and larger.
- I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and I-squared t response.
- K. Current-Limiting Circuit Breakers: Frame sizes 400 amps and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- O. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 5. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  - 6. Auxiliary Contacts: One SPDT switch with “a” and “b” contacts; “a” contacts mimic circuit-breaker contacts, “b” contacts operate in reverse of circuit-breaker contacts.
  - 7. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.

## 2.05 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton.
  2. GE/ABB Inc.
  3. SIEMENS Industry, Inc.; Energy Management Division.
  4. Square D; by Schneider Electric.
- B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- D. Features and Accessories:
  1. Standard frame sizes and number of poles.
  2. Lugs:
    - a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
    - b. Lugs shall be suitable for 194 deg F rated wire, sized according to the 167 deg F temperature rating in NFPA 70.
  3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  5. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
  7. Alarm Switch: One NO contact that operates only when switch has tripped.
  8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
  9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
  10. Electrical Operator: Provide remote control for on, off, and reset operations.

## 2.06 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location
- B. Enclosure Finish: The enclosure shall be NEMA 250 Type 4X stainless steel.
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

## 3.00 EXECUTION

### 3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of Work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### 3.02 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 4X, 304 stainless steel.
  - 3. Other Wet or Damp, Indoor: NEMA 250, Type 4X, 304 stainless steel.

### 3.03 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

### 3.04 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections for Switches:
  - 1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1). Use a low-resistance ohmmeter.
        - a). Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      - 2). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - a). Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
    - i. Verify correct phase barrier installation.
    - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- c. Perform insulation-resistance tests for 1 minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
- b. Inspect physical and mechanical condition.
- c. Inspect anchorage, alignment, grounding, and clearances.
- d. Verify that the unit is clean.
- e. Operate the circuit breaker to ensure smooth operation.
- f. Inspect bolted electrical connections for high resistance using one of the two following methods:
  - 1). Use a low-resistance ohmmeter.
    - a). Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  - 2). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
    - a). Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- g. Inspect operating mechanism, contacts, and chutes in unsealed units.

- h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
  - b. Perform insulation-resistance tests for 1 minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
  - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
  - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500 VDC for 300-volt rated cable and 1000 VDC for 600-volt rated cable. Test duration shall be 1 minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than 2 megohms.
  - e. Determine the following by primary current injection:
    - 1). Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 2). Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 3). Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 4). Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
  - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
  - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
  - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and

trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.

- i. Verify operation of charging mechanism. Investigate units that do not function as designed.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Perform the following infrared scan tests and inspections and prepare reports:
  - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
  - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
  - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
  1. Test procedures used.
  2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  3. List deficiencies detected, remedial action taken, and observations after remedial action.

### 3.06 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

## END OF SECTION

## **26 29 13.13 ACROSS-THE-LINE MOTOR CONTROLLERS**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals to install combination motor starters. Electrical work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical."

#### **1.02 QUALITY ASSURANCE**

- A. Acceptable Manufacturers:
  - 1. ABB (Electrification Products Division).
  - 2. Eaton Cutler Hammer.
  - 3. Rockwell Automation, Inc.
  - 4. Schneider Electric USA (Square D).
  - 5. Siemens Industry, Inc., Energy Management Division.

#### **1.03 STANDARDS**

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
  - 1. National Electric Manufacturers Association (NEMA).
  - 2. National Electric Code (NEC).
  - 3. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.
  - 4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

#### **1.04 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Furnish complete Bill of Materials indicating manufacturer's name and part numbers.
  - 2. Drawings shall show:
    - a. Equipment outline drawings showing elevation and dimensions, internal and external layout views, entrances and anchor bolt patterns. Provide a drawing of the front view elevation with designation of equipment and devices on doors.
    - b. Stub-up locations and conduit entry and exit details.
      - 1). Show vertical clearance/distance between lugs/terminating pads and bottom/top of equipment on elevation drawings.
    - c. Shipping splits.



- d. Shipping weights.
- e. Ventilation details.
- f. Cable terminal sizes.
- g. Nameplate schedule.
- h. Provide control systems engineering to produce project specific unit elementary drawings with internal wiring and interlocking between components and to remotely mounted devices. Include and identify all connecting equipment and remote devices on the schematics. The notation "Remote Device" will not be acceptable. Show wire and terminal numbers. Indicate special identifications for electrical devices per the Drawings.
- i. Indicate all options, special features, ratings and deviations.
- j. Project specific control schematic and wiring diagrams, including manufacturer's selections of component ratings and CT and PT ratios.
  - 1). Labels on the control schematic for control relays, level switches, indication lights, etc. shall correspond to equipment tags/labels indicated on the Control Schematics included in the plans. Include a label above each timing relays indicating the range and set point for that timing relay.
  - 2). The control schematic shall clearly indicate next to the corresponding device symbol the following: the circuit breaker size, number of cables that can be terminated on the incoming and outgoing, fuse sizes, size of CPT, CTs, etc.
  - 3). The control schematic shall include the motor nameplate information (HP, FLA, RPM).
- k. Provide a drawing showing the terminal strip layout showing customer field connections. The terminal strip layout shall also include a label next to each connection indicating signal description. Handwritten terminal numbers are not acceptable.
- 3. Furnish complete Bill of Materials indicating manufacturer's name and part numbers.
- 4. Catalog cuts of major components clearly identifying make and model number of devices being provided.
  - a. Product data sheets and catalog numbers for overcurrent protective devices, motor starters, control relays, control stations, meters, pilot lights, etc. The manufacturer's name shall be clearly visible on the each cut sheet submitted. List all options, trip adjustments and accessories furnished specifically for this Project. Clearly mark each sheet to indicate which items apply and/or those items that do not apply.
  - b. Manufacturer's cut sheets for every component used in the panel assembly adequately marked to show the items being included. The manufacturer's name shall be clearly visible on the each cut sheet submitted.

**B. Factory Tests:**

- 1. Submittals shall be made for factory tests specified herein.

2. Field Test Reports. Submittals shall be made for field tests specified herein.

C. Operation and Maintenance Manuals:

1. Operation and maintenance manuals shall include the following information:
  - a. Manufacturer's contact address and telephone number for parts and service.
  - b. Instruction and replacement parts books.
  - c. Recommended renewal parts list
  - d. Record Documents for the information required by the Submittals paragraph above.
  - e. As-built final drawings.
2. Include the final certified Shop Drawings, submittals, schematics, and maintenance procedures and field test data. O&M manuals to include all field changes made during startup and testing.

1.05 JOB CONDITIONS

- A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than 23 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 1000 feet for electromagnetic and manual devices.
  3. The effect of solar radiation is not significant.

1.06 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective
1. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  2. Indicating Lights: One of each type and color installed.
  3. Each control relay and timing relay shall be equipped with a minimum of two normally open contacts and two normally closed contacts.

**2.00 PRODUCTS**

2.01 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

- A. Description: Across-the-line start, electrically held, for nominal system voltage of 600 VAC and less.
- B. Standard: Comply with NEMA ICS 2, general purpose, Class A.
- C. Configuration: Nonreversing.
- D. The magnetic starter contactor shall have a maximum pick up voltage requirement of 78 percent of nominal coil voltage and a maximum drop out voltage of 54 percent of nominal coil voltage for starter sizes 1, 2, 3 and 4, and 64 percent of nominal coil voltage for starter size 5.

- E. Contactor Coils: Pressure-encapsulated type with coil transient suppressors when indicated.
1. Operating Voltage: 120 VAC, unless indicated.

F. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
2. Control Power:
  - a. Control power shall be 120 VAC from a control transformer located in each starter enclosed motor starter enclosure or combination starter. Extra control transformer VA capacity shall be furnished for powering the motor space heater in the motor which the combination starter serves. This extra VA capacity shall be in addition to the VA required for the other control components powered by the control transformer. The following is the amount of extra VA capacity which shall be furnished:

| <b>Combination<br/>NEMA Size</b> | <b>Control Transformer<br/>Extra VA Capacity</b> |
|----------------------------------|--------------------------------------------------|
| Size 1                           | 100                                              |
| Size 2                           | 200                                              |
| Size 3                           | 300                                              |
| Size 4                           | 500                                              |
| Size 5                           | 750                                              |
| Size 6                           | 1000                                             |

- b. This extra VA capacity shall be furnished in each combination starter regardless of where the motor space heater received its power and regardless of whether the motor has a space heater or not.

G. Overload Relays:

1. Thermal Overload Relays:
  - a. Inverse-time-current characteristic.
  - b. Class 20 tripping characteristic.
  - c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
  - d. Ambient compensated.
  - e. Automatic resetting.
2. Solid-State Overload Relay:
  - a. Switch or dial selectable for motor-running overload protection.
  - b. Sensors in each phase.

- c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
  - d. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.
- H. Digital communication module, using RS-485 Modbus, RTU protocol, 2-wire connection to host devices with a compatible port to transmit the following to the LAN:
- 1. Instantaneous rms current each phase, and 3-phase average.
  - 2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
  - 3. Active Energy (kWh): 3-phase total.
  - 4. Power Factor: Each phase and 3-phase total.

## 2.02 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

- A. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.
- B. Standard: Comply with NEMA ICS 2, general purpose, Class A.
- C. Configuration: Nonreversing.
- D. Contactor Coils: Pressure-encapsulated type with coil transient suppressors when indicated.
  - 1. Operating Voltage: Manufacturer's standard, unless indicated.
- E. Control Power:
  - 1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
- F. Overload Relays:
  - 1. Thermal Overload Relays:
    - a. Inverse-time-current characteristic.
    - b. Class 20 tripping characteristic.
    - c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
    - d. Ambient compensated.
    - e. Automatic resetting.

2. Solid-State Overload Relay:
  - a. Switch or dial selectable for motor-running overload protection.
  - b. Sensors in each phase.
  - c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
- G. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.
- H. Digital communication module, using RS-485 Modbus, RTU protocol, 2-wire connection to host devices with a compatible port to transmit the following to the LAN:
  1. Instantaneous rms current each phase, and 3-phase average.
  2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
  3. Active Energy (kWh): 3-phase total.
  4. Power Factor: Each phase and 3-phase total.
- I. Fusible Disconnecting Means:
  1. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
  2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- J. Nonfusible Disconnecting Means:
  1. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
  2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- K. MCP Disconnecting Means:
  1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
  2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- L. MCCB Disconnecting Means:
  1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse-time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
  2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

## 2.03 ENCLOSURES

- A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location. Where not indicated the following guidance shall be followed:
  - 1. Outdoors: Water, WasteWater, Pump Station, Lift Station, Elevated Storage Tank, Meter Vaults, Valve Vaults, and Ground Storage Tanks shall utilized NEMA 4X 304 stainless steel
- B. The construction of the enclosures shall comply with NEMA ICS 6.
- C. Controllers in hazardous (classified) locations shall comply with UL 1203.

## 2.04 ACCESSORIES

- A. Terminal strip metallic materials shall be stainless steel and/or tinned copper. Power distribution blocks shall be tinned copper or tinned aluminum which is rated for termination of copper conductors. Terminal Blocks to be NEMA type, rated 600 volts.
- B. Combination starter control wiring shall be 14AWG. Power wiring shall have black insulation and control wiring shall have red insulation for ungrounded conductors and white insulation for grounded conductors. Low voltage wiring to be 600-volt rated.
- C. Combination starter wiring shall have tinned copper conductors with MTW insulation only.
- D. Lightning Arrestor: Three-phase; rated 650 volts maximum line-to-ground or phase-to-phase voltage; Delta Pt. No. LA603, or approved equal.
- E. Surge Capacitor: Three-phase suitable for use on three-phase grounded or ungrounded system; rated 0 to 650 volts RMS, phase-to-phase.
- F. Control Relays:
  - 1. NEMA Control Relay: Industrial type; contacts rated for 10 amps at 600 VAC; Square D Class 8501 Type X, Allen-Bradley Bulletin 700 type P, or approved equal. Relays shall have the capability of having contact decks added in the field. Contacts shall be field convertible to normally open or normally closed. Coils and contacts shall each be replaceable without replacing any other part of the relay. Where control relays are indicated on the Plans, industrial control relays shall be furnished whether the relay coil is operated with 120 VAC or 24 VDC.
- G. Timing Relays:
  - 1. NEMA Relay:
    - a. Industrial type; contacts rated 10 amps at 600 VAC; Square D, Class 9050 Type JCK60, time delay relay, Allen-Bradley 700-FS, or approved equal.
      - 1). Timing relays to be provided with restraining strap. Timing relays to be front-mounted and readily accessible.
      - 2). Having the capability to be hand set by an external dial/setting knob with dial or using push-button thumbwheel.

- 3). Ranges shall be as shown on the Plans. The timing relays shall have both normally open and normally closed contacts by having two sets of form C contacts.
- 4). Voltage rating based on the voltages identified on the control schematics.
- H. Phase Failure, Phase Reversal Relay: 460-600 volts, three-phase, phase unbalance, phase reversal, phase failure and high-low voltage relay PFR furnished and installed on the line side of the motor starter as shown on the plans. The relay shall be factory wired to the necessary auxiliary relays PFT with contacts which open in the event of high voltage-low voltage phase failure, phase reversal or phase unbalance. Auxiliary contacts shall be connected to control circuits. Relay shall have on and off delays with automatic reset upon return to normal operating conditions. The relay shall be GE D65VM Series, or equal.
- I. Elapsed Time Meter: Eaton Cat# 6-T-3H-508RPM-406 or approved equal; a non-reset type six-digit counter for totalizing of hours and operating on 120 VAC, 60 Hertz. Digital time meters are not acceptable.
- J. Indicating Lights, Switches, Pushbuttons: Heavy duty and oil tight; Square D Class 9001 (30.5mm) or approved equal. Pilot lights shall consist of a cluster of light emitting diodes (LEDs), push to test and Square D SKT or approved equal.
- K. Control Transformer: Included in combination starter units with sufficient VA capacity for powering the devices shown in the control schematic; 480- to 120-volt transformer with a fuse in each primary leg and one fuse in the secondary leg. The unfused secondary leg shall be grounded.
- L. Space heaters, with N.C. auxiliary contacts, to mitigate condensation enclosures installed in unconditioned interior spaces subject to humidity and temperature swings. Space heaters shall be thermostatically controlled and be power from internal power inside the enclosure.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Make electrical connections to equipment specified. Install equipment in accordance with the manufacturer's recommendations and the Drawings. If neither is available, then install the equipment using the best practices of the electrical industry and trade.
- B. Where control transformers are indicated and unless shown otherwise, each starter shall contain a 480- to 120-volt fused control transformer with sufficient capacity for all the devices shown in the schematic. The control transformer shall have two primary fuses, one in each primary lead and one secondary fuse in one of the secondary leads. The unfused secondary lead shall be grounded.
- C. Each combination starter shall have an engraved plastic nameplate fastened to the outside of the unit door. Engraved plastic nameplates shall have 0.33-inch high black letters on a white background. Wiring diagrams shall be provided on the inside of each compartment door and shall be protected so that they remain attached and legible for the service life of the equipment.
- D. If any circuit breaker operating handle is more than 6 feet-6 inches above the floor surface immediately in front of the combination starter, a supplementary operating device shall be

attached to the operating handle. This supplementary device shall require a person to reach no more than 6 feet-6 inches above the floor surface at any point of opening or closing the circuit breaker.

- E. Control relays, timing relays, control transformers, control circuit fuse blocks, etc., shall be grouped in the corresponding combination starter with control wiring kept as short as possible. Ample space shall be allowed between devices so that each component is completely accessible without removing any other device.
- F. Overload relays shall be reset from outside the enclosure with an insulated bar or button. Auxiliary contacts shall be furnished on the circuit breaker operating mechanism, the starter contactor and on the overload sensing unit as shown on the plans.
- G. Wiring in the combination starter shall terminate on numbered terminal strips or power distribution blocks. No other wire connecting devices, including but not limited to wire nuts and split bolts, shall be allowed in the combination starter. Each combination starter shall be provided with an individual terminal strip for control wiring.
- H. Devices installed in the combination starter or on the door of the combination starter shall be completely factory wired with connections to external devices brought to a terminal strip installed in the starter. No field wiring shall be permitted except for connections to remote devices from the terminal strip. A physical wiring diagram shall be provided on each enclosure door and shall be protected to remain intact and legible for the service life of the equipment. Control devices shall be identified as to type and manufacturer.
- I. The combination starter shall have a magnetic starter contactor. The magnetic starter contactor shall be NEMA rated and NEMA 1 magnetic starter contactors shall be the minimum size allowed. Magnetic starter contactors shall have renewable contacts and a renewable coil which shall allow each to be replaced without replacing other parts of the magnetic starter contactor. Magnetic starter contactors shall have a maximum pick up voltage of 71 percent of nominal coil voltage and a maximum drop out voltage of 59 percent of nominal coil voltage.
- J. The combination starter shall include a motor circuit protector (MCP) type circuit breaker or a thermal magnetic type circuit breaker as indicated on the Drawings. MCPs shall be magnetic trip only with adjustable magnetic trip limited to 1300 percent of motor nameplate full load current to comply with NEC requirements. Devices shown on the schematic and not specifically designated as being elsewhere shall be installed inside the combination starter.
- K. Combination starter doors shall be interlocked mechanically with the circuit breaker operator mechanism to prevent unintentional opening of the door while the circuit breaker is in the closed position. The circuit breaker operator mechanism shall be mounted on the stationary part of the enclosure and not on the door of the enclosure. The circuit breaker operator mechanism shall indicate "On" and "Off" with the door open or closed. The circuit breaker shall be manually operated, resettable after trip from the operator mechanism handle. The operating handle shall clearly indicate whether the circuit breaker is "On" or "Off", or "Tripped." Means shall be provided to lock each operator mechanism handle in the "Off" position and to close the door. Means shall be provided for releasing the interlock for intentional access to the interior at any time and intentional application of power, if desired, while door is open. Padlocking arrangements shall permit locking the disconnect device "Off" with at least three padlocks with door closed or open. Manufacturer shall



provide space in wire-ways/wire-ducts for control cables routed to field devices and equipment. Manufacturer shall accommodate all conductors for controls without exceeding the bending radius of the wire.

### 3.02 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved nameplate.
  - 3. Label each enclosure-mounted control and pilot device.

### 3.03 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
  - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
  - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### 3.04 FIELD QUALITY CONTROL

- A. Upon completion of the installation, perform continuity tests and functional checkout to assure the proper operation of all equipment.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
  - 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
  - 3. Test continuity of each circuit.
  - 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Contractor/Owner before starting the motor(s).
  - 5. Test each motor for proper phase rotation.

6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.05 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner/Contractor before increasing settings.
- D. Set field-adjustable circuit-breaker trip ranges.

### 3.06 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

## END OF SECTION

**26 41 13      LIGHTNING PROTECTION FOR STRUCTURES**

**1.00      GENERAL**

**1.01      WORK INCLUDED**

- A. Furnish labor, design, materials, equipment and incidentals necessary to install a complete lightning protection system in accordance with UL 96A, NFPA 780 for the Summerfield Elevated Storage Tank. Lightning protection system shall be tied to each structures grounding system.

**1.02      QUALITY ASSURANCE**

- A. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer’s latest approved design. Listing of the manufacturer in the lightning protection section of the current edition of Underwriters’ Laboratories, Inc., Electrical Construction Materials List will be accepted as compliance with this requirement.
- B. All materials shall be copper and bronze and of the size, weight and construction to suit the application where used in accordance with UL, NFPA, NEC code requirements for this type structure and as per manufacturer’s recommendations. Class I sized components may be utilized on roof levels 75 feet and below in height. Class II sized components are required for roof levels over 75 feet in height.

**1.03      SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:
  - 1. Specifications.
  - 2. Catalog Sheets for All Products Provided.
  - 3. Shop drawings showing type, size and location of all equipment, grounds, cable routings, etc.
  - 4. Continuity Test Report.
  - 5. Copy of U.L. Master Label for the Facility.

**1.04      STANDARDS AND REFERENCES**

- A. Refer to Section 26 05 00 “Common Work Results for Electrical” for all standards which apply to this Section.
  - 1. National Electrical Manufacturer Association (NEMA) Standards:

|          |                                                               |
|----------|---------------------------------------------------------------|
| NFPA 780 | Standard for the Installation of Lightning Protection Systems |
|----------|---------------------------------------------------------------|

## 2. Underwriters Laboratories (UL) Standards:

|        |                                                                         |
|--------|-------------------------------------------------------------------------|
| UL 96A | Standard for Installation Requirements for Lightning Protection Systems |
|--------|-------------------------------------------------------------------------|

### 2.00 PRODUCTS

#### 2.01 MATERIALS

- A. Materials used in connection with the installation of the lightning protection systems shall be approved for lightning protection systems by the Underwriters' Laboratories, Inc. No combination of materials shall be used that form an electrolytic couple of such a nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. When unusual conditions exist which would cause deterioration or corrosion of conductors, conductors with suitable protective coatings or oversize conductors shall be used. If a mechanical hazard is involved, the conductor size shall be increased to compensate therefore, or suitable protection shall be provided. The conductors may be protected by covering them with molding or tubing preferably made of wood or nonmagnetic material. If metal tubing is used, the conductor shall be electrically connected to it at its upper and lower ends.
- B. All equipment used shall be new and of a design and construction to suit the application in accordance with UL 96A requirements and shall be so marked.

#### 2.02 MANUFACTURED PRODUCTS

- A. Conductors: Copper conductors manufactured of copper grade ordinarily required for commercial electrical work generally designated as being 98 percent conductive when annealed. Down conductors of copper cable for installations other than towers shall weigh not less than 187.5 pounds per thousand feet and the size of any wire of this cable shall not be less than No. 17 AWG (0.045 inch). Down conductors shall be tinned. The thickness of any copper ribbon or strip shall be not less than No. 16 AWG (0.051 inch).
- B. Air Terminals: Air terminals shall be tapered to a blunt point. The rod shall be of solid copper, 1/2 inch in diameter. Air terminals and support shall be designed over 24 inches to handle a 75-pound per square foot wind load. All air terminals shall be supported by a suitable brace, with guide(s) not less than one-half the height of the air terminal. Air terminals shall be located in accordance with the requirements of NFPA 780 and UL 96A. Air terminals shall extend at least 10 inches above the object or area they are intended to protect. Air terminals shall be placed around the perimeter of flat or gently sloping roofs at intervals not exceeding 20 feet.
- C. Fasteners: Fasteners shall be of the same material as the conductor base material or bracket being fastened, or other equally corrosion resistant material. Galvanized or plated materials shall not be used.
- D. Fittings: Fittings/bonding devices, cable splicers, and miscellaneous connectors shall be suitable for use with the installed conductor and shall be copper, bronze or aluminum with bolt pressure connections to the cable. Cast or stamped crimp type fittings shall not be used.

### 3.00 EXECUTION

### 3.01 INSTALLATION

- A. The Contract Drawings (shop drawings) shall indicate the extent and general arrangement of the lightning protection system. If any departures from the Contract Drawings (shop drawings) are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer. Lightning protection systems for all applications shall conform to National Fire Protection Association Code No. 780 and the NEC, whichever is more stringent.
- B. Installation shall be performed by a certified master installer. Installer shall provide an Underwriters' Laboratories Master Label for the facilities.
- C. Air terminals shall be provided on the highest projections and at intervals not exceeding 20 feet along the perimeter top surface. Air terminals shall extend at least 10 inches above the object or area that they are intended to protect. Air terminals shall be connected to the lightning protection system when specifically authorized by the Engineer.
- D. Roof and down conductors shall be stranded and shall meet the requirements given in NFPA 780. Roof and down conductors shall maintain a horizontal or downward course. No bend in a roof or down conductor shall form an included angle of less than 90 degrees, nor shall it have a bend radius of less than 8 inches. Conductors shall be routed external to buildings and 6 feet or more from power or signal conductors. Down conductors shall be routed outside of any structure and shall not penetrate or invade that structure. All down conductors except one may be provided with a screw type connector as described in UL 96 where lightning protection system testing may be required. Down connectors shall be supported from and secured to the building exterior using one-hole straps of copper or bronze at maximum intervals of 3 feet.
- E. Guards shall be provided for down conductors located in or next to driveways, walkways or other areas where they may be displaced or damaged. Guards shall extend at least 6 feet above and 1 foot below grade level. Guards shall be metal pipe. Metal guards shall be bonded to the down conductor at both ends. Bonding jumpers shall be of the same size as the down conductor. Crimp type fittings shall not be used.
- F. Metallic bodies, on or below roof level, that are subject to induced charges from lightning include exhaust fans, radio towers, HVAC units, ladders, railings, antennas, roof drains, plumbing, vents, metal coping, metal flashing, gutters, downspouts, small metal wall vents, door and window frames, metal balcony railings, and in general any isolated metallic body within 6 feet of an exposed lightning protection system element. When these metallic bodies have a metal thickness of 3/16 inch or greater, they shall be bonded to the nearest main lightning protection system conductor with UL approved fittings and conductors meeting the requirements of NFPA 780. These bonding fittings shall provide surfaces of not less than 3 square inches. Provisions shall be made to prevent corrosive effects introduced by galvanic action of dissimilar metals at bonding points. If the metal parts of these units are less than 3/16 inch thick, additional approved air terminals, conductors and fittings, providing a two-way path to ground from the air terminals shall be installed.
- G. If metallic, the mast of roof mounted antennas and obstruction lightning shall be bonded to the nearest roof or down conductor using UL approved fittings and conductors. The

bonding jumpers shall be of the same size and material as the roof or down conductor to which they are connected. Provide two paths for ground.

### 3.02 FIELD QUALITY CONTROL

- A. The lightning protection system will be inspected by the Engineer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Engineer.
- B. The Contractor shall establish and maintain quality control for the "Lightning Protection System" installation to assure compliance with contract requirements, and shall maintain records of his quality control for all construction operations. A copy of these records and Contractor tests, as well as records of corrective action taken, shall be furnished to Owner's Representative. Contractor shall obtain an Underwriters' Laboratories Master Label for the facility.
- C. Testing of Continuity of all Conductors: A copy of these records and tests, as well as the records of corrective action taken, will be furnished to the Owner's Representative.

**END OF SECTION**

## **26 50 00 LIGHTING**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install light fixtures, complete with lamps, ballasts and other incidentals. Electrical work shall be in accordance with Section 26 05 00 "Common Work Results for Electrical."

#### **1.02 QUALITY ASSURANCE**

- A. Acceptable Manufacturers: Lamps shall comply with the specifications and shall be by the following Manufacturers:
  - 1. Holophane.
  - 2. Sylvania.
  - 3. General Electric.
- B. Fixtures and Lamps shall be UL Listed.

#### **1.03 STANDARDS**

- A. The applicable provisions of the following standard shall apply as if written here in its entirety:
  - 1. NFPA 70.
  - 2. UL 1570.
  - 3. UL 844.
  - 4. UL 1029.
  - 5. ANSI C82.4.
  - 6. UL924.

#### **1.04 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Product data sheets: Product data sheets shall be marked for each fixture type, arranged in the order of the fixture designation. Product data shall describe fixtures, lamps, ballasts and emergency lighting units and shall include the following:
    - a. Outline drawings indicating dimensions and principal features of the fixture.
    - b. Electrical ratings and photometric data provided by certified laboratory tests for the fixture and lamps.
    - c. Battery and charger data for emergency lighting units.

#### **1.05 DELIVERY AND STORAGE**

- A. Ship light fixtures inside protective cartons and keep packaged until installed. Deliver lamps to the job site in the original packing cases and sleeves.

#### 1.06 JOB CONDITIONS

- A. Provide cold weather ballasts in fixtures which are subject to temperatures below 32 F.
- B. Provide special mounting, enclosures and fire-safing, as required by the authorities having jurisdiction so that the integrity of the U.L. listed ceiling assemblies is maintained.
- C. Provide U.L. labels where fixtures are subject to moisture. Provide DL or WI label on fixtures required for the location.

### 2.00 PRODUCTS

#### 2.01 MATERIALS

- A. Luminaire Requirements:
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
  - 3. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
  - 4. Recessed Fixtures: Comply with NEMA LE 4.
  - 5. Bulb shape complying with ANSI C79.1.
  - 6. Lamp base complying with ANSI C81.61 or IEC 60061-1.
  - 7. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- B. Poles and Support Components:
  - 1. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use 316 stainless-steel fasteners and mounting bolts, unless otherwise indicated.
  - 2. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  - 3. Materials: Shall not cause galvanic action at contact points.
  - 4. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: 316 stainless steel.
  - 5. Anchor-Bolt Template: 316 stainless steel.
- C. LED Drivers and Lamps:
  - 1. Drivers and LED lamps shall be integral to the fixture. The fixture shall be rated for operating temperatures of -40°C to +60°C, UL wet location rated with frosted acrylic lens. Fixture shall be rated for maintained 70% lumen output at 60,000 hours.
- D. Poles and Support Components:



1. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
  2. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
    - a. Materials: Shall not cause galvanic action at contact points.
    - b. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: 316 stainless steel.
    - c. Anchor-Bolt Template: Plywood or steel.
- E. Photocell:
1. Fully adjustable from 2- to 50-foot candles with SPST contacts; rated 1500 watts at 120 VAC. Cells shall have a built-in time delay of 5 seconds.
- F. Exit Lights:
1. Single or double face unit as required for each location, with arrows to clearly define the path of egress and which flash at a rate not exceeding 5 Hertz. Provide battery-powered exit lights if the exits lights are not served with an emergency power source. Minimum Height of Letters shall conform to local code. Lamps shall Light-emitting diodes (LED), 70,000 hours minimum rated life.
- G. Emergency Lighting Units:
1. Units shall include a battery and charger integral to the fixture. Relay shall automatically turn lamps on when supply voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Provide the lighting fixtures, as specified and scheduled on the plans. If a type designation is omitted, verify the fixture selection with the Engineer before installation.
- B. Check the architectural finishes and provide fixtures with proper trim, frames, support hangers and other hardware required to coordinate with the proper finishes, regardless of the specified or scheduled catalog number, prefixes and suffixes.
- C. Fixtures which are tandem-mounted and recessed in gypboard or plaster ceilings shall be yoke-mounted.
- D. Test and aim flood lights, when dark outside to provide a uniform and widespread, illuminated area. Direct units as indicated or instructed by the Engineer to prevent objectionable glare.
- E. Furnish and install photocells where indicated on the plans. Cells shall face a northerly direction.
- F. Furnish and install exit lights where scheduled and indicated on the plans. Locate fixtures on the ceiling or wall, as required by the Engineer.

- G. Furnish and install a complete exterior lighting control system, as indicated on the plans. Provide materials and equipment to properly interface timing devices and photocells with relays and contactors so that a complete and satisfactory operating system is rendered.
- H. Fixtures containing emergency ballast shall be wired such that a line voltage conductor shall keep the ballast energized at all times. If the fixture is also switched, the operation shall turn off the emergency ballast with the fixture as long as normal power is available. If normal power is lost, the emergency ballasts will operate the lamp.

### 3.02 CLEAN AND ADJUST

- A. Immediately before final inspection, clean all fixtures, inside and out, including plastics and glassware. Adjust all trim to properly fit adjacent surfaces, Replace broken or damaged parts. Lamp and test all fixtures for electrical, as well as, mechanical operation.

### 3.03 SPARE PARTS

- A. LED Driver: Furnish at least one of each type.
- B. Globes and Guards: Furnish at least one of each type.

### 3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

## END OF SECTION

**DIVISION 31**  
**EARTHWORK**

**31 05 13        SOILS FOR EARTHWORK****1.00    GENERAL****1.01    WORK INCLUDED**

- A. This Section of the specifications describes the various classes of Earth Fill. All of the classes of Earth Fill contained in this specification may not be used on this project. The classes of Earth Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include specifications for placement and compaction of Earth Fill. Specifications for placement and compaction of Earth Fill are included in other sections of the specifications and/or shown on the drawings.

**1.02    STANDARDS**

- A. Soil materials shall be classified into the appropriate class of Earth Fill shown below according to ASTM D2487 "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)" or other appropriate methods as designated by the Engineer.

**2.00    PRODUCTS****2.01    MATERIALS; CLASSIFICATIONS**

- A. Class 1 Earth Fill: Limited to clays and sandy clays classified as CH material with a liquid limit greater than or equal to 50, a plasticity index greater than or equal to 25, and a minimum of 60 percent passing the No. 200 sieve, which are free of organic materials.
- B. Class 2 Earth Fill: Limited to clays and sandy clays classified as CH and CL materials with a coefficient of permeability less than or equal to  $1.0 \times 10^{-7}$  cm/sec, a liquid limit greater than or equal to 30, a plasticity index greater than or equal to 15, and more than 50 percent passing the No. 200 sieve, which are free of organic materials.
- C. Class 3 Earth Fill: Consist of any materials classified as CH, CL, SM, SP, SP-SM, SC, and GC, which have a minimum plasticity index of 4, which are free of organic materials.
- D. Class 4 Earth Fill: Consist of materials which are classified as SP, SM, SC, CL, or dual classifications thereof, which have a liquid limit less than or equal to 35 and a plasticity index of a minimum of 4 and a maximum of 15, which are free of organic materials.
- E. Class 5 Earth Fill: Consist of materials classified as SP or SP-SM which have a plasticity index less than or equal to 4 and a maximum of 12 percent passing the No. 200 sieve, which are free of organic materials.
- F. Class 12 Earth Fill: Consist of soils suitable for topsoil which are relatively free of stones or other objectionable debris, which have sufficient humus content to readily support vegetative growth. The suitability of soils for topsoil shall be subject to the approval of the Engineer.

**3.00    EXECUTION (NOT APPLICABLE)**

**END OF SECTION**

## 31 05 16      **AGGREGATES FOR EARTHWORK**

### 1.00      **GENERAL**

#### 1.01      **WORK INCLUDED**

- A. This Section of the specifications describes the various classes of Aggregate Fill. All of the classes of Aggregate Fill contained in this specification may not be used on this project. The classes of Aggregate Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include installation. Installation of Aggregate Fill is included in other sections of the specifications and/or on the drawings.

#### 1.02      **QUALITY ASSURANCE**

A. Classification Testing:

1. Contractor Testing:

- a. Arrange and pay for the services of an independent testing laboratory to sample and test proposed Aggregate Fill materials.
- b. Submit the test results to the Engineer, and obtain approval prior to providing Aggregate Fill.

2. Owner Testing: The Owner shall arrange and pay for additional testing on the Aggregate Fill after delivery to the project site as determined necessary by the Engineer.

B. Contamination Certification:

1. Obtain a written, notarized certification from the Supplier of each proposed Aggregate Fill source stating that to the best of the Supplier's knowledge and belief there has never been contamination of the source with hazardous or toxic materials.
2. Submit these certifications to the Engineer prior to proceeding to furnish Aggregate Fill to the site. The lack of such certification on a potential Aggregate Fill source shall be cause for rejection of that source.

#### 1.03      **STANDARDS**

- A. Aggregate Fill shall be classified into the appropriate class listed below according to ASTM testing procedures as specified for the various classes.

1. American Society for Testing and Materials (ASTM) Standards:

|           |                                                                                                                            |
|-----------|----------------------------------------------------------------------------------------------------------------------------|
| ASTM C33  | Specification for Concrete Aggregates                                                                                      |
| ASTM C88  | Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium sulfate                                      |
| ASTM C125 | Terminology Relating to Concrete and Concrete Aggregates                                                                   |
| ASTM C131 | Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM C535 | Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM D448 | Classification for Sizes of Aggregate for Road and Bridge Construction                                                     |

## 2.00 PRODUCTS

### 2.01 MATERIALS; CLASSIFICATIONS

- A. Class 1 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 57:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 1-1/2"                       | 100             |
| 1"                           | 95-100          |
| 1/2"                         | 25-60           |
| No. 4                        | 0-10            |
| No. 8                        | 0-5             |

- B. Class 2 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 67:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 1"                           | 100             |
| 3/4"                         | 90-100          |
| 3/8"                         | 20-55           |
| No. 4                        | 0-10            |
| No. 8                        | 0-5             |

- C. Class 3 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 7:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 3/4"                         | 100             |

|       |        |
|-------|--------|
| 1/2"  | 90-100 |
| 3/8"  | 40-70  |
| No. 4 | 0-15   |
| No. 8 | 0-5    |

- D. Class 4 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 467:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 2"                           | 100             |
| 1-1/2"                       | 95-100          |
| 3/4"                         | 35-70           |
| 3/8"                         | 10-30           |
| No. 4                        | 0-5             |

- E. Class 5 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 357:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 2-1/2"                       | 100             |
| 2"                           | 95-100          |
| 1"                           | 35-70           |
| 1/2"                         | 10-30           |
| No. 4                        | 0-5             |

- F. Class 6 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 1:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 4"                           | 100             |
| 3-1/2"                       | 90-100          |
| 2-1/2"                       | 25-60           |
| 1-1/2"                       | 0-15            |
| 3/4"                         | 0-5             |

- G. Class 7 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and shall have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 6:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 1"                           | 100             |
| 3/4"                         | 90-100          |
| 1/2"                         | 20-55           |
| 3/8"                         | 0-15            |
| No. 4                        | 0-5             |

- H. Class 8 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable materials and shall have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation in accordance with ASTM D448, size number 56:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 1-1/2"                       | 100             |
| 1"                           | 90-100          |
| 3/4"                         | 40-85           |



|       |       |
|-------|-------|
| 1/2"  | 10-40 |
| 3/8"  | 0-15  |
| No. 4 | 0-5   |

I. Class 9 Aggregate Fill:

1. Consist of washed and screened gravel and natural sands or sands manufactured by crushing stones complying with the requirements of ASTM C33, except that the gradation shall be as follows:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 1/2"                         | 100             |
| 3/8"                         | 95-100          |
| No. 4                        | 80-95           |
| No. 8                        | 65-85           |
| No. 16                       | 50-75           |
| No. 30                       | 25-60           |
| No. 50                       | 10-30           |
| No. 100                      | 0-10            |

2. Class 9 Aggregate Fill shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

J. Class 10 Aggregate Fill:

1. Consist of washed and screened natural sands or sands manufactured by crushing stones complying with the requirements and tests of ASTM C33. The gradation as included in ASTM C33 is as follows:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 3/8"                         | 100             |
| No. 4                        | 95-100          |
| No. 8                        | 80-100          |
| No. 16                       | 50-85           |
| No. 30                       | 25-60           |
| No. 50                       | 10-30           |
| No. 100                      | 0-10            |

2. Class 10 Aggregate Fill shall have not more than 45 percent passing any sieve and retained on the next consecutive sieve of those shown above, and its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

- K. Class 11 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

| Sieve Size<br>Square Opening | Percent Passing         |
|------------------------------|-------------------------|
| 1-3/4"                       | 100                     |
| 7/8"                         | 65-90                   |
| 3/8"                         | 50-70                   |
| No. 4                        | 35-55                   |
| No. 40                       | 15-30                   |
| No. 100                      | 0-12 (Wet Sieve Method) |

- L. Class 12 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

| Sieve Size<br>Square Opening | Percent Passing         |
|------------------------------|-------------------------|
| 1-1/2"                       | 100                     |
| 1"                           | 85-100                  |
| 3/4"                         | 60-95                   |
| 3/8"                         | 50-80                   |
| No. 4                        | 40-65                   |
| No. 16                       | 20-40                   |
| No. 100                      | 0-12 (Wet Sieve Method) |

- M. Class 13 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and shall meet the following gradation:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 1-3/4"                       | 100             |
| 7/8"                         | 65-90           |

|         |                        |
|---------|------------------------|
| 3/8"    | 50-70                  |
| No. 4   | 35-55                  |
| No. 40  | 15-30                  |
| No. 100 | 0-3 (Wet Sieve Method) |

- N. Class 14 Aggregate Fill: Consist of durable particles of crushed stone free of silt, clay, or other unsuitable material and have a percentage of wear of not more than 40 percent when tested in accordance with ASTM C131 or C535. When material is subjected to five cycles of the sodium sulfate soundness test in accordance with ASTM C88, Sodium Sulfate Solution, the weighted percentage of loss shall not exceed 12 percent. The source of the material shall be approved by the Engineer and meet the following gradation:

| Sieve Size<br>Square Opening | Percent Passing        |
|------------------------------|------------------------|
| 1-1/2"                       | 100                    |
| 1"                           | 85-100                 |
| 3/4"                         | 60-95                  |
| 3/8"                         | 50-80                  |
| No. 4                        | 40-65                  |
| No. 16                       | 20-40                  |
| No. 100                      | 0-3 (Wet Sieve Method) |

- O. Class 15 Aggregate Fill: Consist of durable particles of silica sand, washed clean, chemically inert, and packaged by the Supplier. The material shall meet applicable regulatory requirements for monitor well filter pack. The source of the material shall be approved by the Engineer and shall meet the following gradation requirements:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| No. 20                       | 98-100          |
| No. 40                       | 0-2             |

### 3.00 EXECUTION (NOT APPLICABLE)

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

## **31 11 00      CLEARING AND GRUBBING**

### **1.00      GENERAL**

#### **1.01      WORK INCLUDED**

- A. Provide labor, materials, equipment and incidentals necessary to perform operations in connection with clearing, grubbing, and disposal of cleared and grubbed materials.

#### **1.02      QUALITY ASSURANCE; DEFINITIONS**

- A. Clearing: Clearing is defined as the removal of trees, shrubs, bushes, and other organic matter at or above original ground level.
- B. Grubbing: Grubbing is defined as the removal of stumps, roots, boards, logs, and other organic matter found at or below ground level.

### **2.00      PRODUCTS (NOT APPLICABLE)**

### **3.00      EXECUTION**

#### **3.01      PREPARATION**

- A. Mark areas to be cleared and grubbed prior to commencing clearing operations. The Owner's Representative shall approve clearing and grubbing limits prior to commencement of clearing operations.
- B. Trees and shrubs outside of the clearing limits, which are within 10 feet of the clearing limits, shall be clearly marked to avoid damage during clearing and grubbing operations.
- C. Remove trees and brush outside the clearing limits, but within the immediate vicinity of the work, upon receipt of approval by the Owner's Representative, when the trees or brush interfere with the progress of construction operations.
- D. Clearly mark trees and shrubs within the clearing limits, which are to remain, and protect the trees and shrubs from damage during the clearing and grubbing operations.
- E. The clearing limits shall not extend beyond the project limits.
- F. Establish the clearing limits as follows:
  - 1. Embankments plus 10 feet beyond the toe of the embankment.
  - 2. Excavations plus 5 feet beyond the top of the excavation.
  - 3. Concrete structures plus 10 feet beyond the edge of the footing.
  - 4. Roadways and parking areas plus 5 feet beyond the edge of pavement or R.O.W. limits.
  - 5. Underground utility trench top width plus 8 feet.
  - 6. 15 feet along the centerline of the overhead utility lines.
  - 7. All areas inside proposed fence line, as well as 5 feet beyond it.
- G. Establish the grubbing limits as follows:
  - 1. Embankments plus 2 feet beyond the toe of the embankment.

2. Concrete structures plus 2 feet beyond the edge of the footing.
3. Roadways, runways, taxiways, and parking areas plus 1 foot beyond the edge of pavement.
4. All areas inside proposed fence line, as well as 5 feet beyond it.

### 3.02 INSTALLATION

- A. Clearing: Clearing shall consist of the felling, cutting up, and the satisfactory disposal of trees and other vegetation, together with the down timber, snags, brush, rubbish, fences, and debris occurring within the area to be cleared.
- B. Grubbing:
  1. Grubbing shall consist of the removal and disposal of stumps and roots larger than 1 inch in diameter.
  2. Extend grubbing to the depth indicated below: In the case of multiple construction items, the greater depth shall apply.
    - a. Footings: 18 inches below the bottom of the footing.
    - b. Walks: 12 inches below the bottom of the walk.
    - c. Roads: 18 inches below the bottom of the subgrade.
    - d. Parking Areas: 12 inches below the bottom of the subgrade.
    - e. Embankments: 24 inches below existing ground.
    - f. Concrete Structures: 18 inches below the bottom of the concrete.

### 3.03 FIELD QUALITY CONTROL

- A. Completely remove timber, logs, roots, brush, rotten wood, and other refuse from the Owner's property. Disposal of materials in streams shall not be permitted and no materials shall be piled in stream channels or in areas where it might be washed away by floods. Timber within the area to be cleared shall become the property of the Contractor, and the Contractor may cut, trim, hew, saw, or otherwise dress felled timber within the limits of the Owner's property, provided timber and waste material is disposed of in a satisfactory manner. Materials shall be removed from the site daily, unless permission is granted by the Engineer to store the materials for longer periods.

## END OF SECTION

## 31 23 10 STRUCTURAL EXCAVATION AND BACKFILL

### 1.00 GENERAL

#### 1.01 SUMMARY

- A. This Section specifies excavation, backfill materials, backfill placement and compaction procedures, and other construction activities incidental to project structures.

#### 1.02 QUALIFICATION ASSURANCE

- A. Testing Agency: An independent testing agency that is AASHTO accredited.

#### 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
1. Qualification Data: For testing agency.
  2. Provide list of compaction equipment to be used.
  3. Backfill material classifications: For each soil or aggregate backfill material provide a certification by the testing agency.
  4. Compaction Test Results: Submit test results within 24 hours of successful testing.

#### 1.04 STANDARDS

- A. Material classification, placing, and testing shall be in compliance with the latest revisions of the following standards, unless otherwise noted in the Contract Documents.

1. ASTM International (ASTM) Standards:

|            |                                                                                                                                                          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASTM D698  | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> )) |
| ASTM D1556 | Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method                                                                    |
| ASTM D2487 | Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)                                              |
| ASTM D4253 | Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table                                                         |
| ASTM D6938 | Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)                               |

- B. Any other testing required by these specifications and not specifically referenced to a standard shall be performed under ASTM or other appropriate standards as designated by the Engineer.

#### 1.05 DELIVERY AND STORAGE

- A. Deposit material to be used for backfill in storage piles at points convenient for handling of the material during the backfilling operations and as required to prevent contamination with other materials.

## 1.06 JOB CONDITIONS

- A. Review subsurface investigations. A limited subsurface investigation has been performed by S&ME, Inc. A geotechnical report from that investigation is a part of the Construction Documents for information purposes only. The precise profile of soil and rock strata beneath this Site is not known.
- B. Review the Site and determine the conditions which may affect the structural excavation, prior to the commencement of the excavation.

## 2.00 PRODUCTS

### 2.01 BACKFILL MATERIALS

- A. Structural Fill Backfill: Structural fill shall be Class 4 Earth Fill as specified in Section 31 05 13 "Soils for Earthwork."
- B. Clay Cap: Clay cap shall be Class 2 Earth Fill as specified in Section 31 05 13 "Soils for Earthwork."
- C. Structural Aggregate Backfill: Structural aggregate backfill shall be Class 1 Aggregate Fill as specified in Section 31 05 16 "Aggregates for Earthwork."
- D. Lean Concrete Backfill: Lean concrete in accordance with Section 03 30 00 "Cast-In-Place Concrete."
- E. Mud Slab: Lean concrete in accordance with Section 03 30 00 "Cast-In-Place Concrete."
- F. Flowable Fill: Flowable fill shall be in accordance with Section 31 23 23.34 "Flowable Fill."
- G. Topsoil: Topsoil shall be Class 12 Earth Fill as specified in Section 31 05 13 "Soils for Earthwork."
- H. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand, or recycled, crushed concrete in accordance with NCDOT Section 1010 – Aggregate Base Course; ASTM D448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and 5 to 15 percent passing No. 200 sieve; maximum plasticity index of 7; complying with deleterious substance limits of ASTM C33 for fine aggregates.
- I. Levelling Course For Slab-On-Grade: Provide a 3-inch layer of compacted Fine-Graded Granular Material.

### 2.02 COMPACTION EQUIPMENT

- A. Compaction equipment shall conform to the following requirements.
  - 1. Heavy Compaction Equipment:
    - a. Tamping Compactor: Steel wheels with rectangular face, tapered pads that prevent fluffing the soil. Compactor shall be equipped with cleaning fingers to remove soil accumulation from between pads.
      - 1). Operating Weight, Minimum: 30,000 pounds.
      - 2). Wheels or Drum Size, Minimum: 4 feet diameter.



- 3). Travel Speed, Maximum: 10 mph.
- b. Pneumatic Rollers: Minimum eight-tire, pneumatic roller with a modular ballast system and flexible operating weight, and which will equally distribute load between tires to provide compaction uniformity.
  - 1). Operating Weight Range: As required for specified compaction, 36,000 to 50,000 pounds.
  - 2). Tire Pressure Range: 80 psi to 100 psi.
  - 3). Travel Speed, Maximum: 10 mph.
  - 4). Distance Between Edges of Adjacent Tires: Less than 50 percent of tire width.
- c. Vibratory Rollers: Smooth drum roller with 90 percent of the static weight transmitted through a single drum.
  - 1). Static Weight, Minimum: 20,000 pounds
  - 2). Centrifugal Force Per Drum, Minimum: 40,000 pounds
  - 3). Frequency: 1400 v/min
  - 4). Drum Size: Diameter 5 feet, +/- 1 foot; width between 6 and 9 feet.
  - 5). Travel Speed: 5 mph for self-propelled; 2 mph for towed.
  - 6). No backing up of the vibratory roller will be allowed on an embankment unless the vibrating mechanism is capable of being reversed.
2. Hand-Directed Compaction Equipment: Use power tampers and vibratory plate compactors in areas where it is impracticable or unacceptable to use heavy compaction equipment.

### **3.00 EXECUTION**

#### **3.01 PREPARATION**

- A. Clear and grub the area to be excavated prior to the start of excavation in accordance with Section 31 11 00 "Clearing and Grubbing."

#### **3.02 EXCAVATION FOR FOUNDATIONS**

- A. General: Excavate subgrade to the depth indicated on Drawings, +/- 0.1 feet tolerance. Extend limits of the excavation beyond the perimeter of the foundations [as specified by the tank manufacturer.
  1. Exposed subgrade surfaces shall be level and of sound, stable material; free of mud, frost, snow, or ice. Testing agency or Owner's representative shall confirm exposed subgrade is a suitable bearing material based on the Construction Documents.
  2. Proof roll the exposed subgrade in accordance with Section 220-3 – Proof Rolling. Do not proof roll wet or saturated subgrades.
  3. Where unsound or unstable material is uncovered, notify Owner's representative. Remove objectionable material and replace after approval is received from Owner's

representative. Replacement material shall be as indicated here unless otherwise indicated on Drawings:

- a. Rock subgrade replacement material: Flowable fill.
- b. Soil subgrade replacement material: Flowable fill.
- B. Aggregate Work Platform: Where indicated, install work platform on exposed foundation subgrade prior to allowing any vehicular traffic on subgrade.
- C. When the material encountered at footing bearing elevation is found to be partially rock or incompressible material, but otherwise satisfactory for the foundation, remove the incompressible material to a depth of 6 inches below the footing grade and 12 inches on each side and backfill with compacted select fill.
- D. Excavation Safety: All excavations shall be in accordance with OSHA requirements.

### 3.03 WATER IN FOUNDATION EXCAVATIONS

#### A. General:

- 1. Prevent water infiltration into foundation excavations. Remove standing water from excavation prior to placing concrete. If removal of standing water is not possible due to continuous water infiltration, then contact Owner's representative for additional direction regarding placing concrete underwater.
- 2. Do not dewater a foundation excavation while placing concrete or for a period of at least 24 hours after concrete placement.
- B. Rock Foundation Subgrade: If rock material becomes weathered due to water infiltration, then remove weathered material and provide rock replacement material to restore foundation subgrade elevation.
- C. Soil Foundation Subgrade: If foundation subgrade becomes saturated do not disturb the subgrade. Wait for water to evacuate the subgrade and subgrade surface to adequately stiffen prior to placing concrete. If subgrade is disturbed, then wait until subgrade has dried out, excavate disturbed subgrade and provide replacement material as indicated above.

### 3.04 COMPACTED BACKFILL

#### A. General: Backfill excavated spaces and areas not occupied by the permanent structure.

- 1. Backfill behind a retaining wall or basement-type wall shall not be placed until the concrete has reached its 28-day compressive strength or 7 days, whichever is longer.
- 2. Unless otherwise indicated on Drawings, structures with a top slab shall not backfilled until the top slab has been in place at least 4 days.
- 3. Structures with soil on opposing (opposite) sides shall be backfilled to prevent uneven loading of the structure – evenly raise backfill on opposing sides of the structure. The maximum differential backfill height between opposing sides is 1 foot.
- 4. Do not permit rollers to operate within 3 feet of structures.
- 5. Maximum Loose Lift Height:
  - a. Heavy Compaction Equipment: 8 inches.

- b. Hand-Directed Compaction Equipment: 4 inches.
- 6. Previous Compacted Layer: If backfill placement occurs over a period of time greater than 24 hours, then scarify and recompact the previous day's final compacted layer.
  - a. Scarify and Recompact: 6-inch depth; adjust the moisture content; recompact.
  - b. Saturated subgrades shall not be worked on until sufficiently dry and harden so as not to be rutted with compaction equipment. Scarify and recompact layers damaged by weather or construction equipment.
- B. Moisture: Prior to compacting backfill, mix and aerate or water the loose lift backfill material as necessary to adjust the moisture content and evenly distribute throughout. The material shall contain moisture within the limits specified below.
  - 1. In accordance with ASTM D6938, determine the optimum moisture content for the maximum dry density.
  - 2. Backfill moisture content shall be as indicated in Table 1, "Compacted Fill."
  - 3. Aggregate fill: Completely cohesionless materials, shall be at a moisture content which will allow use of the specified compaction equipment and consistent achievement of the specified density.
- C. Compaction: As required to achieve the specified density, increase the number of passes above the minimum specified and/or modify the weight of the equipment.
  - 1. Determine the maximum dry density in accordance with ASTM D698 for cohesive soils and ASTM D4253 for cohesionless soils.
  - 2. Minimum number of passes for all compacted fill types: 8.
  - 3. Cohesive Soils: A tamping compactor or tamping compactor followed by a pneumatic roller shall be used.
  - 4. Cohesionless or low cohesive soils: A vibratory roller or vibratory plate compactors shall be required if the material is cohesionless or with less than 15 percent passing the No. 200 sieve. Confirm applicability of vibratory compaction equipment in the field.
  - 5. Overlap passes a minimum of 1 foot for heavy compaction equipment and 50 percent of the baseplate width for hand-directed equipment.
  - 6. Backfill density shall be as indicated in Table 1, "Compacted Fill."

| Table 1: Compacted Fill       |                        |                                 |          |
|-------------------------------|------------------------|---------------------------------|----------|
| Backfill Type                 | Density <sup>1,2</sup> | Moisture Content <sup>3,4</sup> | Comments |
| Classes 1 & 2                 | 95%                    | -0% to +5%                      | N/A      |
| Classes 3, 4, & 5             | 95%                    | -2% to +5%                      | N/A      |
| Fine Graded Granular Material | 98%                    | See Note 4                      | N/A      |

<sup>1</sup> The percentage indicated is the minimum required percentage of the maximum dry density as determined by the applicable ASTM.

<sup>2</sup> Below Vehicular Pavement: Scarify to a depth of 8, moisture condition, and recompact to not less than 100 percent of the maximum dry density.

<sup>3</sup> Range indicated is the acceptable tolerance with respect to the optimum moisture content.

<sup>4</sup> Completely cohesionless materials, shall be at a moisture content which will allow use of the specified compaction equipment and result in consistent achievement of the specified density.

### 3.05 FIELD QUALITY CONTROL

- A. Contractor is responsible for coordinating with an approved testing agency to perform quality control testing of backfill operations and verification of subgrade bearing material. The costs involved with these tests shall be covered by the Owner's Quality Control Allowance.
- B. The testing laboratory shall make tests of in-place density and moisture in accordance with ASTM Standards previously mentioned in this Section. The testing agency shall monitor backfill operations continuously or at intervals acceptable to the Owner's representative. It shall be the responsibility of the Contractor to notify the testing agency a minimum of 2 business days before backfill operations begin.
  - 1. Unless noted otherwise, in-place density tests shall be conducted at a rate of one test per 3000 square feet for every lift.

**END OF SECTION**

## **31 23 33 TRENCHING AND BACKFILL**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to perform operations in trenching, pipe bedding, backfilling, clearing, grubbing and site preparation; handling, storage, transportation and disposal of excavated material; pumping and dewatering; preparation of subgrades; protection of adjacent property; fills, grading; and other appurtenant work.
- B. Trenching, backfilling, and pipe embedment procedures shall be in full compliance with Section 31 23 36 "Trench Safety."
- C. Material sampling and testing roles, responsibilities and procedures shall be in full compliance with Section 01 40 00 "Quality Management."
- D. Earth removed from excavations and which is not required for backfill shall be removed from the Site by the Contractor at its own expense, unless arrangements are made with the Owner through its representative to allow disposal on Site. If permitted, the Contractor shall dump and spread excess earth in a manner agreed upon by the Contractor and the Owner.
- E. Excavations, other than trench excavation, are not part of this Section.
- F. Bidders must satisfy themselves as to the actual existing subsurface conditions prior to the submittal of a proposal to complete the proposed Work. No extra or separate payments shall be made for rock, dewatering, or any other condition.

#### **1.02 QUALITY ASSURANCE**

- A. Excavations shall include material of whatever nature encountered, including but not limited to clays, sands, gravels, conglomeritic boulders, weathered clay shales, rock, debris and abandoned existing structures. Excavation and trenching shall include the removal and subsequent handling of materials excavated or otherwise handled in the performance of the Work.
- B. Trench excavation shall consist of excavation to the lines and grades indicated, required for installation of the pipe, pipe bedding, backfill, and to accommodate trench safety systems.

#### **1.03 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Certified test reports for embedment material, backfill material, and coarse gravel. Certified Test Reports shall be from an independent laboratory. Test reports shall include sieve analysis, Atterburg limits, results of an abrasion test, and other tests as required to demonstrate compliance with Paragraph 2.01.
  - 2. Test results indicating soil resistivity for embedment material used on metal pipe.
  - 3. Field density test reports indicating that the Contractor's method of backfill meets the requirements of the Contract Documents. The field density testing for granular

embedment shall be done in a manner approved by the Owner/Engineer by an independent testing lab in accordance with ASTM D4253. The cost of the field testing shall be included in the Bid Price for the Work, with no additional compensation to the Contractor.

#### 1.04 REFERENCE SPECIFICATIONS

- A. Section 01 33 00 "Document Management."
- B. Section 01 40 00 "Quality Management."
- C. Section 03 30 001 "Cast-In-Place Concrete."
- D. Section 31 05 13 "Soils for Earthwork."
- E. Section 31 05 16 "Aggregates for Earthwork."
- F. Section 31 23 23.34 "Flowable Fill"
- G. Section 31 23 36 "Trench Safety."

#### 1.05 STANDARDS

- A. The following publications, referred to hereafter by basic designation only, form a part of this Section to the extent indicated by the references thereto:

##### 1. ASTM International (ASTM):

|            |                                                                                                                                                         |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASTM C33   | Standard Specification for Concrete Aggregates                                                                                                          |
| ASTM C88   | Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate                                                          |
| ASTM C125  | Standard Terminology Relating to Concrete and Concrete Aggregates                                                                                       |
| ASTM C131  | Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine                     |
| ASTM C535  | Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine                     |
| ASTM D75   | Standard Practice for Sampling Aggregates                                                                                                               |
| ASTM D448  | Standard Classification for Size of Aggregate for Road Bridge Construction                                                                              |
| ASTM D698  | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft <sup>3</sup> (600 kN-m/m <sup>3</sup> )) |
| ASTM D1556 | Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method                                                               |
| ASTM D2487 | Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)                                             |
| ASTM D4253 | Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table                                                        |
| ASTM D6938 | Standard Test Method for In-Place Density and Water Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)                               |
| ASTM G57   | Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method                                                   |

- B. Any other testing required by these specifications and not specifically referenced to a standard shall be performed under ASTM or other appropriate standards as designated by the Engineer.
- C. Reference herein or on the Drawings to soil classifications shall be understood to be according to ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

#### 1.06 DELIVERY AND STORAGE

- A. Excavated materials to be used for backfill may be deposited in stockpiles at points convenient for rehandling the material during the backfilling process. If not indicated on the Drawings, the location of stockpiles shall be within the limits of construction easements or public right-of-way. The location of stockpiles is subject to the approval of the Owner or the Owner's representative. Do not place stockpiles over buried pipelines or utilities unless adequate provisions are made for protection. Roads and driveways must be kept open unless written authorization is granted by Owner. Keep drainage channels clear of stockpiled materials.
- B. If more than one material is stockpiled on site, maintain separation and clearly identify stockpiles. Cross-contamination of materials will not be permitted and will serve as grounds for rejection.

#### 1.07 JOB CONDITIONS

- A. Classification of Excavation: Excavation shall be "unclassified" and involves the removing of the necessary materials to provide the trench/excavation to the required width and depth. Contractor must satisfy itself as to the actual sub-surface conditions prior to submitting a proposal. No extra or separate payments shall be made for rock, dewatering or any other condition.
- B. Road Crossings: Where the Work requires road closure, coordinate with the Owner to obtain written approval detailing the extents of the road closure as well as the duration the road will be out of service. Provide temporary access and detours for roads and driveways as required by the Owner.
- C. Place no embedment or backfill material during freezing weather or upon frozen subgrades or previously placed frozen embedment or backfill materials.

### 2.00 PRODUCTS

#### 2.01 MATERIALS

- A. Concrete for Backfill, Blocking, Cradling and Encasement: Unless other strength requirements are designated, concrete used shall be as specified for pipe blocking, lean concrete, in Section 03 30 30 "Cast-In-Place Concrete (Limited Applications)."
- B. Earth Fill: Earth fill materials shall be as specified in Section 31 05 13 "Soils for Earthwork."
- C. Granular Embedment and Backfill: Granular embedment material shall be as specified in Section 31 05 16 "Aggregates for Earthwork."
- D. Cement: Cement shall be in accordance with Section 03 30 00 "Cast-In-Place Concrete."

- E. Coarse Gravel: Where coarse gravel is required for water drainage, restoration of trench foundation, or other uses, it shall be crushed stone or gravel and in compliance with ASTM C33 for Coarse Concrete Aggregate. Gradation shall be ASTM C33 No. 57, No. 67, No. 357, or as follows:

| Sieve Size<br>Square Opening | Percent Passing |
|------------------------------|-----------------|
| 1"                           | 95-100          |
| 3/4"                         | 55-85           |
| 1/2"                         | 25-50           |
| No. 4                        | 0-5             |

- F. Flowable Fill: Flowable fill shall be in accordance with Section 31 23 23.34 "Flowable Fill."
- G. Modified Flowable Fill: Modified flowable backfill in areas of possible future excavation shall consist of a mixture of native soils or manufactured materials, cement and/or fly ash, air entraining material and water which produces a material with unconfined compressive strength of between 250 and 450 psi after 28 days. Any materials used shall be primarily granular, with a plasticity index less than 12 and with 100 percent passing a 3/4-inch sieve. The flowable mixture shall be mixed in a pug mill, concrete mixer, or transit mixer and shall have a minimum slump of 5 inches. The flowable mixture must be allowed to set prior to the placement of any overlying materials. Modified flowable backfill in permanent areas such as abandoned pipe closures shall contain the same materials and have an unconfined compressive strength greater than 250 psi after 28 days.
- H. Utility Detection Tape: Utility pipe detection tape shall be installed over all PVC, HDPE, or fiberglass pipelines 8 inches and larger. The tape shall be bright-colored, continuous-printed plasticized aluminum tape, intended for direct-burial service, and meet the following requirements:
1. Width: 6 inches.
  2. Thickness: 5 mils minimum.
  3. Lettering: 1-inch high permanent black, continuously printed.
  4. Color: Per APWA Uniform Color Code:
    - a. Green - Sanitary Sewer Lines.
    - b. Blue - Potable Water.
    - c. Purple - Reclaimed Water, Irrigation.
  5. Detection tape must be installed above the pipe zone, 12 inches above pipe.
- I. Tracer Wire: All piping shall be installed with a continuous, insulated TW, THW, THWN or HMWPE insulated copper, 10 gauge or thicker wire for pipeline location purposes by means of an electronic line tracer. The wire shall be installed along the entire length of pipe. The insulation color shall match the color of the pipe being installed. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.



## 2.02 MIXES; SAND-CEMENT BACKFILL

- A. A minimum sand and cement mixture of 25 parts sand and 2 parts cement will be required.
1. Fine Sand: 25 Cubic Feet.
  2. Cement: 2 Bags (minimum).
  3. Water: Optimum moisture.
- B. Sand shall be free of any cohesive material and shall meet the following gradation and plasticity index requirements:

| Sieve Size | Percent Passing |
|------------|-----------------|
| 1"         | 100             |
| 1/2"       | 95-100          |
| No. 40     | 80-100          |

- C. PI and LL Amounts:
1. Plasticity Index: 10 Maximum.
  2. Liquid Limit: 25 or less.

## 3.00 EXECUTION

### 3.01 PREPARATION

- A. Site:
1. Clear sites of logs, trees, roots, brush, tree trimmings and other objectionable materials and debris which are to be occupied by pipe trenches, and grub stumps. Designate material not salvaged for reuse as surface material as spoiled and dispose of material in accordance with Paragraph 3.01.E, Disposal of Spoil Material.
  2. Do not remove trees outside of the required working area unless their removal is authorized in writing by the Engineer and with the approval of the local governing authority. Adequately protect the trees left standing from permanent damage by construction operations. Standing trees may be trimmed where necessary to facilitate construction, but only with written authorization from the Engineer.
- B. Dewatering:
1. Provide and maintain adequate dewatering equipment to remove and dispose of surface and ground water entering the excavations, trenches, or other parts of the Work. Keep each excavation dry during subgrade preparation and continually thereafter until the proposed pipe is installed. Maintain the proper procedures necessary to protect against damage to the proposed Work from hydrostatic pressure, flotation, or other water related causes.
  2. Dewater excavations which extend down to or below ground water elevation by lowering and keeping the ground water level a minimum of 2 feet below the bottom of the excavation.

3. Divert surface water or otherwise prevent water from entering excavated areas to the fullest extent possible without causing damage to adjacent property.
4. Provide and maintain any piping or conduit necessary to facilitate drainage. Do not alter area drainage patterns to the extent that adjacent property and landowners become threatened with localized flooding and/or water damage. Should such a situation occur, the Contractor shall be responsible for repairing the damage at no additional cost to the Owner.

C. Protection of Existing Structures and Utilities:

1. Prior to the start of construction, communicate with the representatives of the local utility companies, including the oil, gas, telephone and communications companies, and local water and sewer utilities operating in the location of the proposed construction area. Seek the utility companies' assistance in locating existing facilities to avoid conflicts during construction. The location, number, depth, and owner of utilities indicated are for information purposes only, and all utilities and structures may not be shown or may not be at the location shown.
2. Where construction endangers adjacent structures, utilities, embankments and/or roadways, the Contractor shall, at his own expense, carefully support and protect such structures so that no damage occurs throughout the construction process. In case damage should occur, the Contractor shall be responsible for restoring the damaged structure to a condition acceptable to the Owner of that structure and shall bear all cost of such reparations.
3. Repair or replace damaged street surfaces, driveways, sidewalks, curbs, gutters, fences, drainage structures, or other such facilities to the satisfaction of the Owner. Structures shall be returned to a condition equal to or better than the original condition and of same or better material and quality.
4. Relocate minor utilities as necessary, at no additional cost to the Owner, in order to resolve conflicts with new Work. Minor utilities shall be defined as conduit less than or equal to 2 inches in diameter and pressure piping less than or equal to 6 inches in diameter. All proposed relocations shall be submitted in writing and approved by Owner or Owner's representative prior to accomplishing the Work.

D. Blasting: Blasting shall not be allowed in any instance.

E. Disposal of Spoil Material:

1. Suitable material from excavations which meets the requirements for pipe backfill material as indicated, except stripping excavation, may be reused. Designate the remaining excavated materials as spoiled material and dispose of material off the Site in accordance with all applicable laws, ordinances, and codes. Contractor shall be responsible for the storage, transportation, and deposition of spoiled material and shall be responsible for acquiring the necessary permits, and the payment of fees and duties at no additional cost to the Owner.
2. No burning of materials shall be permitted on the Site.

### 3.02 TRENCH EXCAVATION

- A. General: The trenches shall be excavated to the alignment and depth indicated or as necessary for the proper installation of the pipe and appurtenances. Brace and dewater the trench if necessary so that the workmen may work therein safely and efficiently. Any specific requirement listed in Paragraph **[3.00]**, Execution, may be modified as necessary to meet OSHA requirements. However, if trench widths are wider than indicated, the Contractor shall be responsible for determining and furnishing the proper class of embedment and piping for the installation with no additional compensation to the Contractor.
- B. Trench Width: The trench widths shall be as shown on the Drawings.
- C. Pipe Foundation Subgrade:
  - 1. Excavate the trench to an even grade to permit the installation of the pipe so that the full length of the pipe barrel is supported on the proper depth of bedding material. The entire foundation subgrade area in the bottom of the excavations shall be firm, stable material, and the material shall not be disturbed below required grade except as described in this Section. Where the character of the subgrade material is such that proper subgrade cannot be obtained at the elevation indicated, deepen the excavation to a satisfactory subgrade material.
  - 2. Remove the material until a firm, stable, and uniform bearing is reached and the subgrade brought back to the required grade with coarse gravel thoroughly compacted to 95 percent maximum density as measured by ASTM D4253. The expense of replacing any unsatisfactory subgrade shall be borne by the Contractor.
- D. Correcting Faulty Grade: If the trench is excavated to a faulty grade (at a lower elevation than indicated), correct the faulty grade as specified below:
  - 1. In uniform, stable, dry soils, correct the faulty grade with granular embedment material thoroughly compacted to 95 percent of the maximum density measured in accordance with ASTM D4253.
  - 2. In soft spongy disintegrated soils or where necessary to allow proper drainage, correct the faulty grade with coarse gravel compacted to 95 percent of the maximum density measured in accordance with ASTM D4253.
  - 3. Correct faulty grade at no additional cost to Owner.
- E. Care of Surface Material for Reuse: If local conditions permit reuse, keep surface material suitable for reuse separate from the general excavation material.
- F. Trenching Methods: The use of any suitable trench digging machinery is permitted except in places where such operations may cause damage, above or below ground, in which case, employ hand methods.
- G. Pipe Clearance in Rock: Remove ledge rock, rock fragments, shale, or other rock to provide proper clearance for bedding materials. Provide adequate clearance for properly jointing pipe laid in rock trenches at bell holes.
- H. Open Trench:

1. Owner shall have the right to limit the amount of trench which may be opened or partially opened at any time in advance of the completed line; and also the amount of trench left not backfilled.
2. Not more than 150 feet of trench shall be left open unless otherwise permitted in writing by the Owner.
3. Backfill and/or protect trenches as necessary to prevent injury to adjacent property, Owner's personnel, livestock, and the public.
4. Trenches left open at night shall be fenced with adequate construction fencing. No trenches in streets or populated areas shall be left open at night.
5. These requirements are minimum standard for trenching and more stringent construction requirements may be located elsewhere in the Contract Documents. The most restrictive requirements shall apply.

### 3.03 BACKFILL

- A. Time of Backfilling: Backfill operations shall immediately follow pipe jointing, joint coating application, and curing.
- B. Braced and Sheeted Trenches: Remove sheeting and shoring as backfilling operations progress. Incorporate methods so that a good bond is obtained between the backfill material and the undisturbed trench walls.
- C. Protection of Pipe During Backfilling Operations: Take the necessary precautions to protect the pipe during backfilling operations. Take care to prevent damage to the pipe or to the pipe coating, and repair any damaged pipe before it is backfilled. Backfill the trench in a method to prevent the deformation or other deflection of the cylindrical shape of the pipe by more than the allowable pipe deflection as specified elsewhere.
- D. Bedding within Pipe Zone:
  1. Concrete Cradle, Encasement or Concrete Arch: Where indicated, install the pipe in concrete cradle, encasement, or concrete arch. Take precautions to prevent pipe movement or deflection during construction. Where pipes are placed below structures, completely encase pipes in Class E concrete, and extend up to bottom of structure.
  2. Concrete Blocking: Place blocking to rest against firm undisturbed trench walls. The supporting area for each block shall be at least as great as that indicated and shall be sufficient to withstand the thrust, including water hammer, which may develop. Each block shall rest on a firm undisturbed foundation of trench sides and bottom.
- E. Aggregate Fill Bedding:
  1. After the trench has been cut to the depths indicated, bring up the bedding layer to a point slightly above grade in maximum 4-inch lifts and uniformly compact to the density indicated. Form bell holes and scoop out a trough to grade so that the pipe is uniformly supported by the embedment material. Lay and joint the pipe. Bring up the embedment material in maximum 4-inch lifts on either side of the pipe to the elevation above the pipe shown on the Drawings. Uniformly compact the pipe as indicated.

2. After moisture is gone from the embedment material, place utility detection tape and backfill and compact the remaining backfill by tamping or other appropriate methods. Water jetting shall not be permitted.
3. Install utility detection tape and tracer wire.

F. Compaction Requirements:

1. Compact earth fill and cohesive aggregate fill in maximum 4-inch lifts with pneumatic rollers or power hand tampers and make a minimum of eight passes.
2. Compact cohesionless aggregate fill in maximum 4-inch lifts with vibratory rollers or vibratory plate power hand compactors and make a minimum of eight passes.
3. The acceptability of the compaction equipment shall be based upon the results of a test section. Compact earth fill and aggregate fill to a minimum of 95 percent of maximum dry density as determined by ASTM D698, Standard Proctor.
4. Compact Class 1 and 2 earth fill at a moisture content within minus 0 to plus 5 percentage points of the optimum moisture content. Compact the remaining classes of earth fill and cohesive aggregate fill at a moisture content within minus 2 to plus 5 percentage points of optimum moisture content. The moisture ranges listed above are minimum and maximum limits. A tighter moisture range within these limits may be required to consistently achieve the specified density.
5. Compact cohesionless aggregate fill at a moisture content within a range that accommodates consistent placement and compaction to achieve the density specified above.
6. Contractor will arrange and pay for density and moisture testing. The testing frequency and methods shall be as requested by the Engineer. Engineer may waive testing requirements on cohesionless bedding where testing is not practical because of limited space between the pipe and trench walls, however, the minimum number of passes of the compaction equipment specified above shall be achieved.

### 3.04 FINISHING

- A. Grade and rake areas smooth and even which do not receive any type of paved surface, to allow drainage to drain away from the structures and toward the roads and streets or the natural drainage course. Break up large clods of earth and remove rocks, trash or debris near the surface.
- B. Finish the top portion of backfill beneath established sodded (lawn) areas with not less than 6 inches of topsoil corresponding to, or better than, that underlying adjoining sodded areas.

### 3.05 FIELD QUALITY CONTROL

- A. Compact backfill and appropriate embedment material to a minimum of 95 percent of maximum density at a moisture content of 0 to plus 5 percent of optimum for backfill and at optimum for sand-cement embedment as determined by ASTM D698, Standard Proctor.
- B. Make periodic tests of compaction for conformance with this Section by an approved testing laboratory selected and paid for by the Owner's Quality Control Allowance. Contractor shall pay for re-testing until acceptable test results are obtained.

3.06 CLEAN AND ADJUST

- A. Remove surplus pipeline materials, tools, rubbish and temporary structures and leave the construction site clean, to the satisfaction of the Engineer. Grade the surface and re-establish drainage. Removal of rock and other excess excavated material and general leveling and grading of the Site shall be part of the bid price and no additional payment shall be made.

**END OF SECTION**

## **31 23 36 TRENCH SAFETY**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. This specification is for the purpose of providing minimum performance specifications and consists of the basic requirements which the Contractor must comply with in order to provide for the safety and health of workers in a trench.
- B. Contractor shall develop, design, and implement the trench safety system and will be solely responsible for the adequacy of the trench safety system and providing “a safe place to work” for the workman.
- C. Should the trench safety protection system require wider trenches than specified elsewhere, the Contractor shall be responsible for the costs associated with determining adequacy of pipe bedding and class, including the purchase and installation of alternate materials.
- D. Contractor shall comply with all applicable federal, state, and local rules, regulations, and ordinances related to trench excavation and safety.
- E. Contractor’s trench safety system engineer shall design the system accounting for soils and subsurface conditions. No additional geotechnical information will be provided by the Owner. It will be the complete responsibility of the trench safety system engineer to satisfy himself of the geotechnical conditions. If the trench safety system engineer deems it necessary for additional geotechnical investigations and analysis, such investigations and analysis must be provided by the Contractor at no additional cost to the Owner and no additional time will be added to the Contract for such investigations. All changes to the trench safety system design based on any additional geotechnical information acquired after the Project is awarded is to be included in the project cost and no additional payment or time is due to the Contractor.

#### **1.02 STANDARDS**

- A. The following standard shall be the minimum governing requirement of this specification and is hereby made a part of this specification as if written in its entirety.
  - 1. Occupational Safety and Health Administration (OSHA): 29 CFR Part 1926 - Safety and Health Regulations for Construction, Subpart P – Excavations (latest version).

#### **1.03 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:
  - 1. Plans and procedures for a trench safety plan shall be prepared by a licensed engineer and be submitted as Record Data. Modifications to these plans, due to changing or unforeseen soil conditions, shall also be submitted as Record Data. If the Project contains separate phases that require different procedures in the design of the trench safety plan, then the trench safety plan(s) must clearly distinguish the differences in each phase. Plans for each phase in the sequence may be submitted separately, but

prior to any trench excavation and/or installation of the pipeline for the phase which the trench safety plan(s) govern.

2. Show arrangement, details, and soil classification for each type of trench safety system.
    - a. Include tabulated data for each type of trench safety system or provide reference to OSHA prescribed requirements.
  3. Record Data shall be signed and sealed by the qualified professional engineer responsible for their preparation. The Contractor shall select an engineer based on competence and qualifications and not on the basis of competitive bid and will certify to that effect with the Trench Safety Plan Submittal.
- B. Submittal of Record Data does not relieve the Contractor of full responsibility and liability for the trench safety system and the protection of the Contractor's workers. Contractor is solely responsible for jobsite safety and assumes all responsibilities for any necessary modifications to the trench safety plan as changing soil conditions may necessitate.

**2.00 PRODUCTS (NOT APPLICABLE)**

**3.00 EXECUTION (NOT APPLICABLE)**

**END OF SECTION**



**DIVISION 32**  
**EXTERIOR IMPROVEMENTS**

## **32 13 13      CONCRETE PAVING**

### **1.00    GENERAL**

#### **1.01    WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to construct finished pavement of Portland cement concrete on the prepared subgrade, crushed stone drainage course, and with monolithic curbs, in conformity with the plans, and as specified herein to the lines and grades as established by the Engineer.

#### **1.02    QUALITY ASSURANCE**

##### **A. Design Criteria:**

1. The concrete shall be designed for a minimum compressive strength as indicated in Paragraph 2.03E. Flexural strength is to be determined as a simple beam with center point loading (ASTM C293). While concrete placing operations are in progress, beam and cylinder specimens, of such dimension and numbers as may be required, shall be made by the Owner's independent testing laboratory each day. Beams and cylinders shall be continuously cured in water until tested.
2. If the concrete fails to meet the strength requirements, as shown by the failure of any flexural or compressive test specimen on 2 out of 3 consecutive days' tests, increase the cement factor in the increments of 1/2 sack per cubic yard of concrete until the strength requirements are met and redesign the concrete mix. No increase in price or extra compensation shall be allowed the Contractor for such increase in the cement factor. Failure of all the test specimens, either flexural or compressive, on any day's run of concrete, may be cause for rejection of that particular section of pavement. In such event, submit a redesign of the concrete mix.
3. Redesign of the concrete mix by the Contractor, when required, shall include the required corrective measures as indicated by the deficiencies in the original design mix. Material samples shall be resubmitted for the laboratory check of the redesign mix. Sources of supply of materials may be changed, if desirable, at this time.

- B. Concrete Mix Control: Furnish, at the Contractor's own expense, continuous plant control of the concrete by securing the services of an independent local testing laboratory, sufficiently experienced. The following tests and inspections shall be required:

1. Check incoming aggregates, fine and coarse, for gradations, specific gravity, unit weight, abrasion wear, etc.
2. Determine moisture contents of the aggregates to adjust bin weights to comply with designs.
3. Make all concrete designs in accordance with the applicable specifications.
4. Check scales as needed for accuracy.
5. Help maintain proper slumps, as specified.
6. Send inspection reports for each day's operations.
7. Check fibrous reinforcement for conformance as specified.

8. If the characteristics of the aggregate furnished in the design are such that when mixed with the minimum allowable amount of cement and the maximum allowable amount of water, the slump and workability requirements are not met or if free water comes to the surface of the slab during finishing operations, as specified, add mineral filler or cement only to the limits provided in Paragraph 2.01.D, or may be required to redesign of the concrete mix. When the finishing machine has gone over an area twice and all surface voids are not filled, the workability shall be considered as unsatisfactory, terminate concreting operations and redesign the concrete mix.

C. Laboratory Testing:

1. Material samples submitted for approval shall be sufficiently large to permit the Owner's independent testing laboratory-to-laboratory batch the construction of test beams to check the adequacy of the design. When the design mix has been approved, there shall be no change or deviation from the proportions thereof or sources of supply except as hereinafter provided. No concrete shall be placed on the job site until the mix design has been approved by the Engineer in writing to the Contractor.
2. The concrete shall contain not less than 5 sacks of cement per cubic yard. Total water shall not exceed 7 gallons per sack of cement. The mix shall be uniform and workable. The amount of coarse aggregate (dry-loose volume) shall not be more than 85 percent per cubic yard of concrete.
3. The net amount of water shall be the amount added at the mixer plus the free water in the aggregate or minus the amount of water needed to compensate for absorption by the aggregates. Free water or absorption determinations shall be based on a 30 minute absorption period. No water allowance shall be made for evaporation after batching.
4. When gauged by the standard slump test, the settlement of the concrete shall not be less than 3 inches nor more than 5 inches.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Submittal Procedures."
- B. Within a period of not less than 10 days prior to the start of concreting operations, submit to the Engineer a design of the concrete mix he proposes to use together with samples of materials to be incorporated into the mix and a full description of the source of supply of each material component. The design of the concrete mix shall conform to the provisions and limitation requirements of these specifications.
- C. Manufacturer's Certified Test Reports for each lot of silicone joint sealant shipped to the project site.

1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
  1. ASTM International (ASTM) Standards:

|            |                                                                 |
|------------|-----------------------------------------------------------------|
| ASTM A1064 | Specification for Steel Wire, Plain, for Concrete Reinforcement |
|------------|-----------------------------------------------------------------|

|            |                                                                                                                                                    |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| ASTM A1064 | Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement                                                                     |
| ASTM C39   | Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens                                                                    |
| ASTM C94   | Standard Specification for Ready-Mixed Concrete                                                                                                    |
| ASTM C143  | Standard Test Method for Slump of Hydraulic-Cement Concrete                                                                                        |
| ASTM C150  | Specification for Portland Concrete                                                                                                                |
| ASTM 156   | Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete                         |
| ASTM 172   | Standard Practice for Sampling Freshly Mixed Concrete                                                                                              |
| ASTM A184  | Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement                                                                    |
| ASTM C231  | Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method                                                              |
| ASTM C293  | Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)                                                        |
| ASTM C309  | Specification for Liquid Membrane-Forming Compounds for Curing Concrete                                                                            |
| ASTM A615  | Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement                                                                  |
| ASTM A616  | Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement                                                      |
| ASTM C679  | Standard Test Method for Tack-Free Time of Elastomeric Sealants                                                                                    |
| ASTM C719  | Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)                                 |
| ASTM A1064 | Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete                                       |
| ASTM C946  | Standard Specification for Ready Mix Concrete                                                                                                      |
| ASTM C1077 | Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation         |
| ASTM C1116 | Standard Specification for Fiber-Reinforced Concrete                                                                                               |
| ASTM D412  | Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension                                                                   |
| ASTM D792  | Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement                                              |
| ASTM D793  | Method of Test for Short-Time Stability at Elevated Temperatures of Plastics Containing Chlorine (Withdrawn 1981)                                  |
| ASTM D2240 | Standard Test Method for Rubber Property—Durometer Hardness                                                                                        |
| ASTM D1751 | Specification for Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types) |
| ASTM E329  | Standard Specification for Agencies Engaged in Testing and/or Inspection of Materials used in Construction                                         |

## 2. Military Standard for Testing and Materials (MIL S) Standards:

|            |                                                                                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MIL S 8801 | Reference MIL S 8802                                                                                                                                                          |
| MIL S 8802 | MIL-S-8802F, MILITARY SPECIFICATION: SEALING COMPOUND, TEMPERATURE-RESISTANT, INTEGRAL FUEL TANKS AND FUEL CELL CAVITIES, HIGH-ADHESION (07 MAR 1990) [S/S BY SAE-AMS-S-8802] |

## 1.05 JOB CONDITIONS

- A. Should the Contractor desire to use Type III cement in lieu of Type I, permission to do so must be secured from the Engineer in writing before use. When such use is granted, the concrete produced shall meet the requirements specified herein.
- B. When Type III cement is used, either as required on the plans or as an option to Type I cement, the average tensile strength of briquettes at the age of 28 days shall be higher than that attained at 3 days.
- C. Any cement which, for any reason, has become partially set or which contains hard lumps or cakes shall be rejected.
- D. The following special requirements apply to this Work:
  - 1. After a joint has been sealed, promptly remove surplus sealant or other residue on the pavement or structure surfaces.
  - 2. If a primer is recommended by the Manufacturer, use primer in accordance with such recommendations. When required, apply primer before installing backup material.
  - 3. Equipment compressors used for cleaning joints with suitable traps capable of removing surplus water and oil in the compressed air. The Engineer shall check the compressed air daily for contamination. Do not use contaminated air. The compressor shall be capable of delivering compressed air at a continuous pressure of at least 90 psi.
  - 4. Do not permit traffic over sealed joints until the sealant is tack free, cured sufficiently to resist displacement of the sealant due to slab movement or other causes, and until debris from traffic does not imbed into the sealant.
  - 5. Any of the following conditions at the sealed joint shall be cause for rejection and repair of the joint:
    - a. Adhesion or cohesion failure of joint sealant material.
    - b. Unsatisfactory or improper workmanship by Contractor.
    - c. Damage by Contractor's operations or public traffic.
    - d. Damage to the sealant due to displacement of the sealant from slab movements or insufficient cure before opening to traffic.

## 1.06 OPTIONS

- A. Bulk cement meeting the above ASTM specifications may be used provided the manner and method of handling and storing is approved by the Engineer. When cement is delivered in bulk, the brand and the Manufacturer's name, as contained in the shipping invoices accompanying the shipment, shall be furnished to the Engineer prior to use of the cement.

## 2.00 PRODUCTS

### 2.01 MATERIALS

#### A. Cement:

1. Cement shall conform to ASTM C150 for Type I. If high-early-strength Portland cement is required, it shall conform to ASTM C150 for Type III, and current revisions.
2. Cement delivered in bags shall be marked plainly with the brand and name of the Manufacturer on the bag. A bag shall contain 94 pounds net. Bags shall be in good condition at the time of use. Bags of cement varying more than 5 percent from the specified weight shall be rejected, and if the average net weight of bags in any shipment, as shown by weighing 50 bags taken at random, is less than 94 pounds, the entire shipment shall be rejected. Do not use cement salvaged from discarded or used bags.

#### B. Coarse Aggregate:

1. Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, or a combination of these materials of which the maximum permissible percentage of deleterious substances, by weight, shall not exceed the following:

| Coarse Aggregate – Deleterious Substances                                                                        |       |
|------------------------------------------------------------------------------------------------------------------|-------|
| Material removed by decantation                                                                                  | 1.0%  |
| Shale, slate, or similar materials                                                                               | 1.0%  |
| Clay lumps                                                                                                       | 0.25% |
| Soft fragments                                                                                                   | 3.0%  |
| Other deleterious substances including friable, thin elongated, or laminated pieces                              | 3.0%  |
| The sum of all deleterious ingredients, exclusive of material removed by decantation, shall not exceed by weight | 5.0%  |

2. The aggregate shall be free from an excess amount of salt, alkali, vegetable matter, or other objectionable matter. At the time of its use the aggregate shall be free from frozen material and all foreign material which may have become mixed with it in the stockpiles.
3. The coarse aggregate shall consist of sound particles having a percent of wear not more than 45 (Test Method TEX-410-A) and shall be mixed so that when tested by standard laboratory sieves, the coarse aggregate meets the following requirements:

| Coarse Aggregate Requirements             |             |
|-------------------------------------------|-------------|
| Retained on 1-1/4" sieve                  | 0%          |
| Retained on 1-1/2" sieve                  | 0% to 5%    |
| Retained on 3/4" sieve                    | 30% to 65%  |
| Retained on 3/8" sieve                    | 70% to 90%  |
| Retained on No. 4 sieve                   | 95% to 100% |
| Loss by Decantation Test Method TEX-604-A | 1% max.     |

4. Coarse aggregate of different characteristics, though tested and approved, shall not be mixed with other aggregates; but shall be stored, batched, and weighed separately.

C. Fine Aggregate:

1. Fine aggregate shall consist of sand or a mixture of sands with or without mineral filler. The sand or mixture of sand comprising one fine aggregate shall consist of clean, hard, durable, uncoated grains and shall be free from lumps. The maximum permissible percentage, by weight, of deleterious substances shall not exceed the following:

| Fine Aggregate – Deleterious Substances                                                   |      |
|-------------------------------------------------------------------------------------------|------|
| Material removed by decantation                                                           | 3.0% |
| Other deleterious substances such as coal, shale, coated grains, and soft flaky particles | 3.0% |

2. An additional loss of 2 percent by decantation may be allowed provided this additional loss is material of the same quality as specified for fine aggregate or mineral filler.
  - a. The fine aggregate shall be free from an excess amount of salt or alkali and at the time of use shall be free from frozen material and foreign material.
  - b. When tested for organic impurities the fine aggregate shall not have a color darker than the standard color.
  - c. The fine aggregate shall be well graded from fine to coarse and when tested by standard laboratory sieves shall meet the following requirements:

| Fine Aggregate - Gradation |             |
|----------------------------|-------------|
| Retained on 3/8" sieve     | 0%          |
| Retained on No. 4 sieve    | 0% to 5%    |
| Retained on No. 8 sieve    | 0% to 20%   |
| Retained on No. 16 sieve   | 15% to 50%  |
| Retained on No. 30 sieve   | 35% to 75%  |
| Retained on No. 50 sieve   | 70% to 90%  |
| Retained on No. 100 sieve  | 90% to 100% |
| Retained on No. 200 sieve  | 97% to 100% |

3. Fine aggregate of different characteristics shall not be mixed prior to batching, but shall be weighed and batched separately.
4. Fine aggregate will be subjected to the sand equivalent test (test method TEX-203-F). The sand equivalent value shall not be less than 80.

- D. Mineral Filler: Stone dust, crushed sand, or crushed shell may be added as a mineral filler, if so directed by the Engineer, in amounts not to exceed 5 percent of the fine aggregate to improve the workability or plasticity of the concrete mix. Such mineral filler must be of the quality specified for fine or coarse aggregate and when tested by standard laboratory sieves shall meet the following requirements:

| Mineral Filler - Gradation |
|----------------------------|
|----------------------------|

|                           |           |
|---------------------------|-----------|
| Retained on No. 30 sieve  | 0%        |
| Retained on No. 200 sieve | 0% to 35% |

- E. **Mixing Water:** Water for use in concrete and for curing shall be free from oil, acids, organic matter or other deleterious substances and shall not contain more than 1000 parts per million of chlorides as Cl nor more than 1000 parts per million of sulfates as SO<sub>4</sub>. Water from municipal supplies approved by the State Health Department will not require testing, but water from other sources shall be sampled and tested before use.
- F. **Steel Dowel Bars:** Steel dowel bars, if shown and required on the plans, shall be of the size and type indicated and shall be open hearth, new billet steel of intermediate or hard grade conforming to the requirements of ASTM A615. The free end of dowel bars shall be smooth and free of shearing burrs.
- G. **Dowel Caps:** Provide dowel caps when required by the drawings. Encase one end of each dowel bar with an approved cap having an inside diameter of 1/16 inch greater than the diameter of the dowel bar. The cap shall be of such strength, durability, and design as to provide free movement of the dowel bar and shall be filled with a soft felt plug or shall be void in order to permit free movement of the dowel bar for a distance of 1-1/2 times the width of the expansion joint used. Securely hold the dowel caps and dowel bars in place.
- H. **Bar Coating:** When bar coating is required, the material may be any standard grade of oil asphalt and shall be applied hot.
- I. **Steel Bar Reinforcement:** Steel reinforcing bars shall be of the size and type indicated and shall be open hearth new billet steel of structural, intermediate, or hard grade, ASTM A615, Grade 60 or shall be rail steel concrete reinforcement bars, ASTM A616, Grade 60. Steel shall be bent cold. When tie bars are to be bent they shall be Grade 40 conforming to requirements of ASTM A615.
- J. **Reinforcing Mats:** When deformed bars are specified, the forms of the bar shall be such as to provide a net sectional area at all points equivalent to that of a plain square or round bar of equal nominal size. Fabricated steel bar or rod mats shall meet the current requirements of ASTM A184.
- K. **Steel Wire Fabric Reinforcement:** When steel wire fabricated reinforcement is specified, or permitted as an option, the wire fabric shall conform to the gauge and wire spacing shown on the plans and the requirements of ASTM A1064. Longitudinal and transverse wires shall be electrically welded together at all points of intersection and the welds shall be of sufficient strength so not to break during handling or placing. Welding and fabrication of the fabric sheets shall conform to the requirements of ASTM A1064. Welded steel wire fabric shall be furnished in flat sheets as per plan dimensions and steel fabric having been previously bundled into rolls shall not be accepted. If wire fabric is used, it shall replace only the longitudinal and transverse bars. The tie bars and load transmission units at joints shall not be affected.
- L. **Drainage Course:** The crushed stone drainage course shall be Class 1 aggregate fill as specified in Section 31 05 16 "Aggregates for Earthwork."



## 2.02 MIXES

- A. Concrete shall be composed of Type I cement or Type III cement, coarse aggregate, fine aggregate, mineral filler, and water. Type III cement shall be used only when specifically approved by the Engineer in writing and the concrete made therewith shall be subject to all applicable provisions of these specifications. Mix shall comply with approved laboratory design or adjusted mix proportions.

## 2.03 MANUFACTURED PRODUCTS

- A. Reinforcement Chairs: Reinforcing steel, tie bars, dowels, etc., shall be placed and held securely in place during placing of concrete by steel or plastic chairs approved by the Engineer. These chairs shall be placed at every other intersection of longitudinal and transverse bars.
- B. Joint Filler:
  - 1. Joint filler shall consist of boards or a pre-molded bituminous fiber of the size, shape, and type indicated.
  - 2. Redwood Boards: Boards used as a filler shall be sound heartwood obtained from redwood. Boards shall be of selected stock and shall be free from sapwood, knots, cluster bird's eye, checks, and splits. Occasional sound or hollow bird's eye, when not in clusters, shall be permitted, provided the board is otherwise free of any defects that may impair the usefulness as a joint filler. The board, when tested in the condition as used in the pavement, shall have a compressive resistance of not more than 1500 pounds per square inch in compressing to one-half of its original thickness.
  - 3. Fiber Board: Fiber used for filler shall be preformed strips which have been formed of cane or other suitable fibers of a cellulose nature securely bound together and uniformly and thoroughly impregnated with a suitable asphaltic binder. Fiber joint fillers shall meet the requirements of ASTM D1751.
- C. Joint Sealing Material:
  - 1. The sealant shall be furnished in a one-part silicone formulation which does not require a primer for bond to concrete. The compound shall be compatible with the surface to which it is applied. Acid cure sealants are not acceptable for use on concrete. Apply the sealant with a pressure applicator that forces it into the joint. Silicone rubber joint seals shall exhibit an adequate bond to concrete when subjected to testing.
  - 2. The silicone sealant shall meet the requirements of Table I. Sealant may be accepted for immediate use on the basis of Manufacturer's certified test results which indicate the material meets the requirements of Table I. Each lot of sealant shall be delivered in containers plainly marked with the Manufacturer's name or trademark and a lot number. The Manufacturer shall furnish certified test results of each lot of joint sealant shipped to the project. The Manufacturer shall also indicate the date of shipment on each lot. Material shall not be used after 6 months from the date of shipment from the manufacturer without first being sampled and tested. Foam back-up rod may be accepted based on visual inspection by the Engineer.
- D. Membrane Curing Compound:
  - 1. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

2. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
3. Water: Potable.
4. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
  - a. Products:
    - 1). Axim Concrete Technologies; Cimfilm.
    - 2). Burke by Edeco; BurkeFilm.
    - 3). ChemMasters; Spray-Film.
    - 4). Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
    - 5). Dayton Superior Corporation; Sure Film.
    - 6). Euclid Chemical Company (The); Eucobar.
    - 7). Kaufman Products, Inc.; Vapor Aid.
    - 8). Lambert Corporation; Lambco Skin.
    - 9). L&M Construction Chemicals, Inc.; E-Con.
    - 10). MBT Protection and Repair, ChemRex Inc.; Confilm.
    - 11). Meadows, W. R., Inc.; Sealtight Evapre.
    - 12). Metalcrete Industries; Waterhold.
    - 13). Nox-Crete Products Group, Kinsman Corporation; Monofilm.
    - 14). Sika Corporation, Inc.; SikaFilm.
    - 15). Symons Corporation; Finishing Aid.
    - 16). Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
5. White Waterborne Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B.
  - a. Products:
    - 1). Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
    - 2). Burke by Edoco; Resin Emulsion White.
    - 3). ChemMasters; Safe-Cure 2000.
    - 4). Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
    - 5). Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
    - 6). Euclid Chemical Company (The); Kurez VOX White Pigmented.
    - 7). Kaufman Products, Inc.; Thinfilm 450.
    - 8). Lambert Corporation; Aqua Kure-White.
    - 9). L&M Construction Chemicals, Inc.; L&M Cure R-2.
    - 10). Meadows, W. R., Inc.; 1200-White.

- 11). Symons Corporation; Resi-Chem White.
- 12). Tamms Industries, Inc.; Horncure 200-W.
- 13). Unitex; Hydro White.
- 14). Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

E. Concrete Mixtures:

- 1. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
  - a. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- 2. Proportion mixtures to provide normal-weight concrete with the following properties:
  - a. Compressive Strength (28 Days): 4000 psi.
  - b. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
  - c. Slump Limit: 5 inches, plus or minus 1 inch.
  - d. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
  - e. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
  - f. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.
- 3. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- 4. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - a. Use water-reducing admixture in concrete, as required, for placement and workability.
  - b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- 5. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb./cu. yd.

2.04 EQUIPMENT

- A. General: The equipment necessary for the construction of this item shall be on the project and shall be approved by the Engineer as to condition before the Contractor is permitted to begin construction operations on which the equipment is to be used.
- B. Field Laboratory: A field laboratory structure shall be required only when specifically required and provided for in the Special Provisions.

C. Cement Weighing and Batching Equipment:

1. Where bulk cement is used, the method of handling and the handling equipment shall be inspected and approved by the Engineer. Cement shall be fully protected from contamination or damage during handling.
2. Cement shall be batched by weight and scales shall be of the beam or springless dial type and shall be the product of a reputable manufacturer. Scales not accurate to a tolerance of 4 pounds per 1000 pounds net load in the hopper shall not be used. The value of the minimum gradation on any type scale shall not be greater than 5 pounds.
3. The scales shall be so constructed as to indicate to the operator that the required load in the hopper or container is being approached; similarly they shall also indicate when the hopper or container is empty. The indicator shall show at least the last 50 pounds of the load. After cement is weighed, protect cement from damage or loss in handling or in transit.

D. Aggregate Weighing Equipment:

1. Aggregate weighing equipment shall conform to the following general requirements and shall be approved by the Engineer prior to use.
2. The storage bins shall be of a suitable size and shape to adequately meet the needs of the weighing and batching equipment. The framework and foundation shall be adequate to support the total imposed loads.
3. The weighing hopper or container shall be of sufficient size and tight enough to hold the entire load without leakage, shall be supported entirely upon the scales, and shall be free of other supports. The hopper or container shall be so constructed as to permit easy and sufficient removal of any overload. The discharge gate shall have a substantial latch which holds tightly in place during introduction of the aggregate into the hopper. When more than one aggregate size is to be weighed in a single hopper there shall be a separate compartment for each size so arranged that each could be discharged separately and the overload of any compartment easily removed.
4. Scales shall conform to the requirements as provided under Paragraph **[2.05C]** of this specification and in addition thereto the indicator requirement (paragraph 2) shall be amended to show at least the last 200 pounds of the load.
5. Aggregate weighing equipment shall be fully loaded for 5 hours before testing and using in order to allow settlement and adjustment under working conditions.

E. Planer and Templates:

1. A subgrade planer shall be furnished and shall be operated immediately ahead of the paving operations. The planer shall be equipped with adjustable blades which trim the subgrade to the exact section as shown on the plans. The planer shall be supported on wheels that travel on the side forms and shall be so constructed on wheels that are plainly visible during operations and must be heavy enough to remain on the form at all times. The frame shall be of such strength and rigidity that should the support of the planer be transferred from the wheels to the center, there shall not be a deflection of more than 1/8 inch.

2. A template shall be provided having adjustable rods projecting downward at 1-foot intervals. The bottom of these rods shall be adjusted to the true cross-section of the bottom of the slab when the template rests upon the side forms. The template shall be of sufficient strength and rigidity that the deflection at the center shall be no greater than 1/8 inch, should the support be transferred to that point.

F. Mixer:

1. Unless otherwise provided for or approved by the Engineer, the paving mixer shall be of a capacity of not less than a 27-E paver; mixer rating to be as established by the Mixer Manufacturer's Bureau of the Associated General Contractors. The paving mixer shall be provided with a boom and bucket for placing concrete or with a full width mechanical spreading or placing machine of approved design. The motor shall be provided with a governor to regulate the speed of the mixer drum within a limit of 16 to 20 revolutions per minute. The mixer shall be equipped with an automatic attachment for satisfactorily timing the mix and locking the discharging device so as to prevent the discharging of the mixer until the materials have been mixed together for the minimum time required. This attachment shall be operated independently of the drum and shall have a bell in operation at all times to indicate the completion of the mixing time. The bell shall be such that it can be plainly heard at a distance of 50 feet from the mixer.
  2. Dual drum mixers may be used provided their operations shall be properly synchronized so as to permit a minimum mixing time of 60 seconds exclusive of the time required to transfer the materials from the first to the second drum.
  3. The distribution bucket shall be tightly constructed and of a sufficient capacity to hold an entire batch of concrete. The discharge gate shall be so constructed as to give a uniform distribution of the concrete on the subgrade without segregation.
  4. The paver shall be equipped with a water measuring device of sufficient accuracy that it will measure the water within one percent of the amount required per batch. The measuring device shall be so constructed that it opens to atmospheric pressure when the measured amount of water is in it and shall be so placed and constructed that the measured amount of water required for a single batch of concrete can be discharged into a calibrated tank or weighing device. The water measuring device shall be checked daily for accuracy.
  5. When the use of a mixer of a capacity less than 27-E paver is permitted, it shall be of an approved type and so designed as to positively insure the uniform distribution of the materials throughout the mass and insure the discharge of the batch without segregation.
- G. Forms: The side forms shall be metal, of approved cross-section and bracing, of a height not less than the prescribed edge thickness of the concrete section, and a minimum of 10 feet in length for each individual form. Forms shall be of ample strength and shall be provided with adequate devices for secure setting so that when in place forms withstand the impact and vibration of equipment imposed thereupon without appreciable springing or settlement. In no case shall the base width be less than 8 inches for a form 8 feet or more in height. The forms shall be free from warps, bends, or kinks and shall show no variation from the true plane for face or top. Each 10-foot length of forms shall be provided with at least three pins for securely staking in position. Sufficient forms shall be provided for satisfactory prosecution of the work. The 10-foot metal form sections shall be used in forming curves with a 250-foot

and larger radius. For curves with a radius of less than 250 feet, acceptable flexible metal forms or wood forms may be used upon approval of the Engineer.

**H. Finishing Equipment:**

1. Pavement shall be machine or hand finished except as hereinafter provided. The finishing machine shall be power-driven, equipped with two screeds, and a tamp. The finishing machine shall be so designed, equipped, and operated as to strike off, consolidate, and compact the concrete. Strike-off grade shall be to the flowline of the gutter.
2. Alternate floating and finishing equipment may be substituted for the equipment specified herein, when approved by the Engineer in writing, provided the finished surface conforms to the surface test requirements of Paragraph 3.07.
3. Hand finishing shall not be permitted except in intersections, driveways, and parking areas inaccessible to a finishing machine. Provide a strike template 2 x 6 lumber at least 2 feet longer than the width of the pavement to be finished. The strike template shall be so constructed as to leave a sufficient amount of concrete above the finished surface to allow for tamping. The tamping template shall be cut to the crown section and shall have a 3/8-inch steel face. There shall also be provided a hand operated longitudinal float with wood face, of approved design, 12 to 16 feet in length, or an approved type of mechanical float with not less than 10 feet of longitudinal screed. There shall be furnished a sufficient number of bridges for the operation of the longitudinal float and for finishing all joints. Furnish edging and finishing tools required to complete the slab in accordance with the plans and specifications.
4. Furnish a belt of canvas-rubber composition, two- to four-ply, not less than 8 inches nor more than 10 inches wide, and at least 2 feet longer than the width of the slab, or furnish a burlap drag consisting of not less than two layers of burlap, not less than 3 feet wide, and at least 2 feet longer than the width of the pavement.
5. Furnish and maintain at least two standard 10-foot straightedges on the job at all times.

### **3.00 EXECUTION**

#### **3.01 PREPARATION**

- A. Prepare subgrade to receive the pavement geotextile and drainage course as specified in Section 31 32 19.15 "Geotextile". Any section of the subgrade which does not meet the requirements of those sections of the specifications immediately prior and following to the placement of the geotextile and drainage course shall be reprocessed and re-compacted to be in full compliance with specification requirements.

#### **3.02 INSTALLATION**

- A. Geotextile: Install the geotextile on the prepared subgrade as indicated and as specified in Section 31 32 19.15 "Geotextile."
- B. Drainage Course:
  1. Install the drainage course on the prepared subgrade in conjunction with the geotextile as indicated and as specified in Section 31 32 19.15 "Geotextile."

2. After being spread to the specified thickness, compact the drainage course by rolling with a minimum of eight passes of a vibratory roller of the type specified in Section 31 23 23.16 "Compacted Earth Fill [Landfills and Heavy Earthwork Projects, Excluding Dams]." The drainage course shall not require specific compaction testing, but shall receive not less than eight passes by the specified vibratory roller. Increase the number of passes, if necessary, to fully densify and interlock the aggregate particles.
3. The completed surface of the drainage course shall be within a tolerance of +0.00 and - 0.04 foot of the lines and grade indicated. The minimum thickness of the drainage course at any point in the completed course shall not be less than the thickness indicated on the plans.
4. If regrading or reshaping of the surface of the drainage course is required to meet the specified tolerances, reroll the surface with the vibratory roller as specified.
5. Protect the completed drainage course from all traffic which might loosen, contaminate with soil or otherwise damage the course, until the next course of surface course is installed. If the drainage course should become contaminated with soil from runoff or otherwise, replace those contaminated areas prior to proceeding with the next course.

### 3.03 PLACING AND REMOVING FORMS

- A. Set forms to line and grade at least 100 feet, where practicable, in advance of the paving operations. Adequately stake forms with at least three pins per 10-foot section. Forms shall be capable of resisting the pressure of concrete placed against them and the thrust and the vibration of the construction equipment operating upon them without appreciable springing or settlement. Neatly and tightly join the forms and set with exactness to the established grade and alignment. Forms must be in firm contact with the subgrade throughout the length and base width. If the subgrade becomes unstable, reset the forms using heavy stakes or other additional supports as necessary to provide the required stability.
- B. When forms settle over 1/8 inch under finishing operations, stop paving operations, reset the forms to line and grade, and bring the pavement to the required section and thickness.
- C. Thoroughly clean forms after each use and oil forms before reuse.
- D. Forms shall remain in place until the concrete has taken its final set. At the time the forms are removed, bank earth against the sides of the slab and immediately and thoroughly wet.
- E. Form super-imposed curb from the flow line of the gutter to the top of curb. Expansion joints in the curbs shall conform to the joint locations in the slab.

### 3.04 PLACING REINFORCING STEEL, TIE, AND DOWEL BARS

- A. Reinforcing steel, welded wire mesh, tie bars, dowels, etc. shall conform to the provisions set out under Paragraphs 2.01.F-2.01.K and 2.03.A and shall be placed as shown on the plans. Reinforcing shall be clean, free from rust in the form of loose or objectionable scale, and of the type, size, and dimensions shown on the plans. Securely wire reinforcing bars together at all intersections and splices and securely wire to each dowel and load transmission unit intersected. Install bars in their required position.
- B. Install reinforcing bars and bar mats in the slab at the required depth below the finished surface and support by and securely wiring to reinforcement chairs installed on prescribed

longitudinal and transverse centers as shown by section and detailed drawings on the plans. After the reinforcing steel is securely installed above the subgrade, there shall be no loading imposed upon (or walking upon) the bar mats or individual bars before or during the placing or finishing of the concrete.

- C. Where welded wire fabric reinforcement mats are necessary, place and struck off the concrete by means of a template to the depth below the finished surface as specified for the location of the mesh. Place welded wire mats, conforming to the specified side lap and end splice requirements upon the struck surface, and place the remainder of the concrete with finishing operations proceeding immediately. There shall be no loading imposed upon the mesh mats after installation in the slab concrete.
- D. Expansion joints or dummy joints which may require an assembly of parts supported by special devices shall be completely assembled and rigidly supported in the correct position well in advance of the placing of concrete.

### 3.05 JOINTS

#### A. Expansion Joints:

1. Install expansion joints perpendicular to the surface and to the center line of the pavement at the locations indicated. Joint filler shall be a pre-molded asphaltic type or redwood boards of the size and shape specified. The oven-dry weight of the wood shall not exceed 30 pounds per cubic foot. Board joint material with less than 25 percent of moisture at the time of installation shall be thoroughly wetted on the job. Green lumber of much higher moisture content is desirable and acceptable.
2. Appropriately drill the joint filler to admit the dowel bars. Extend the bottom edge of the filler to or slightly below the bottom of the slab and hold the top edge approximately 1/2 inch below the finished surface of the pavement in order to allow the finishing operations to be continuous. Where the joint filler is of a pre-molded asphaltic type, protect the top edge by a metal cap of at least 10 gauge material having flanges not less than 1-1/2 inches in depth. The channel cap may remain in place during the joint finishing operations to serve as a guide for tooling the edges of the joint. After the removal of the side forms, carefully open the ends of the joints at the edges of the slab for the entire depth of the slab. The joint filler may be composed of more than one length of board in the length of the joint, but no board of a length less than 6 feet may be used unless otherwise shown on the plans.
3. Where a monolithic curb or a separate curb and gutter are used, the expansion joints therein shall coincide and be continuous with the pavement joint and of the same size and type.
4. When the pavement is adjacent to or around existing structures, construct expansion joints in accordance with the details shown on the plans.
5. Install dowel bars through the pre-drilled joint filler and rigidly support in true horizontal and vertical positions by an assembly of bar chairs and dowel holders welded to transverse bars extending across the slab and placed on each side of the joint.

- B. Contraction Joints: Install contraction joints at the locations and at the intervals indicated. Construct the joints by sawing to the width and to the depth indicated. Saw joints into the completed pavement surface as soon after initial concrete set as possible to control cracking,



but with enough lapsed time to prevent any damage by blade action to the slab surface and to the concrete immediately adjacent to the joint. Restore any portion of the curing membrane which has been disturbed by sawing operations by spraying the areas with additional curing compound. In the absence of joint sawing instructions on the plans, conduct and complete sawing operations within a time period of 5 to 12 hours after the concrete slab is poured including the sealing operation.

- C. Construction Joints: Construct construction joints formed at the close of each day's work or when the placing of concrete has been stopped for 30 minutes or longer by use of metal or wooden bulkheads cut true to the section of the finished pavement and clean and oil. Wooden bulkheads shall have a thickness of not less than 2-1/2 inches. Longitudinal bars shall be continuous through the construction joints. Securely hold the bulkheads in place in a plane perpendicular to the surface and at right angles to the center line of the pavement. Round edges to a 1/4-inch radius. Remove any surplus concrete on the subgrade upon the resumption of the work. In no case shall an emergency construction joint be placed within 8 feet following a regular installation of expansion or contraction joint. If the emergency construction joint should fall within this limitation, remove the concrete back to the previously installed joint.
- D. Longitudinal Parting Strips: Accurately place longitudinal parting strips or planes of weakness, when required.
- E. Longitudinal Construction Joints: Longitudinal construction joints shall be of the type indicated. Longitudinal construction joints shall be constructed accurately to the required lines in order to coincide with traffic lane lines. No width between longitudinal construction joints shall exceed 24 feet, unless specifically authorized or directed by the Engineer in writing. Construct concrete curbs as an integral part of the pavement.

### 3.06 MIXING

- A. Mix concrete in an approved method conforming to the requirements of this specification. Ready-mix concrete shall be permitted in lieu of the paver-mixer. When ready-mix concrete is used, provisions of ASTM C94 Alternate No. 2 shall govern. Materials for concrete placed in pavements shall conform to the requirements of the governing item of this specification.
  - 1. Batch Mixing including Material Transportation: Mix the concrete in a batch-mixer, as indicated and only in the quantities required for immediate use. The mixing of each batch shall continue for a period of not less than 1 minute after all materials comprising the batch are in the mixer. The mixer discharge gate shall be locked by the automatic timing device until the required time has elapsed. The entire contents of the drum shall be discharged before any materials are placed therein for the succeeding batch. Retempering or remixing shall not be permitted.
    - a. Batch boxes, containers, or vehicle bodies used in transporting material from the proportioning plant to the mixers shall be tight and of a sufficient size to hold a batch of maximum size with a margin of safety to prevent spillage. The batch must be protected when hauling is in progress so as to positively prevent any loss of material and minimize loss of moisture by evaporation. On long length hauls, this may require tarpaulin covers. Partitions intended to separate batches shall be adequate and effective in preventing material spilling from one compartment into another while in transit or when being dumped.

- b. When cement is transported in the original package, do not empty from the bags at a greater distance from the mixer than 1000 feet.
  - c. The mixer shall produce a concrete of uniform consistency and appearance. Correct spilling of the mixer by reducing the size of the batch. When a 27-E mixer is used, a maximum overload of 20 percent above the rated capacity of the mixer shall be permitted. In other size mixers, a maximum overload of 10 percent above the rated capacity of the mixer shall be permitted. Replace pick-up and throw-over blades inside the mixer drum when worn down 3/4 inch.
  - d. When the use of a mixer of a capacity greater than that of a 27-E mixer is used, increase the mixing time to 1-1/2 minutes.
  - e. Do not use concrete which has developed initial set or has been mixed longer than 30 minutes.
  - f. Thoroughly clean the mixer each time when out of operation for more than 30 minutes.
2. Transit Mixing: When transit mixing is used, the transit mixer shall be of an approved revolving drum or revolving blade type so constructed as to produce a thoroughly mixed concrete with a uniform distribution of the materials throughout the mass and shall be equipped with a discharge mechanism which insures the discharging of the mixed concrete without segregation.
- a. The mixer drum shall be water-tight when closed and equipped with a locking device which automatically prevents the discharging of the mixer prior to receiving the required number of revolutions.
  - b. Accurately measure the entire quantity of mixing water by visible calibrated mechanism. Leaking water valves shall be considered as ample reason for condemnation of the mixer unit by the Engineer and removal from the job. Mix each batch not less than 70 nor more than 100 revolutions at the rate of rotation specified by the Manufacturer as mixing speed. Any additional mixing shall be done at a slower speed specified by the Manufacturer for agitation, and shall be continuous until the batch is discharged.
  - c. Truck mixers shall be equipped with actuated counters by which the numbers of revolutions of the drum may be readily verified. The counters shall be actuated at the time of starting mixing at mixing speeds.
  - d. The rate of delivery of the mixed concrete shall be such that the interval between loads shall not exceed 10 minutes. Deliver the concrete to the site of the work and discharge from the mixer within a period of 90 minutes, or before the drum has been revolved 300 revolutions, whichever comes first, after the introduction of the mixing water with the dry materials.
3. Central Mixing Plant: A central mixing plant shall be allowed provided the method of mixing and handling has first been approved by the Engineer and concrete produced is in conformity with the specification requirements as herein provided.
- a. Mix the concrete in a batch mixer of approved type and in the same manner as indicated.

- b. Haul the concrete in vehicles so constructed and operated as to provide continuous mechanical agitation during the transportation period. The rate of delivery of the mixed concrete shall be such that the interval between loads shall not exceed 10 minutes. Deliver the concrete to the site of the work and discharge from the transporting vehicle within a period of 90 minutes after the introduction of water into the batch at the central mixing plant.
4. Commercial Concrete Plants: In the event the Contractor elects to use concrete produced by a commercial concrete plant, an agreement shall be drawn and executed by the responsible executive management of said plant granting the Engineer ingress and egress to all parts of the plant with full authority to have any and all required tests of aggregates and to observe all batching plant and/or central mixing plant operations. This regulatory access shall be applicable only to the concrete produced by the commercial plant for the work herein specified.

### 3.07 CONCRETE PLACEMENT

- A. Unless otherwise provided for on the plans, the full width of the finished pavement shall be constructed monolithically. Rapidly deposit the concrete on the crushed stone drainage course in successive batches and distribute to the required depth and for the entire width of the pavement by shoveling or other approved methods. Where bar mats or wire mesh reinforcing is specified, see Paragraphs 3.04 A, B and C for method of concrete placement. Do not use rakes in handling concrete. The placing operation shall be continuous. At the end of the day, or in case of unavoidable interruption or delay of more than 30 minutes, place a transverse construction joint at the point of work stoppage, provided the point at which work has been suspended is not less than 8 feet from the last regularly established joint. If the length is less than 8 feet, remove the concrete back to the last regularly established joint (Refer to Paragraph 3.05C).
  1. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
  2. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
  3. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
  4. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
  5. Do not add water to fresh concrete after testing.
  6. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
  7. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
    - a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side

- forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
8. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
    - a. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
  9. Screed pavement surfaces with a straightedge and strike off.
  10. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
  11. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
  12. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
    - a. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
  13. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
  14. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
    - a. When air temperature has fallen to or is expected to fall below 40 F (4.4 C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 F (10 C) and not more than 80 F (27 C) at point of placement.
    - b. Do not use frozen materials or materials containing ice or snow.
    - c. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
  15. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
    - a. Cool ingredients before mixing to maintain concrete temperature below 90 F (32 C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

- b. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
- c. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.08 FINISHING

#### A. Machine Finishing:

1. When the concrete has been deposited, level and strike off concrete to such elevation that when mechanically screeded and tamped the concrete is thoroughly compacted and finished to the required line, grade, and section with surface voids filled. Where bar mats or wire mesh reinforcing is specified, see Paragraphs 3.04.A and 3.04.B for method of procedure.
2. After the finishing machine has processed the concrete surface, use the longitudinal float on the surface. Operate the float from parallel bridges or float carriages moving on the side forms. Operate the float transversely across the slab with a sawing motion, always maintaining the float parallel to the center line of the pavement, in such a manner as to remove variations in the surface. Add concrete to fill minor depressions, if needed, during the longitudinal floating operation. The longitudinal float shall not be moved ahead more than one-half its length at each time. The longitudinal float must be maintained straight and free from warp at all times. Take care to preserve the true cross-section of the pavement.
3. While the concrete is still workable, test for irregularities with a 10-foot straightedge placed parallel to the center line of the pavement so as to bridge depressions and to touch high spots. Ordinates measured from the face of the straightedge to the surface of the pavement shall at no place exceed 1/16 inch per foot from the nearest point of contact, and in no case shall the maximum ordinate to a 10-foot straightedge be greater than 1/8 inch. Rework and refinish any surface not within the tolerance limits.
4. While the concrete is still workable, give the surface final belting in order to produce a uniform surface of gritty texture. This belting shall be of short, rapid, transverse strokes combined with a longitudinal sweeping motion. When the burlap drag is permitted in lieu of the belting, accomplish the burlap drag finish by drawing a wet drag over the surface in a longitudinal direction to produce a uniform surface of a gritty nature.
5. Carefully tool the edges of slabs and joints requiring edging with an edger, of the radius required by the plans, at the time the concrete begins to set and becomes non-workable. Leave work smooth and true to lines.

#### B. Hand Finishing:

1. Hand finishing shall be permitted only in intersections, driveways, and parking areas inaccessible to a finishing machine.
2. When the hand method of striking off and consolidating is permitted, level and strike off the concrete, as soon as placed, and screed to such elevation above grade that when consolidated and finished the surface of the pavement is at the grade elevation shown on the plans. Vibrate the entire surface to consolidate the concrete so as to insure maximum compaction and a minimum of voids. For the strike off and consolidation, provide both a

strike template and tamping template on the work. Once in operation, move the strike template forward with a combined longitudinal and transverse motion and manipulate so that neither end of the template is raised from the forms during the striking off process. Keep a slight excess of material in front of the cutting edge at all times.

- 3. The longitudinal floating, straight edging, belting, and joint finishing shall be as specified above.

3.09 CURING

- A. The curing of concrete pavement shall be thorough and continuous throughout the entire curing period. Failure to provide proper curing as specified herein shall be considered sufficient cause for immediate suspension of the paving operations. The curing method specified herein does not preclude the use of any of the other commonly used methods of curing, and the Engineer may approve them if so requested by the Contractor. If any selected method of curing does not afford the desired results, the Engineer shall have the right to order that another method of curing be instituted. Immediately after the finishing of the surface, cover the pavement with a continuous, uniform, water-impermeable coating. The impermeable coating shall be of the type specified in Paragraph 2.03D. After removal of the side forms, the sides of the slab shall receive a like coating before earth is banked against them. Apply the solution under pressure with a spray nozzle in such a manner as to cover the entire surfaces thoroughly and completely with a uniform film.
- B. The rate of application shall be such as to ensure complete coverage and shall not exceed 200 square feet per gallon of curing compound when applied mechanically and 150 square feet per gallon of curing compound when applied by hand sprayers. When thoroughly dry, it shall provide a continuous and flexible membrane, free from cracks or pinholes, and shall not disintegrate, check, peel, or crack during the curing period. If for any reason the seal is broken during the curing period, immediately repair the seal with additional sealing solution.
- C. When tested in accordance with ASTM C156, the curing compound shall provide a film which will have retained within the test specimen the following percentages of the moisture present in the specimen when the curing compound was applied:

| Curing Compound – Moisture Retained |                          |
|-------------------------------------|--------------------------|
| Time                                | Retained Moisture (Min.) |
| After 24 hours                      | 97%                      |
| After 3 days                        | 95%                      |
| After 7 days                        | 91%                      |

3.10 CLEANING JOINTS

- A. Immediately after sawing the joint, completely remove the resulting slurry from the joint and clean the immediate area by flushing with a jet of water under pressure, and by the use of other tools as necessary. After flushing, blow out the joint with compressed air. When the surfaces are thoroughly clean and dry and just before the joint sealer is placed, use compressed air having a pressure of at least 90 psi to blow out the joint and remove traces of

dust. Equip air compressors, used for cleaning joints, with suitable traps capable of removing surplus water and oil in the compressed air.

- B. In the event freshly cut sawed joints become contaminated before they are sealed, reclean the joints as outlined above.
- C. Cleaning methods shall not alter the joint profile, including rounding of the top corners, or alter the texture of the concrete riding surface. Accomplish cleaning of the joint faces by sandblasting.

### 3.11 INSTALLING BACKER-ROD IN JOINT

- A. Prior to placing the backer-rod, thoroughly dry and clean the joint. Complete any necessary cleaning, air blasting, or air-drying before placing backer-rod and sealant. If backer-rod specified for applicable joint detail are on joints less than 1 inch wide after cleaning, install a round backer-rod of resilient material, compatible with silicone sealant, and slightly oversized to prevent movement during the sealing operation in the joint at the depth specified on the appropriate joint detail in the plans. The thickness of the backer-rod shall be greater after squeezing it into the joint and some "rebound" may occur allowance must be made for this to ensure placing at correct depth. Backer-rod shall be a readily compressible, non-reactive, non-absorptive type material such as expanded closed cell polyethylene foam rod.

### 3.12 INSTALLING SILICONE SEALANT

- A. The installation of the silicone sealant is to be done as soon after cleaning and after placing the backer-rod as reasonably possible to ensure that joint is still clean and dry. In the event the joint does become contaminated, damp, or wet, remove the backer-rod, clean and dry the joint, and reinstall a new backer-rod prior to placing the sealant material. The sealant material used shall be a low modulus silicone sealant material as specified. The temperature of the concrete surface and air at time of placement must be 40 F or higher. Apply the silicone sealant by pumping only.
- B. The pump shall be of sufficient capacity to deliver the necessary volume of material to completely fill the joint to the specified width and height of sealant in one pass. The nozzle shall be of sufficient size and shape to closely fit into the joint and introduce the sealant inside the joint with sufficient pressure to prevent voids occurring in the sealant and to force the sealant into contact with the joint faces. Tool the sealant, after being placed, to provide the specified recess depth, thickness, and shape of sealant. Apply sufficient force or pressure to the sealant in this tooling operation to force the sealant against the joint faces to ensure satisfactory wetting and bonding of the sealant to the joint faces. The silicone sealant is not self-leveling and will not position itself correctly in the joint under its own weight. Place the sealant to reasonably close conformity with the dimensions and shape shown on the plans. Any unreasonable deviation shall be cause for rejection and necessary corrective action shall be made by the Contractor.

### 3.13 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
  - 1. Elevation: 1/4 inch.
  - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.

3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

#### 3.14 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.
- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

#### 3.15 OPENING PAVEMENT TO TRAFFIC

- A. Exclude traffic from the pavement for a period of not less than 14 days unless the Engineer directs that sections be opened to traffic at an earlier date. On sections of the pavement where the use of Type III cement is required, or permitted, the pavement may be opened to traffic after 4 days. Should tests of beam specimens show a flexural strength of not less than 500 pounds per square inch, the Engineer may direct that the pavement so represented be opened to traffic in less than 14 days and for Type III cement in less than 4 days. In all cases, clean the pavement and fill and trim the joints before opening to public.
- B. When it is necessary to provide for traffic across the pavement, construct, at the Contractor's own expense, suitable and substantial crossings over the concrete which will be adequate for the traffic using same.
- C. Opening pavement to traffic shall not relieve the Contractor of responsibility for the work and shall not in any way affect the time charge on the entire project. The number of days stated in the contract shall govern for the completion of the entire work covered by the contract.

#### 3.16 FIELD QUALITY CONTROL; TESTING OF MATERIALS

- A. Samples of all materials for test shall be made at the expense of the Owner. In the event the initial sampling and testing does not comply with the specifications, all subsequent testing of the material in order to determine if the material is acceptable, shall be at the Contractor's expense at the same rate charged by the commercial laboratories.



1. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
2. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
  - a. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd., 5000 sq. ft., or fraction thereof of each concrete mix placed each day.
    - 1). When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - b. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
  - c. Air Content: ASTM C231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  - d. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40 F and below and when 80 F and above, and one test for each composite sample.
  - e. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  - f. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at 7 days and two specimens at 28 days.
    - 1). A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
3. Strength of each concrete mix will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
4. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.
5. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
6. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
7. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

8. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.17 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than 2 days before date scheduled for Substantial Completion inspections.

### 3.18 SCHEDULES

- A. See Table I for silicone sealant requirements:

| <b>Table 1 - Silicone Sealant Requirements</b>                                                                          |                                                                              |                          |
|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------|
| <b>Item</b>                                                                                                             | <b>Requirement</b>                                                           | <b>Test Method</b>       |
| Flow                                                                                                                    | 0.3" Max.                                                                    | MIL S 8801<br>ASTM D2202 |
| Extrusion rate                                                                                                          | 75-350 grams/minute                                                          | MIL S 8802               |
| Tack free time @ 77 F±1                                                                                                 | 20-90 minutes                                                                | MIL S 8802<br>ASTM C679  |
| Specific Gravity                                                                                                        | 1.010-1.515                                                                  | ASTM D792                |
| Durometer Hardness,<br>Shore A. ( 7 days cured @ 77 F±3 and<br>45-55% relative humidity                                 | 10-25 (0 F)                                                                  | ASTM D2240               |
| Tensile stress @ 150% elongation ( 7<br>day cure @ 77 F ± 3 and 45-55%<br>Relative Humidity)                            | 45 psi maximum                                                               | ASTM D412<br>(Die C)     |
| Elongation: (7 day cure @ 77 F ± 3<br>and 45-55% Relative Humidity)                                                     | 700% minimum                                                                 | ASTM D412<br>(Die C)     |
| Ozone and UV Resistance                                                                                                 | No chalking, cracking, or bond<br>loss after 5000 hours                      | ASTM D793                |
| Movement Capability and Adhesion                                                                                        | +100% and -50%; no adhesive<br>or cohesive failure after 10<br>cycles at 0 F | ASTM C719                |
| Shelf Life                                                                                                              | 6 months from date of<br>shipment from manufacturer                          |                          |
| Silicone Sealant material shall meet or exceed Federal Specifications TT-S-001543A (COM-NBS) and TT-S-00230CC (COM-NBS) |                                                                              |                          |

**END OF SECTION**

## 32 31 13 CHAIN LINK FENCES AND GATES

### 1.00 GENERAL

#### 1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment, and incidentals necessary to install chain link fences and gates. Chain link fences shall be of the industrial variety and 6-feet high. Gates shall be slide gates as indicated on the Drawings.

#### 1.02 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
1. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
    - a. Fence and gate posts, rails, and fittings.
    - b. Chain-link fabric, reinforcements, and attachments.
    - c. Gates and hardware.
    - d. Gate operators, including operating instructions.
  2. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
  3. Field Quality-Control Test Reports.

#### 1.03 STANDARDS

- A. The applicable provisions of the following references and standards shall apply as if written herein in their entirety:
1. ASTM International (ASTM):

|            |                                                                                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASTM A36   | Specification for Carbon Structural Steel                                                                                                                                     |
| ASTM A121  | Specification for Metallic-Coated Carbon Steel Barbed Wire                                                                                                                    |
| ASTM A123  | Specification for Zinc (Hot-Dip Galvanized) Coatings in Iron and Steel Products                                                                                               |
| ASTM A153  | Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware                                                                                                           |
| ASTM A1011 | Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength |
| ASTM F567  | Practice for Installation of Chain-Link Fence                                                                                                                                 |
| ASTM F626  | Specification for Fence Fittings                                                                                                                                              |

|            |                                                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------|
| ASTM F668  | Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric |
| ASTM F1184 | Specification for Industrial and Commercial Horizontal Slide Gates                                            |

2. Chain Link Fence Manufacturers Institute (CLFMI):

|            |                |
|------------|----------------|
| CLF-PM0610 | Product Manual |
|------------|----------------|

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer shall be a company engaged in the manufacturing of chain link fencing and shall be in compliance with the CLFMI.
- C. The chain link fencing shall be Standard 6 Gauge Industrial grade and shall meet the requirements of that grade, according to the CLFMI "PRODUCT MANUAL".

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on the Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.
- B. Refer to Section 03 30 00 "Cast-In-Place Concrete" for concrete post concrete fill.

1.06 DELIVERY AND STORAGE

- A. Products shall be stored at the Site on wood platforms raised above the surrounding grade and covered with weather-resistant coverings.

1.07 JOB CONDITIONS

- A. Contractor shall visit the Site and determine the conditions which must be taken into consideration in the installation of the fencing. Report any condition which could affect the quality of installation.
- B. Ascertain subsurface condition at the Site and provide drilling equipment suitable for boring to the required depth.

**2.00 PRODUCTS**

2.01 MATERIALS

- A. Chain Link Fabric: 9-gauge galvanized steel wire fabric, Class 2, having a coating weight of 1.2 ounces per cubic feet, and a 2-inch mesh. Top edge of mesh shall have selvage edge and bottom of fabric shall be twisted.
- B. Top Rail: 1-5/8-inch O.D. galvanized pipe, weighing not less than 2.27 pounds per foot, with outside sleeve-type couplings at least 6 inches long. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.

- C. Line Posts: Line posts shall be galvanized 2-inch H-columns, weighing not less than 2.72 pounds per foot, or 2.375-inch O.D. schedule 40 pipe, weighing not less than 3.65 lb/ft. Spacing not to exceed 10 feet. Fabric shall be tied to columns with 6-gauge galvanized clips on 14-inch centers and to pipe with 11-gauge galvanized steel tie wire. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.
- D. Terminal Posts: Terminal posts shall be 2.875-inch O.D. diameter, weighing 5.79 lb/ft. Posts shall be equipped with 1/4-inch by 3/4-inch tension bars, 121 gauge by 1-inch-wide tension bands, and 3/8-inch carriage bolts, bands on approximately 14-inch centers. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.
- E. Gate Posts: Posts shall be 6.625-inch O.D. weighing not less than 18.97 lb/lf. Coating: Use type A, consisting of not less than minimum 2-ounce per square foot average zinc coating per ASTM A123.
- F. Bottom Tension Wire: No. 7 galvanized or aluminum-coating spring coil or tension wire which shall hold fabric in proper alignment and be resilient so as to restore alignment when fabric is deflected.
- G. Wire Ties: 9-gauge aluminum.
- H. Post Tops: Pressed steel or malleable iron, galvanized. Top posts shall be designed to permit passage of the top rail.
- I. Stretcher Bars: One-piece galvanized steel having a minimum size of 3/16 inch by 3/4 inch.
- J. Stretcher Bar Bands: Galvanized steel or aluminum alloy conforming to ASTM F626. Tension bars shall be formed from flat or beveled steel and shall have a minimum thickness after galvanizing of 0.078 inches by 3/4 inch for posts 4-inch O.D. or less, and 0.18 inches by 7/8 inches for posts larger than 4-inch O.D.
- K. Tension Rod: 3/8-inch steel rod, hot-dip galvanized after threading, with turnbuckle or other means of adjustment.
- L. Bolts: 5/16-inch by 1-1/4-inch galvanized steel carriage bolts with nuts, or other appropriate fasteners according to the application.
- M. Structural and Miscellaneous Steel: Rolled steel shapes conforming to ASTM A36, galvanized according to ASTM A123.
- N. Swing Gate Frames: Gates shall be fabricated of 2-inch O.D. pipe, weighing not less than 2.72 lb/ft. Gates shall be welded construction, galvanized after fabrication. Gates shall have 180-degree swing hinges, positive latching devices with provision for padlock, and adequate bracing, center rest, and semi-automatic catch to secure gate in open position.
- O. Gates: Gates shall be covered with same fabric as fence. Double gates shall be supplied with positive center stop.
- P. Gate Diagonal Bracing: 3/8-inch diameter galvanized steel rod with turnbuckle or truss tightener. Weight of galvanizing: 2 ounces per square foot, minimum.
- Q. Miscellaneous Gate Hardware: Stretcher bands and bars, bolts, and nuts: steel, galvanized in accordance with ASTM A153. Clips: 6-gauge steel, galvanized in accordance with ASTM A153.

## 2.02 CAST-IN-PLACE CONCRETE

- A. Concrete used for setting posts and other accessories shall be Class A concrete and shall meet the requirements of Section 03 30 00 "Cast-In-Place Concrete."

## 2.03 INDUSTRIAL HORIZONTAL-SLIDE GATES

- A. General: Comply with ASTM F1184 for single slide gate types.
  - 1. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
  - 2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1184 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from square, galvanized steel tubing with outside dimension and weight according to ASTM F1184 and the following:
  - 1. Gate Fabric Height: As indicated.
  - 2. Gate Opening Width: As indicated.
  - 3. Frame Members:
    - a. Tubular Steel: 2 inches (50 mm) rectangular.
  - 4. Bracing Members:
    - a. Tubular Steel: 2 inches (50 mm) rectangular.
- C. Frame Corner Construction: Welded frame with panels assembled with bolted or riveted corner fittings and 5/16-inch (7.9-mm) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
- D. Roller Guards: As required per ASTM F1184 for Type II, Class 1 gates.
- E. Hardware: Latches permitting operation from both sides of gate, locking devices, hangers, roller assemblies and stops fabricated from galvanized malleable iron. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

## 2.04 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
  - 1. Material Above Finished Grade: Copper.
  - 2. Material On or Below Finished Grade: Copper.
  - 3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.
  - 1. Connectors for Below-Grade Use: Exothermic welded type.
  - 2. Grounding Rods: Copper-clad steel.
  - 3. Size: 3/4 inches by 120 inches.

### **3.00 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine areas and conditions, with the installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance.
  - 1. Do not begin installation before final grading is completed, unless otherwise permitted by the Engineer.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, underground structures, benchmarks, and property monuments.

#### **3.03 INSTALLATION, GENERAL**

- A. Install chain-link fencing to comply with ASTM F567 and more stringent requirements specified.
  - 1. Install fencing on established boundary lines inside property line.

#### **3.04 CHAIN-LINK FENCE INSTALLATION**

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 1 inch (25 mm) above grade; shape and smooth to shed water.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at 10 feet (3 m) center to center.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
  - 1. Locate horizontal braces at mid-height of fabric 5 feet (1.52 m). Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch (3.05-mm)



diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) o.c. Install tension wire in locations indicated before stretching fabric.

1. Bottom Tension Wire: Install tension wire within 6 inches (150 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 15 inches O.C. and to braces at 24 inches (610 mm) o.c.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

### 3.05 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

### 3.06 GROUNDING AND BONDING

- A. Fence Grounding: Install gates, corners and every other post as shown on Drawings and Division 26.
- B. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, unless otherwise indicated.
- C. Grounding Method: At each grounding location, drive a grounding rod vertically and connect as shown on the Drawings. Connect conductor to each fence component at the grounding location.
- D. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- F. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

### 3.07 FIELD QUALITY CONTROL

- A. Gate posts shall be accurately located to within 2 inches.
- B. Intermediate posts shall not deviate from perfect alignment in a run by more than 1/2 inch.
- C. Variation in spacings between intermediate posts between corner and terminal post shall not exceed 3 inches.
- D. Grounding-Resistance Testing: Contractor to perform field quality-control testing.
  1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than 2 full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
  2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify the Engineer promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
  3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

### 3.08 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

3.09 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's personnel to adjust, operate, and maintain gates. Refer to Section 01 70 00 "Execution and Closeout Requirements."

**END OF SECTION**



## **32 91 19.13 TOPSOIL PLACEMENT AND GRADING**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to place topsoil, free from rock and foreign material in areas designated to receive sodding or seeding.

### **2.00 PRODUCTS**

#### **2.01 TOPSOIL**

- A. General: The topsoil shall be fertile loam, easily cultivated and free from objectionable material, and shall have a relatively high erosion resistance and be readily able to support the growth of the planting, seeding, or sodding specified on the plans.
- B. Sources:
  - 1. The topsoil may be obtained from the right-of-way at sites of proposed excavation, or it may be obtained from sources outside the right-of-way, secured by the Contractor, and meeting the approval of the Engineer.
  - 2. Topsoil required in addition to salvaged topsoil from the project shall be secured from approved off-site borrow sources. Excavated material from construction which is suitable for topsoil shall be salvaged and used before any topsoil is obtained from borrow source.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Stockpile topsoil material at locations approved by the Owner's Representative. Remove any trash, wood, brush, stumps or other objectionable materials prior to placement. The source and stockpile areas shall be kept drained and in a neat and presentable condition. Place and spread topsoil to a uniform depth to provide 6-inch compacted depth, while maintaining drainage in areas to be seeded or sodded.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

**32 92 13      HYDRO-MULCHING****1.00      GENERAL****1.01      WORK INCLUDED**

- A. Furnish labor, material, equipment and incidentals necessary to prepare the ground, furnish and install fertilizer and hydro-mulching seed or a mixture of seed of the kind specified in areas disturbed by the construction operations.

**1.02      SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
1. Specification of fertilizer to be used.

**1.03      STANDARDS**

- A. The applicable provision of the following standard shall apply as if written here in its entirety:
1. Section 1600 - North Carolina Department of Transportation (NCDOT) Standards.
  2. Town of Southern Pines Seeding and Mulching Standards.

**1.04      GUARANTEES**

- A. Contractor shall fertilize and reseed any area which fails to survive for a period of 1 year from the date the project is accepted by the Owner.

**2.00      PRODUCTS****2.01      MATERIALS**

- A. General: Seed used must carry a North Carolina Testing Seed label showing purity and germination, name, type of seed, and that the seed meets all requirements of the North Carolina Seed Law. Seed furnished shall be of the previous season's crop and the date of analysis shown on each tag shall be within 9 months of the time of delivery to the Project. Each variety of seed shall be furnished and delivered in separate bags or containers.
- B. Seed: The specified seed shall equal or exceed the following percentages of purity and germination:

| Common Name          | Purity | Germination |
|----------------------|--------|-------------|
| Common Bermuda Grass | 95%    | 90%         |
| Rye (Winter only)    | 95%    | 90%         |

- C. Mulch: The straw mulch shall be threshed straw of oats, rye or wheat free from matured seed of obnoxious weeds or other species which would grow and be detrimental to the specified grass. Pine straw mulch shall consist of fresh longleaf pine straw free from

matured seed of obnoxious weeds or other species which would grow and be detrimental to the surrounding area. The mulch shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such that, when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder.

- D. Fertilizer: Pelleted or granulated type fertilizer of the composition 8-8-8 grade (8 parts nitrogen, 8 parts phosphoric acid, 8 parts potash). Upon written approval of the Engineers, a different grade of fertilizer may be used, provided the rate of application is adjusted to provide the same amounts of plant food.

### **3.00 EXECUTION**

#### **3.01 PREPARATION**

- A. After the areas disturbed by construction operations have been backfilled and completed to the original pre-construction lines and grades shown on the Drawings and as provided for in other items of this Contract, perform hydro-mulch seeding in accordance with the requirements hereinafter described.

#### **3.02 INSTALLATION**

- A. Cultivation: Cultivate areas to be seeded to a depth of at least 4 inches. Cultivate the seedbed sufficiently to reduce the soil to a state of good tilth when the soil particles on the surface are small enough and lie closely enough together to prevent the seed from being covered too deep for optimum germination. Cultivation of seedbed will not be required in loose sand where depth of sand is 4 inches or more. Maintain the cross-section previously established throughout the process of cultivation and any necessary reshaping shall be done prior to any planting of seed.
- B. Planting Season and Application Rates: Perform planting between the dates specified for each type except when specifically authorized in writing. The seeds planted per acre shall be of the type specified with the mixture, rate, and planting dates as follows:
  - 1. Common Bermuda Grass - hulled, 30 pounds per acre - February through August; or
  - 2. Rye - unhulled, 50 pounds per acre - August through February.
  - 3. Apply fertilizer uniformly at the average rate of 1,200 pounds per acre.
- C. Hydro-Mulch (Cellulose Fiber) Seeding: Uniformly distribute the fertilizer, seed or seed mixture, in the quantity specified over the areas to be seeded. Mechanical equipment shall be such that all varieties of seed as well as fertilizer may be distributed at the same time, provided that each component is uniformly applied at the specified rate. When seed and fertilizer are to be distributed as a water-slurry, apply the mixture to that area to be seeded within 30 minutes after all components are placed in the equipment. Upon completion of planting the seed, spread cellulose fiber mulch uniformly over the area at the following rates:
  - 1. Sandy soils with 3:1 slope or less: Min. 2000 lb. per acre.
  - 2. Sandy soils with greater than 3:1 slope: Min. 2300 lb. per acre.
  - 3. Clay soils with 3:1 slope or less: Min. 2500 lb. per acre.



4. Clay soils with greater than 3:1 slope: Min. 3000 lb. per acre.
5. The rates are given in dry weight of mulch per acre. A mulching machine, approved by the Owner's representative, shall be equipped to eject the thoroughly wet mulch material at a uniform rate to provide the mulch coverage specified.

D. Maintenance:

1. Water the planted area at such times as necessary for a period of 1 year after final acceptance of the Project by the Owner or until seeding is accepted per Paragraph 3.02.D.3..
2. Fertilize and reseed any area which fails to survive for a period of 1 year from the date the Project is accepted by the Owner or until seeding is accepted per Paragraph 3.02.D.3..
3. Disturbed areas with slopes less than or equal to 4:1 slopes will be accepted when there is a minimum of 70 percent established coverage. Any slopes or grades exceeding a 4:1 must have a minimum of 90 percent established coverage to be accepted.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

**DIVISION 33**  
**UTILITIES**

### **33 05 01.02 DUCTILE IRON PIPE & FITTINGS**

#### **1.00 GENERAL**

##### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install ductile iron pipe and fittings, including taps, connections, and appurtenances as required for a functional system as indicated herein. Unless otherwise noted, all above grade exposed pipe, fittings, and appurtenances shall be flanged while below grade piping, fittings and appurtenances shall be mechanical joint or push on joints. Trenching, backfilling, and pipe embedment shall be as shown on the Drawings and in accordance with Section 31 23 33 "Trenching and Backfill."

##### **1.02 QUALITY ASSURANCE**

- A. Factory Testing: The manufacturer shall perform all tests as required by AWWA C151. Welded outlets shall be hydrostatically tested at a pressure of 250 psi for a period of 1 hour. No leakage shall be allowed.
- B. Experience Requirements: Pipe shall be the product of a manufacturer who has a minimum of 10 years' successful experience manufacturing pipe of the particular type specified and the total pipeline shall be the product of one pipe manufacturer. The manufacturer shall have a minimum of 10 years' successful experience in the design and manufacturing of pipe joints of similar design, working pressure, pipe diameter and wall thickness as specified.
- C. Owner Testing and Inspection:
  - 1. Pipe may be subject to inspection by an independent testing laboratory, which laboratory will be selected and retained by the Owner. Representatives of the laboratory or the Engineer shall have access to the Work whenever it is in preparation or progress, and the pipe manufacturer shall provide proper facilities for access and for inspection. The pipe manufacturer shall notify the Owner in writing, at least 2 weeks prior to the pipe manufacture so that the Owner may advise the manufacturer as to the Owner's decision regarding tests to be performed. Material and pipe which are discovered to be defective, or which do not conform to the requirements of this Section shall be subject to rejection at any time prior to final acceptance of the pipe. After final acceptance, each joint of pipe shall be stamped as approved by the laboratory.
  - 2. It is anticipated that production of pipe shall be done over a normal period of time and without "slow-downs" or other abnormal delays. In the event that an abnormal production time is required, and the Owner is required to pay excessive costs for inspection, then the Contractor shall be required to reimburse the Owner for such laboratory costs over and above those which would have been incurred under a normal schedule of production.
- D. Pipe Classification: Pipe manufacturer shall manufacture the pipe to meet the installation conditions, cover depth, and bedding and backfill requirements as shown on the Drawings or specified and furnish the correct class of pipe to meet these conditions. If additional requirements are required, pipe manufacturer shall coordinate their requirements with the Contractor.

##### **1.03 SUBMITTALS**

A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:

1. Record Data: Catalog data, including dimensions of new pipe and fittings and recommendations for handling and storage; details of lining and coating; thrust restraint provisions; hydrostatic pressure test plan and results; affidavit stating the pipe furnished complies with AWWA C151, AWWA C104, AWWA C110, AWWA C111, and these specifications; mill certificates, including chemical and physical test results for each heat of metal, if requested during pipe manufacturing operations; record drawings, including a schematic location-profile and a tabulated layout schedule, referenced to the pipeline stationing.
2. Shop Drawings: Mechanical joint connections; connections to differing pipe materials.
3. Certified Test Data: Certified Test Reports from the manufacturer's testing facility or an Owner approved testing laboratory; results of factory hydrostatic tests; pipe and fitting certification for conformance to ANSI/NSF 61.

#### 1.04 REFERENCE SPECIFICATIONS

- A. Section 09 97 16 "Pipeline Coatings and Linings."
- B. Section 31 23 33 "Trenching and Backfill."
- C. Section 33 05 05.31 "Hydrostatic Testing."
- D. Section 33 10 13 "Disinfecting of Water Utility Distribution."

#### 1.05 STANDARDS

A. Except as modified herein, the applicable provisions of the following standards shall apply as if written here in their entirety:

1. American Water Works Association (AWWA) Standards:

|           |                                                                         |
|-----------|-------------------------------------------------------------------------|
| AWWA C104 | Standard for Cement Mortar Lining for Ductile Iron Pipe and Fittings    |
| AWWA C105 | Standard for Polyethylene Encasement for Ductile Iron Piping            |
| AWWA C110 | Standard for Ductile Iron and Gray Iron Fittings                        |
| AWWA C111 | Standard for Rubber Gasket Joints for Ductile Iron Pipe and Fittings    |
| AWWA C150 | Standard for Thickness Design of Ductile Iron Pipe                      |
| AWWA C151 | Standard for Ductile Iron Pipe                                          |
| AWWA C153 | Standard for Ductile-Iron Compact Fittings for Water Service            |
| AWWA C600 | Standard for Installation of Ductile Iron Water Mains and Appurtenances |
| AWWA C606 | Grooved and Shouldered Joints                                           |

2. Steel Structures Painting Council (SSPC) Standard: SSPC SP6, Commercial Blast Cleaning.
3. All ductile iron pipe and fittings for potable water systems shall conform to American National Standards/National Science Foundation (ANSI/NSF) Standard 61 and must be certified by an organization accredited by ANSI.

## 1.06 DELIVERY AND STORAGE

- A. Handling and storage of pipe and fittings shall comply with AWWA C600 and the manufacturer's recommendations. It is desired that the pipe be hauled direct from the pipe plant to the right-of-way and strung along the pipeline route, thus avoiding rehandling of the pipe and the possibility of damage thereto. Where fully loaded truck and trailer cannot operate along the pipeline route, pipe may be unloaded at access points along the route and brought to the trench side by approved methods; however, the Contractor shall be responsible to ensure that the pipe is undamaged at the time of laying.

## 1.07 GUARANTEES

- A. The product shall be warranted and guaranteed per the General Conditions of the Specifications.

## 2.00 PRODUCTS

### 2.01 MATERIALS

#### A. Ductile Iron Pipe:

1. Ductile iron pipe shall be made of ductile iron in accordance with AWWA C151. All ductile iron pipe shall have a minimum working pressure as indicated on the Drawings. Pipe shall be rated for pressure in accordance with AWWA C151 for pressure class of pipe as indicated. Standard joint length shall be 18 to 20 feet. Flanged ductile iron pipe shall be in accordance with AWWA C115.
2. Pipe manufacturer shall manufacture the pipe to meet the installation conditions, cover depth, and bedding and backfill requirements as shown on the Drawings or specified and furnish the correct class of pipe to meet these conditions.

- B. Fittings: Fittings shall be ASTM A536 ductile iron or ASTM A48 cast iron in accordance with AWWA C110. Fittings shall be rated for a minimum working pressure of 250 psi, unless specified otherwise. Factory welded outlets may be used in lieu of tee fittings for 18-inch and larger tee fittings. Factory welded outlets shall have a minimum pressure rating of 250 psi. Factory welded outlets may not be used near sources of vibration, such as pump stations or roads.

#### C. Joints for Pipe and Fittings:

1. Joints shall be in accordance with AWWA C110, AWWA C111, and AWWA C151. Standard joints for ductile iron pipe and fittings shall be push-on. Where indicated, joints shall be mechanical joint, flanged, or grooved.
2. Flanged joints shall have pressure ratings equal to or greater than adjacent pipe. Flange pattern shall match pattern of valve, fitting, or appurtenance to be attached. Flanges on ductile iron pipe shall be ductile iron.

#### D. Provisions for Thrust:

1. Thrust at bends, tees, plugs, or other fittings shall be resisted by restrained joints. If thrust cannot be accommodated using restrained joints, thrust blocking or concrete

anchors to restrain thrust may be used on a case-by-case basis when approved by the Engineer.

2. Restrained joints shall be used for a sufficient distance from each bend, tee, plug, or other fitting to resist thrust which will be developed at the design pressure of the pipe. For the purpose of thrust restraint, design pressure shall be 1.5 times the design working pressure class indicated.
3. The length of pipe with restrained joints to resist thrust forces shall be determined by the pipe manufacturer in accordance with Thrust Restraint Design for Ductile Iron Pipe, Ductile Iron Pipe Research Association using the following parameters:
  - a. Laying condition equal AWWA C600 Type 4 bedding.
  - b. If polyethylene encasement is used, restrained length shall be doubled to account for reduced soil to pipe friction resistance.
4. Where indicated and where required for thrust restraint, joints shall be restrained. Restrained joints shall be mechanically interlocking joints. Restrained joints shall be U.S. Pipe "TR Flex", American Ductile Iron Pipe "Flex Ring", or Clow Corporation "Super-Lock". Restraining mechanical joint fittings using set screws, restraining gaskets, gripper type glands, and field-cuts of restrained joints shall be Mega-Lug, or approved equal. Field welding shall not be allowed. Restrained joints shall be capable of sustaining the design pressure as specified herein.

E. Coating:

1. Coat the exterior of the pipe and fittings with a 1 mil bituminous coating in accordance with AWWA C110 and AWWA C151, unless specified otherwise.
2. In addition to the factory applied asphaltic coating, all buried ductile iron pipe and fittings shall have a tube-type polyethylene encasement in accordance with AWWA C105. Polyethylene encasement shall be 8 mils thick. Both ends of the pipe shall be thoroughly sealed with adhesive tape or plastic tie straps at the joint overlap. Place circumferential wraps of tape at 2-foot intervals along the barrel of the pipe to minimize the space between the encasement and the pipe.

F. Lining: Ductile iron pipe and fittings shall have a cement mortar lining in accordance with AWWA C104 and bituminous seal coat. Thickness of lining shall be as specified in AWWA C104. Air piping shall not be lined.

G. Flexible Joint Couplings:

1. Flexible joint couplings shall be Dresser Style 38, Rockwell Style 411, Victaulic Depend-O-Lok - E x E, Type II or approved equal, unless otherwise shown.
2. Provide restrained flexible joint couplings or restrained flexible joints on all pipes connecting to concrete structures and at other locations shown on the Drawings. Restrained flexible couplings shall be Victaulic Depend-O-Lok F x F Type II or approved equal. Restrained flexible joints shall be U.S. Pipe "TR Flex", American Ductile Iron Pipe "Flex Ring", Clow Corporation "Super-Lock", or approved equal.

H. Restrained Flange Coupling Adapter

1. Flanged adapters must be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10. Contractor is responsible for coordinating flange patterns with adjacent connection flanges.
2. All connection hardware must be 304 or 316 stainless steel.
3. Restraint for flange adapter must consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws must be used to ensure proper initial set of gripping wedges.
4. Adaptors must be coated and lined with two coats of thermoset epoxy coating.
5. The flange adapters must be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6 inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
6. Approved Manufacturers:
  - a. EBAA Iron, Inc.
  - b. Romac Industries, Inc.
  - c. Approved Equal.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. General: Install ductile iron pipe, fittings, specials, valves, and hydrants in accordance with AWWA C600 and the Specifications. Trenching and backfilling shall be in accordance with Section 31 23 33 "Trenching and Backfill." Before lowering into the trench, inspect each joint of pipe. Pipe will then be accepted, rejected, or repaired.
- B. Pipe Laying: Lower pipe, fittings, and special castings into trench by crane or other suitable method. Do not roll in or "dump" into the trench. Handle pipe and fittings with belts, slings, or other equipment designed to prevent damage to the pipe and coating. Remove dirt and trash that may be in the barrel of the pipe, on the spigot or in the bell while the pipe is suspended. Keep the pipe clean during the laying operation and free of sticks, dirt, and trash, and at the close of each operating day seal the open end of the pipe with a gasketed night cap. Do not lay pipe in water.
- C. Pipe Alignment: Install pipe and fittings to the line and grade indicated. In areas where the line and grade indicated cannot be achieved using standard manufactured bends and fittings, make slight adjustments by deflecting joints. Joint deflections may not exceed the lesser of the maximum deflections stipulated in AWWA C600 or 75 percent of the manufacturer's maximum recommended deflection. Resolve any conflicts with existing utilities and structures.
- D. Joint Making:
  1. Jointing Mechanical Joint Pipe:
    - a. Joint this type of pipe in accordance with the manufacturer's recommendations, with uniform torque on bolts.



- b. After carefully cleaning both spigot and bell and after slipping the follower ring and gasket over the spigot end, slip the spigot into the bell. Apply a lubricant to the spigot to assist in assembly.
    - c. Carefully seat the gaskets by hand to be even in the bell at all points.
    - d. After drawing up the follower ring to uniform bearing against the gasket, insert the bolts and tighten by hand in pairs using bolts opposite each other.
    - e. Tighten the nuts to hold the required pressure. Extension wrenches or pipes over wrench handles shall not be permitted. Use 10-inch ratchet wrenches to tighten the nuts to a uniform torque.
    - f. The finished joint shall be watertight.
  2. Making Flanged Joints: Erect flanged pipe in accordance with the controlling dimension as specified. Thoroughly clean each piece of flanged pipe to remove dirt, rust, grease, and other foreign matter. Thoroughly wire brush flanged faces to ensure even bearing for gaskets and mating flanges. Place full face gasket, use drift pins to align holes, and tighten flange bolts, each in turn, at a uniform torque around the joint. Finished joints shall be watertight.
  3. Making Push-On Joints:
    - a. The jointing of this type of joint shall be as recommended by the manufacturer. The procedure for jointing shall be generally as follows:
      - 1). Thoroughly clean and dry the spigot and bell before starting the assembly of the joint. Wipe the gasket clean with a cloth.
      - 2). Place the gasket into the gasket seat in the bell.
      - 3). Apply a thin film of lubricant to the surface of the gasket that will come in contact with the entering pipe spigot. If necessary, also apply lubricant to the spigot.
      - 4). Make the joint by exerting sufficient force on the entering pipe so that its plain end will move past the gasket to the seat of the bell.
      - 5). If restrained joints are used, orient pipe to permit ease of assembly. Place locking device after installation of spigot into bell.
  4. Making Split-Sleeve Coupling Joints:
    - a. Exterior surfaces of the pipe shall be clean, smooth and free from weld beads, seams, scars, indentations, roll marks, exterior coatings and flat spots.
    - b. Install split-sleeve couplings in accordance with the manufacturer's latest installation instructions.
  - E. Polyethylene Encasement: Wrap bituminous coated ductile iron pipe in polyethylene encasement in accordance with AWWA C105. Repair or replace encasements which have tears, rips, or punctures in the polyethylene wrap.
  - F. Painting: Paint piping which is submerged or exposed to the atmosphere in accordance with Section 09 97 16 "Pipeline Coatings and Linings."

3.02 FIELD QUALITY CONTROL

- A. Perform a hydrostatic test as specified in Section 33 05 05.31 "Hydrostatic Testing."

**END OF SECTION**

### 33 05 05.31 HYDROSTATIC TESTING

#### 1.00 GENERAL

##### 1.01 WORK INCLUDED

- A. Hydrostatically test new pipe between valves or plugs at the pressure and for the duration specified.
- B. Additional plugs may be installed to reduce the length of each test section. No additional compensation will be paid if additional plugs are used.
- C. Provide a pressure reducing backflow preventer and all temporary piping, pumping, fittings and gauges required to fill, test and then drain the pipe.
- D. Do not begin test until pipe has been backfilled for at least 7 days.

##### 1.02 SUBMITTALS

- A. Submit detailed hydrostatic test procedure 10 days prior to conducting the test.
- B. Submit Hydrostatic Pipe Test Reports per Section 01 33 00 "Document Management."

##### 1.03 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:

- 1. ASTM International (ASTM):

|            |                                                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------|
| ASTM F2164 | Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure |
|------------|------------------------------------------------------------------------------------------------------------------|

- 2. American Water Works Association (AWWA):

|           |                                                                                                                                    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------|
| AWWA C200 | Steel Water Pipe, 6 In (150 mm) and Larger                                                                                         |
| AWWA C600 | Installation of Ductile-Iron Mains and Their Appurtenances                                                                         |
| AWWA C605 | Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings |
| AWWA M23  | PVC Pipe – Design and Installation                                                                                                 |
| AWWA M41  | Ductile-Iron Pipe and Fittings                                                                                                     |
| AWWA M55  | PE Pipe – Design and Installation                                                                                                  |

#### 2.00 PRODUCTS

##### 2.01 WATER FOR TESTING

- A. Obtain water for filling and testing the pipeline and provide all temporary pumps and piping necessary to fill the pipeline.
- B. If chlorinated water is used, then dechlorinate it before disposal per all regulations.

## 2.02 TEST PLUGS

- A. Design plugs or blind flanges to withstand the test pressure on either side with only atmospheric pressure on the opposite side.
- B. Provide a 30-inch access manhole in one side of the plug and a 12-inch flanged outlet on the other side of the plug unless shown differently on the Drawings.

## 3.00 EXECUTION

### 3.01 GENERAL

- A. Perform hydrostatic test in accordance with this Section, AWWA Standards, AWWA Manuals, and the supplier's recommendations.
- B. Pressure and Leakage Tests of Pressure Piping: Perform hydrostatic pressure and leakage tests using methods, and per performance requirements of AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

### 3.02 TEST PRESSURE

- A. The hydraulic grade line for the entire water line shall be **150 psi**.

### 3.03 TEST PREPARATION

- A. Fill pipe at 0.5 feet per second in the main pipe.
- B. Verify all air valves are working, and air is vented from temporary taps. Plug taps after test.
- C. Examine bulkheads, valves, manholes, flanges, and connections for leaks during this period. Stop any leaks before continuing.
- D. If an existing valve is in the test section, then coordinate with the Construction Manager to determine an approved method for measuring any leakage past the valve. Furnish all necessary equipment and include the cost for this effort in the Contract Price.

### 3.04 TEST DURATION

- A. Test the test section for 4 hours.

### 3.05 EXAMINATION UNDER PRESSURE

- A. Protect the gauge from direct sunlight during the test.
- B. Inspect the pipe during the test to locate any leaks or breaks, defective joints, cracked or defective pipe, fittings, or valves. Correct defective Work identified during the pressure test.
- C. Correct all identified leaks even if leakage is within the parameters for permissible make up water per Paragraph 3.06.
- D. Test the pipe again after defective Work has been corrected. Repeat the test and correction of defective Work until satisfactory test results are obtained.

**3.06 PERMISSIBLE MAKEUP WATER**

- A. Measure make up water. Make up water is the amount of water added to the test section to maintain the pressure within 5 psi of the specified test pressure.
- B. The maximum acceptable volume of makeup water for gasketed pipe is 3 gallons per inch of pipe diameter per mile of pipe tested per day.

**3.07 CORRECTIONS OF DEFECTS**

- A. Repair any defective joints, cracked or defective pipe, fittings, or valves discovered in performance of this pressure test with sound material meeting the requirements of the Contract Documents and repeat the test until satisfactory results are obtained. Repair all noticeable leaks even if the actual leakage is within the allowable limits.

**3.08 REMOVAL OF TEST PLUGS**

- A. Remove test plugs once both sides of the pipeline have been tested. If another contractor may need the plug, then coordinate with them – the last contractor to need the plug shall remove it and repair the mortar lining.
- B. Leave the pipeline full of water upon completion of the hydrostatic test, except where internal test plugs must be removed to allow construction to continue.

**END OF SECTION**

**33 12 19      WATER UTILITY DISTRIBUTION FIRE HYDRANTS**

**1.00      GENERAL**

**1.01      WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install fire hydrant and appurtenances, operators, bolts, nuts and gaskets.

**1.02      QUALITY ASSURANCE**

- A. Acceptable Manufacturers:
  - 1. Clow Medallion (with the increased boss thickness in the hydrant shoe)
  - 2. Mueller Centurion
  - 3. American Mark-73
  - 4. Kennedy K-81 D
  - 5. M&H Model 929
  - 6. U.S. Pipe Metropolitan 250
  - 7. Pre-approved equivalent

**1.03      SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:
  - 1. Hydrant cut sheets and Certification of Compliance with AWWA C502 as record data.

**1.04      STANDARDS**

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:

- 1. American National Standards Institute (ANSI) Standards:

|            |                                             |
|------------|---------------------------------------------|
| ANSI B16.1 | Cast Iron Pipe Flanges and Flanged Fittings |
|------------|---------------------------------------------|

- 2. American Society for Testing and Materials (ASTM) Standards:

|            |                                                                                                        |
|------------|--------------------------------------------------------------------------------------------------------|
| ASTM A126  | Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings                   |
| ASTM A307  | Carbon Steel Bolts and Studs, 60,000-psi Tensile Strength                                              |
| ASTM A325  | Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength |
| ASTM A536  | Standard Specification for Ductile Iron Castings                                                       |
| ASTM D2000 | Classification System for Rubber Products in Automotive Applications                                   |

- 3. American Water Works Association (AWWA) Standards:

|           |                                                      |
|-----------|------------------------------------------------------|
| AWWA C105 | Polyethylene Encasement for Ductile-Iron Pipe System |
| AWWA C111 | Standard for Rubber-Gasket Joints                    |
| AWWA C502 | Standard for Dry-Barrel Fire Hydrants                |

4. NSF International

|        |                                                   |
|--------|---------------------------------------------------|
| NSF 61 | Drinking Water System Components – Health Effects |
|--------|---------------------------------------------------|

## 2.00 PRODUCTS

### 2.01 FIRE HYDRANTS

- A. General: Fire hydrants to be installed as shown on the plans or furnished for general installation shall be dry-barrel, traffic model conforming to AWWA Standard for Dry-Barrel Fire Hydrants, AWWA Standard C502.
- B. Fire Hydrants shall have a rated working pressure of 250 psi or greater.
- C. All fire hydrant components in contact with potable water shall conform to the requirements of NSF 61.
- D. Supplementary Details:
  - 1. Type of Shutoff: Compression type with the flow. Valve action shall provide positive shutoff at minimum closing torque. Wedge action closing gates shall not be permitted. Scissor type main valves shall not be permitted unless approved by the Owner's Representative.
  - 2. Inlet Connection: Mechanical joint unless otherwise specified. Inlet connection shall be for a 6-inch cast iron pipe with minimum net valve opening of 5-1/4 inches unless otherwise specified.
  - 3. Bury Length: Ground to bottom of connection pipe shall be 4 feet, or as specified by the Owner's Representative.
  - 4. Harnessing Lugs: Furnished with the hydrants.
  - 5. Nozzle Cap Gasket: Furnished on all nozzle caps; long life; black rubber; conforming to Rubber Products in Automotive Applications ASTM D2000 or equal.
  - 6. Drain Valve and Outlet: Hydrants shall be equipped with two drain holes and provided with an automatic and positively operating, non-corroding drain or dip valve so as to drain the hydrant completely when the main valve is shut.
  - 7. Direction to Open: Counterclockwise. The number of turns to open shall be in accordance with AWWA C502, Section 4.6.5.2.
- E. Breakable Type Hydrants: Breakable Or Sleeve Type Couplings: The barrel of the hydrant between the elbow and the top cap shall be made in two parts connected by a swivel flange or breakable flange which shall permit facing of the nozzles in any desired direction in increments of 45 degrees or less. The complete hydrant shall be of such design that when the hydrant barrel is broken through traffic collision or otherwise, it may be replaced without disturbing the bottom of the hydrant.

1. The materials used for gaskets between the upper and lower barrels and the base and nozzle section shall be compounded to conform to ASTM D2000.
  2. Provision shall be made in the design of the stem to disconnect the stem from the hydrant parts above the standpipe break point in the event of traffic accidents. If breakable or sleeve type couplings are used, they shall have sufficient torsional strength so that a torsional failure of the stem shall occur at some point other than at the coupling. Design of the coupling shall be such that when the coupling is broken, no parts shall come loose and fall into the hydrant barrel, and the break shall not occur through the pins or bolts holding the coupling to the stem.
- F. Main Valve Seats: Designed so that incorrect positioning is impossible.
- G. Gaskets - Ground Line: The valve body flange gaskets shall be EPDM or an equal approved by Owner's Representative prior to substitution. They shall be full face or ring type with the lower flange recessed to hold the gasket in place.
- H. Nozzle Cap Chains: In accordance with AWWA C502, Section 4.6.3.2.
- I. Flanges: All flanges other than break flanges shall be equipped with mechanical joints. Gland bolts shall be high-strength, low-alloy, corrosion-resistant steel conforming to ASTM A325, Type 3.
- J. Operating Stems: The spindle of the operating stem and the stem nuts for hydrants having the operating threads located in the barrel or waterway shall be manganese bronze, Everdur or stainless steel. Barrel bolts and nuts shall meet the requirements of ASTM A307, 60,000-psi tensile strength.
- K. All working parts in the waterway, except for sliding stem support mechanisms, shall be bronze-to-bronze or bronze-to-iron.
- L. O-Ring: Hydrant stem packing boxes, where needed, shall be provided with O-ring grooves and sealed with O-rings. O-rings shall be furnished in lieu of stem packing. They shall be of the double O-ring type designed so that the rubber rings shall move against a bronze, stainless steel or other non-corrodible metal surface. O-ring shall be in accordance with ASTM D2000.
- M. Extensions: Fire hydrants shall be designed to accept 6-, 12-, or 18-inch extensions.
- N. Hydrant Heads: Nozzle may be faced in any desired direction.
- O. Upper Stem Thread Lubrication: Upper stem thread lubrication may be accomplished with oil or grease.
1. When oil is used, it shall be in conjunction with a functional oil reservoir and an oil filler port. This lubrication system shall be sealed from the waterway and any external contaminants by use of O-ring seals. The hydrant shall be factory filled with a low viscosity, FDA approved non-toxic oil lubricant which will remain fluid through a temperature range of -60 to 150 F. Means for field check of oil lubrication level shall be provided.
  2. When grease is used, the hydrant shall be factory lubricated with food grade grease such as Lubriplate No. 630-AA (medium soft) or equal. Means for field lubrication without disassembly shall be provided.
- P. Finishes:



1. Exterior:
  - a. Above Grade:
    - 1). Furnish exterior coating for above grade Fire Hydrant assembly components in accordance with AWWA C502
    - 2). After placement, the outside of the hydrant above the finished ground line shall be thoroughly cleaned and painted with two coats of paint.
  - b. Below Grade: Furnish exterior coating for below grade fire hydrant assemblies in accordance with AWWA C502.
2. Interior: Interior coating for fire hydrant assemblies in accordance with AWWA C502.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install hydrants at the locations shown on the Plans or as directed by the Owner's Representative. Set hydrants truly vertical and securely brace with concrete until self-standing. Surround hydrants with a minimum of 7 cubic feet of washed gravel or stone to allow drain outlets to operate.
- B. Install fire hydrants using special mechanical joint anchoring fittings. Install a flanged by MJ gate valve on the main line tee.
- C. Wrap and protect the gate valve, including bolts at joints, and the bottom of the fire hydrant with polyethylene encasement in accordance with AWWA C105 to prevent direct contact with concrete blocking. At weep holes with filter fabric to prevent dirt and debris from entering the fire hydrant.

#### **3.02 FIELD QUALITY CONTROL**

- A. Upon completion of installation of the equipment, conduct an acceptance test to verify the satisfactory operation of each unit. The test shall be conducted in a manner approved by and in the presence of the Owner's Representative. Check the unit for general operation and leakage. The unit shall perform in a manner acceptable to the Owner's Representative before final acceptance is made by the Owner.

#### **3.03 SCHEDULES**

- A. All fire hydrants shall have a tag reading "NON-POTABLE" to identify them as a non-potable water source.

**END OF SECTION**

**33 16 19 STEEL ELEVATED WATER UTILITY STORAGE TANK****1.00 GENERAL****1.01 WORK INCLUDED**

- A. The Work performed under this Contract must include all labor, materials and equipment necessary to design, construct, inspect and test a multi-column steel elevated water storage tank and all appurtenances and accessories as shown on the Drawings and specified herein. The design must be the product of one manufacturer.
- B. The Work must also include, but not limited to, all labor, materials and equipment necessary to clean, coat and disinfect the water storage tank.
- C. Electrical power at the Site must be in accordance with Section 01 11 00 "Summary of Work" and as indicated in Division 26. The tank manufacturer will be responsible for coordination and installation of all water, communications, and electrical utilities as required.
- D. System Description:
1. The elevated tank consists of the following: foundation, steel support structure, all internal and external piping ending at the tee between yard piping and 12" water line, tank accessories, platforms, handrails, balconies, any related appurtenances, and a welded steel water tank.
  2. Concrete foundations must be provided as structural support for the steel tank.
  3. The tank, appurtenances, and all material exposed on the interior of the tank or in contact with stored water must be resistant to degradation from the use of chlorine and chloramines.
  4. All materials in contact with stored water must comply with the requirements of the Safe Drinking Water Act, NSF/ANSI 61 and other federal, state, local, and provincial requirements.
  5. Hydraulic Design Criteria:

| <b>Design Criteria</b>                                                                                                           | <b>Base Bid</b> |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Minimum Capacity Within Operating Range                                                                                          | 150,000 gallons |
| Maximum Operating (Head) Range                                                                                                   | 28 feet         |
| Elevation                                                                                                                        |                 |
| Overflow/Top Capacity Elevation                                                                                                  | 1,078 feet      |
| Pedestal Floor Elevation                                                                                                         | 914.1 feet      |
| Inlet/Outlet Pipe Diameter                                                                                                       | 12 inches       |
| Overflow Pipe Diameter, minimum                                                                                                  | 10 inches       |
| Maximum Fill Rate                                                                                                                | 200 GPM         |
| Maximum Drain Rate (under normal operating conditions, tank manufacturer must design based on broken pipe analysis as specified) | 1,000 GPM       |

#### 6. General Design:

- a. Environmental Loads: The steel tank, concrete support structure and foundation must be designed to safely withstand loads acting separately or in load combinations as specified by the most current editions of AWWA D100 and ASCE/SEI 7 for category IV structures.
  - 1) Wind pressure formula must be determined using the mapped site location per AWWA D100.
  - 2) Dead load must be the estimated weight of all permanent construction.
  - 3) Water load must be the weight of water when the tank is filled to 6-inches above the overflow elevation.
  - 4) Roof snow load must be the larger of 15 psf or the snow load determined in accordance with AWWA D100 and ASCE/SEI 7.
- b. Seismic Loads must be determined in accordance with AWWA D100, Section 13.
- c. Foundation Design:
  - 1) The concrete foundations must be designed by the tank manufacturer and compatible with its proposed tank design per AWWA D100 and ACI 318. Foundations must be constructed by the tank manufacturer, or a subcontractor directly supervised by the tank manufacturer in accordance with the drawings supplied. Foundations must be of adequate size to properly distribute the bearing loads from the tank and to resist uplift due to wind forces.
  - 2) The tank manufacturer must design the foundations accounting for soils and subsurface conditions. The successful tank manufacturer must satisfy themselves as to the adequacy of the geotechnical report that is included with these Contract Documents, and its recommendations. The successful tank manufacturer must acquire any additional soils and foundation data necessary for the final design at no additional cost to the Owner.

#### 1.02 QUALITY ASSURANCE

##### A. Qualifications:

1. The Work described in this Section must be performed by an elevated tank manufacturer that has a minimum of 10 years of experience in composite tank design and construction. Manufacturer must have designed, constructed, and commissioned a minimum of five steel elevated tanks of equal or greater capacity, all in satisfactory operation for at least 5 years. These tanks must be of the same design as described above.
2. Acceptable Manufacturers:
  - a. McDermott International, Inc./CB&I Storage Tank Solutions.
  - b. Caldwell Tanks, Inc.
  - c. Phoenix Fabricators & Erectors, Inc.
  - d. Landmark Tank Structures, LP.

e. Maguire Iron, Inc.

3. Other manufacturers may submit proposals only if they pre-qualify and show conformance with the specification criteria. Request for qualification with supporting documentation must be received in writing 14 days prior to bid date. Documentation must include an experience list detailing the projects completed directly by the manufacturer that comply with this Section. Information to be submitted must also include details of construction, steel tank erection process, and quality control procedures. The Owner and/or Engineer will be the sole judge as to the acceptability of the tank manufacturer based on the submitted documentation.
4. Elevated tank design and steel tank construction must not be subcontracted. These items must be performed by the tank manufacturer.
5. The tank manufacturer must directly employ a full time professional engineer licensed in the state in which the tank is being constructed, with a minimum 5 years of cumulative experience in the design and construction of elevated steel tanks of the type specified as described in this Section. The engineer must be in responsible engineering charge of the Work.
6. The tank manufacturer must have in its employ for this Project a team consisting of a tank superintendent, project manager and foreman(s) each of whom must have constructed a minimum of five AWWA D100 elevated steel tanks having a capacity equal to or greater than the tank specified and have a minimum of 10 years of experience in the construction of steel elevated tanks.
7. All welders employed on the Project must be tank manufacturer's employees and AWS D1.1 certified if welding structural steel and AWS D1.6 certified if welding stainless steel and/or ASME Section IX Certified as required by AWWA D100. Welders that have not had proof of certification submitted in accordance with the Specifications must not be employed on the Project until such certification is submitted.
8. The tank manufacturer's geotechnical engineering firm and testing laboratory may not be the same company as the one the Engineer used in the development of the project documents, as this is considered a conflict of interest per the International Building Code. The geotechnical firm to be used by the tank manufacturer must be approved by the Engineer prior to construction.

B. Regulatory Requirements:

1. The elevated tank must be designed and constructed in compliance with applicable federal, state and local regulations.
2. Personnel safety equipment, access openings, fall protection, etc. must be provided in accordance with OSHA 1910 requirements and manufacturer's documentation.

C. Singular Responsibility: It is acknowledged that the successful design and construction of elevated storage tanks requires specialized and proprietary knowledge and skills. It is further recognized that successful performance of the tank requires that the earthwork preparation, foundation for the tank and the tank itself be considered an integrated system. Therefore, it is the express intent of this Section to create a singular responsibility for the design and construction of this integrated system required for elevated storage tanks. The design and construction of all aspects, including but not limited to, excavation, tank

subgrade, fill placement beneath tank, tank foundation, foundation drainage systems, steel support structure, inlet and outlet pipes, all piping and equipment inside the tank, welded steel tank, and welded steel tank finishes must be performed by the tank manufacturer or its subcontractor under the direct supervision of the tank manufacturer.

### 1.03 FIELD QUALITY CONTROL

- A. Refer to Section 09 95 00 "Coatings for Water Storage Tanks" for coordination of Owner's Representative Field Quality Assurance Coordination during coating operations.
- B. Owner's Representative Field Quality Assurance Coordination for Concrete Placement:
  - 1. Observations may be conducted by the Owner's representative. Final observations will be performed in the presence of the Owner or its representative and the Contractor's superintendent. All materials and equipment used in the accomplishment of testing are subject to observation at any time by the Owner's representative. Periodic observation times will be agreed upon by the Owner's representative and Contractor and approved by the Owner.
  - 2. Contractor must provide a schedule for anticipated:
    - a. Observation of concrete reinforcement before all concrete pours.
    - b. Observation of concrete pouring operations.
  - 3. Contractor will notify the Owner's representative at least 7 days prior to any required inspections and confirmed 24 hours prior to inspection. Prior to scheduling an inspection, Contractor is responsible for reviewing Work and verifying it is ready for inspection. Once scheduled, if the Owner's representative finds the Project not ready for inspection any additional trips for re-inspection or inspection for retesting of failed tests will be borne by the Contractor and deducted from the Contract Value by Change Order. Costs for additional inspection will be billed at the rates indicated in Section 00 73 00 "Supplementary Conditions."
- C. Owner's Representative Field Quality Assurance Coordination for Welding Operations:
  - 1. Observations must be conducted by the Owner's representative and a third-party inspection company retained by the Engineer. Final observations will be performed in the presence of the Owner or its representative and the Contractor's superintendent. All materials and equipment used in the accomplishment of testing are subject to observation at any time by the Owner's representative. Periodic observation times will be agreed upon by the Owner's representative and Contractor, and approved by the Owner.
  - 2. Contractor must provide a schedule for anticipated welding operations and must notify the Owner's representative at least 7 days prior to any required inspections and confirmed 24 hours prior to inspection. Prior to scheduling an inspection, Contractor is responsible for reviewing Work and verifying it is ready for inspection. Once scheduled, if the Owner's representative finds the Project not ready for inspection any additional trips for re-inspection or inspection for retesting of failed tests will be borne by the Contractor and deducted from the Contract Value by Change Order.

3. Costs for additional inspection will be billed at the following rates:

| Position          | Per Day    |
|-------------------|------------|
| Welding Inspector | \$104/hour |
| Trip Charge       | \$58/day   |

4. Cost includes all travel expenses. Construction Contract Administration will be billed for actual effort per the rates established in Section 00 73 00 "Supplementary Conditions."
5. Contractor must not move or remove scaffolding, ladders or other fixtures necessary to provide proper observation until such Work has been observed and approved by the Owner's representative.
6. Any Work found to be deficient, damaged, or otherwise unacceptable must be repaired in accordance with these specifications at no additional cost to the Owner.
7. Observation and/or acceptance of Contractor's work by Owner's representative(s) in no way releases Contractor from any of the terms and conditions of the Contract Documents.
8. Contractor will provide the inspection and testing of the tank and welds. The number and location of spot radiographs must be in accordance with AWWA D100 and must include the review of spot radiographs. The Owner's representative may provide additional testing and will review tests provided by the Contractor. All sets of radiographs will be taken at locations selected by the Owner's representative and developed while the Owner's representative is present. All developed film will then be the property of the Owner.

#### 1.04 SUBMITTALS

- A. Submit the following Shop Drawings prior to the start of tank construction:

1. Construction Drawings:

- a. Contractor may provide the submittal for the tank's foundation separate from the rest of the construction drawings. All other drawings must be all inclusive in one submittal. Partial submittals for tank design and components will not be accepted and will be returned without review.
- b. Drawings must show all features of the Work, including the size and position of all structural components, interior layout of all floors, the required strength or grade of all materials, and construction tolerances.
- c. Foundation details must also include excavation and backfill required.
- d. Reinforced concrete details must include construction joints, openings and inserts. Reinforcement must be clearly indicated on the structural drawings and identified by mark numbers that are used on the fabrication schedule. Location, spacing and splice dimensions must be shown. Placement and fabrication details must conform to ACI 318.
- e. Drawings of steel components must show all details of welded joints and other connections. Standard weld symbols as listed in AWS A2.4 must be used unless joint details are shown.

- f. Provide a table showing capacity of the tank in gallons at all levels in 1-foot increments.
  - g. Final construction drawings must be sealed and signed by a professional engineer licensed in the state the tank is constructed in and submitted as Product Data.
- B. Submit the following Product Data prior to the start of tank construction:
  - 1. Signed and sealed construction drawings.
  - 2. Provide shop and field welding procedures for all structural joints on the steel tank.
  - 3. Tank manufacturer's Quality Control Plan.
  - 4. Design Data: Provide a summary of the design and design calculations for the foundation, support structure, overflow weir, vent, tank and other components sealed and signed by the tank manufacturer's engineer. Document the codes and standards, methods of analysis, design coefficients, and resultant gravity, snow, wind, and seismic loads utilized.
  - 5. Product Data:
    - a. Provide a separate concrete mix design for each specified concrete compressive strength indicated on the tank manufacturer's drawings.
    - b. Provide manufacturer's descriptive information for appurtenant equipment and accessories that are not detailed on the Drawings.
  - 6. Reports/Certification:
    - a. Provide certification that testing and inspection requirements of this Section have been performed and the results comply with the requirements of the Specifications.
    - b. Documentation must include certification of test results and other information required by ASTM A6 or ASTM A20, as applicable.
    - c. Foundation excavation report as inspected by a representative of the tank manufacturer's geotechnical engineer prior to foundation construction.
    - d. Provide report to document field measurements, and certify compliance or non-compliance with the tolerance requirements in AWWA D100.
    - e. Inspection of concrete reinforcement and embedment.
    - f. Report on concrete sampling and testing during the Project.
    - g. Conformance to ASTM standards of concrete testing agency.
    - h. Certification of NDT personnel.
    - i. Certification of AWS Certified Welding Inspector (CWI).
    - j. Welding Report(s):
      - 1) Welding procedure specification for all welds on the tank.
      - 2) Provide proof of AWS D1.1, AWS D1.6 and/or ASME Section IX certifications of all welders. Documentation must include a current color photograph of the welder and welder performance qualifications.

- 3) Summary of visual and inspection of radiographs and other inspections, including location of tests on developed shell plate diagrams.
- 4) Identification of defective welds and a statement of action/procedure for repair.
- 5) Record of welders employed at each joint.

k. Leak and vacuum testing reports.

l. Settlement monitoring report.

C. Certified Test Reports:

1. Certified Test Reports must be submitted to the Owner within 7 days of the test being performed. Failure to submit test reports may result in non-payment for those pay items.
2. Steel mill test reports.
3. Welding test reports.
4. Subgrade compaction report.
5. Concrete test reports during construction.
6. Tests on hardened concrete.
7. Settlement monitoring report.
8. Vacuum box testing report.

D. Operation and Maintenance (O&M) Manual: Provide O&M manual with all operating instructions and maintenance procedures for the composite elevated tank, including but not limited to, complete drawings of the composite elevated tank, manuals and operating instructions for equipment, minimum maintenance and inspection instructions.

E. Logo and Artwork Mock-Up: Provide Owner with a mock-up of the artwork design for approval prior to commencing paint Work. Mock-up must be to scale, color and indicate size of logo and lettering. Paint samples of proposed colors must also be submitted for Owner approval per Section 09 95 00 "Coatings for Water Storage Tanks."

## 1.05 STANDARDS

- A. Comply with the provisions of the following standards as if written here in their entirety.
- B. In the event of a conflict between the published standards, codes, and this Section, the provisions of this Section will govern.

1. American Concrete Institute (ACI):

|         |                                                                |
|---------|----------------------------------------------------------------|
| ACI 117 | Standard Tolerances for Concrete Construction and Materials    |
| ACI 301 | Specifications for Structural Concrete                         |
| ACI 304 | Guide for Measuring, Mixing, Transporting and Placing Concrete |
| ACI 305 | Hot Weather Concreting                                         |
| ACI 306 | Cold Weather Concreting                                        |
| ACI 318 | Building Code Requirements for Structural Concrete             |



|         |                                |
|---------|--------------------------------|
| ACI 347 | Guide to Formwork for Concrete |
|---------|--------------------------------|

2. American Institute of Steel Construction (AISC):

|           |                                              |
|-----------|----------------------------------------------|
| AISC S335 | Specification for Structural Steel Buildings |
|-----------|----------------------------------------------|

3. American National Standard Institute (ANSI):

|            |                                   |
|------------|-----------------------------------|
| ANSI B16.5 | Pipe Flanges and Flanged Fittings |
|------------|-----------------------------------|

4. American Society of Civil Engineers (ASCE):

|            |                                                         |
|------------|---------------------------------------------------------|
| ASCE/SEI 7 | Minimum Design Loads for Buildings and Other Structures |
|------------|---------------------------------------------------------|

5. ASTM International (ASTM):

|           |                                                                                           |
|-----------|-------------------------------------------------------------------------------------------|
| ASTM A123 | Zinc Coatings on Iron and Steel Products                                                  |
| ASTM A240 | Stainless Steel Plate, Sheet and Strip for Pressure Vessels                               |
| ASTM A285 | Pressure Vessel Plates, Carbon Steel                                                      |
| ASTM A774 | Welded Stainless Steel Fittings                                                           |
| ASTM A778 | Welded Stainless Steel Tubular Products                                                   |
| ASTM A780 | Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |

6. American Welding Society (AWS):

|           |                                                                       |
|-----------|-----------------------------------------------------------------------|
| AWS A 2.4 | Standard Symbols for Welding, Brazing, and Nondestructive Examination |
| AWS D1.1  | Structural Welding Code                                               |
| AWS D1.6  | Structural Welding Code – Stainless Steel                             |

7. American Water Works Association (AWWA):

|           |                                             |
|-----------|---------------------------------------------|
| AWWA C200 | Steel Water Pipe 6 In. and Larger           |
| AWWA C206 | Field Welding of Steel Water Pipe           |
| AWWA C220 | Stainless Steel Pipe 4 In. and Larger       |
| AWWA C652 | Disinfection of Water Storage Facilities    |
| AWWA D100 | Welded Carbon Steel Tanks for Water Storage |
| AWWA D102 | Coating Steel Water Storage Tanks           |

8. Federal Aviation Administration (FAA):

|                |                                  |
|----------------|----------------------------------|
| FAA 70/7460-1H | Obstruction Marking and Lighting |
|----------------|----------------------------------|

9. Miscellaneous Standards:

|             |                                                                                                                   |
|-------------|-------------------------------------------------------------------------------------------------------------------|
| IBC         | International Building Code as Adopted by Owner                                                                   |
| NACE SP0178 | Standard Recommended Practice: Design, Fabrication, and Surface Finish of Metal Tanks and Vessels to be Lined for |

|                      |                                                     |
|----------------------|-----------------------------------------------------|
|                      | Immersion Service with Weld Comparator Assembly     |
| NSF/ANSI Standard 61 | Drinking Water System Components – Health Effects   |
| OSHA 29 CFR          | Part 1910, Occupational Safety and Health Standards |

#### 1.06 DELIVERY AND STORAGE

- A. Handling and Shipping: The tank manufacturer must handle materials and fabricated components in a manner that will protect them from damage. Allow painted materials adequate cure time prior to stacking or shipping.
- B. Storage and Protection: Protect delivered materials and equipment from damage. Store in well-drained areas and provide blocking to minimize contact with the ground.

#### 1.07 JOB CONDITIONS

- A. Permits and Easements:
  - 1. Permits or licenses required for permanent structures, changes in existing facilities or advancement of the construction must be secured and paid for by the tank manufacturer prior to the start of construction. These include building permits, code inspections, etc.
  - 2. Airspace authority permits and site easements have been secured by the Owner prior to construction. Contractor will be required to coordinate and permit any temporary structures or cranes exceeding the permitted height with the FAA.
- B. Access: Tank manufacturer must provide access to the Site as indicated on the Drawings.
- C. Working Conditions:
  - 1. Safety and Health: Tank manufacturer must comply with safe working practices and all health and safety regulations of OSHA, state and local health regulatory agencies and Safety Data Sheets (SDS). Provide protective and lifesaving equipment for persons working at the Site.
- D. Subsurface and Physical Conditions:
  - 1. The following reports of explorations and tests of subsurface conditions at or contiguous to the Site of the Work:
    - a. The technical data contained in the report upon which the Contractor may rely is core depth. Contractor recognizes that the technical data listed reflect only the conditions for the day the data was collected and reflects only conditions existing at the exact location of samples.
    - b. Copies of these reports and drawings that are not included with Bidding Documents may be examined at the offices of Freese and Nichols located at 531 N. Liberty Street, Winston-Salem, NC during regular business hours. These reports and drawings are not part of the Contract Documents. Tank manufacturer is not entitled to rely upon other information and data utilized by the Engineer and Engineer's consultants in preparation of the Contract Documents.
    - c. No additional geotechnical information will be provided by the Owner. It will be the complete responsibility of the tank manufacturer to satisfy itself of the geotechnical

conditions at the proposed tank site. If the tank manufacturer deems it necessary for additional geotechnical investigations and analysis, such investigations and analysis must be provided by the tank manufacturer at no additional cost to the Owner and no additional time will be added to the Contract for such investigations. All changes to the tank manufacturer's design based on any additional geotechnical information acquired after the Project is bid is to be included in the project cost and no additional payment or time is due to the Contractor.

## **1.08 SEQUENCING AND SCHEDULING**

- A. Notification: The Contractor must provide notification of the intent to start Work at least 7 days prior to commencing each major phase of the Work.

## **1.09 GUARANTEES**

- A. Workmanship and Material Guarantee: The tank manufacturer will guarantee the tank structure against defects in workmanship and material for a period of 2 years. If, within 2 years from final completion of the Project, workmanship or material is proven defective, the tank manufacturer must repair such defects at their own expense.
- B. Design Warranty: The tank manufacturer will warrant its design of the proposed facility to be structurally and functionally applicable to serve the intended use of the projected Work. Such intended use is exemplified by the criteria of design, workmanship, and material expressed by the requirements of the Specifications and Drawings prepared by the Engineer. The Owner's or Engineer's review of the tank manufacturer's design, or the Owner's acceptance and final payment for the Work does not relieve the tank manufacturer of design responsibility. The Owner must be the direct beneficiary of the warranty.

## **2.00 PRODUCTS**

### **2.01 MATERIALS**

- A. Reinforced Concrete:
  - 1. All structural concrete materials, foundations, and reinforcement used in constructing the elevated tank must comply with applicable requirements of AWWA D100 and ACI 318, except as modified in this Section and are the responsibility of the Contractor.
  - 2. Driveways, mow strips, sidewalks, flumes, and other miscellaneous concrete items must be in accordance with Section 03 30 00 "Cast-In-Place Concrete."
- B. Steel Structure:
  - 1. Steel tank and structure components, including steel plates, sheets, structural shapes and filler metals must be in accordance with AWWA D100.
  - 2. The minimum thickness for any part of the structure must be 3/16-inch for parts not in contact with water and 1/4-inch for parts in contact with water. All portions of the tank including the roof must be of watertight construction.
  - 3. At junctions in plates where the meridional forces are discontinuous such as cone to cylinder junctions or cone to base plate junctions, a tension or compression ring may be

required to resist radial forces generated by the discontinuous membrane forces. In these regions, allowable stresses must not exceed the following stresses:

- a. Tension ring must not exceed the lesser of 15,000 psi or one half of the minimum specified yield of the plate materials.
- b. Compressions ring stresses must not exceed 15,000 psi.
- c. The overturning moment used in designing the pedestal and foundation must include the moment due to eccentricity of the gravity loads caused by deflection of the structure under wind or seismic conditions (i.e., P-delta effect).

## 2.02 STEEL TANK STRUCTURE

- A. General: The steel structure must be all welded construction and must be designed in accordance with applicable sections of AWWA D100. The required capacity and dimensions of the tank are noted on the Drawings and in this Section of the Specifications.
- B. Structural posts or columns must be tubular and must be sealed against the entrance of air and/or water.
- C. Tank roof structural members must be flat bar or sealed square tubular sections. I-beams or other sections with horizontal projections may be used if the nominal depth is 10 inches or greater. Support beams must be seal welded to the underside of the roof plate along the entire length of the beam.
- D. All tank interior lap joints must be continuously seal welded, including penetrations of roof accessories.

## 2.03 ACCESSORIES

- A. General:
  1. Accessories must comply with the minimum requirements of the Specifications, Codes and Standards listed in this Section, current applicable safety regulations, and the operating requirements of the structure.
  2. Electrical isolation kits must be used between dissimilar pipe and other metal materials.
- B. Name Plate:
  1. Provide minimum 8-inch by 10-inch laser engraved stainless steel name plate on the exterior of the tank, field verify location. Provide stainless steel hardware to mount nameplate.
  2. Name plate must include the following information:
    - a. Manufacturer.
    - b. Manufacturer's Job Number.
    - c. Date of Completion.
    - d. Capacity.
    - e. Tank Diameter.
    - f. Head Range.

- g. Bottom Height AMSL.
- h. Overflow Height AMSL.

C. Ladders:

1. Install ladders with appurtenances as indicated:

| Location                          | Material         | Ladder Safety System Req. |
|-----------------------------------|------------------|---------------------------|
| Exterior Tank (Ground to Balcony) | Galvanized Steel | X                         |
| Balcony to Top Platform           | Galvanized Steel | X                         |

- 2. Ladders must be in accordance with OSHA 1910, except as modified in this Section.
- 3. Ladder rails must be punched for the rungs and welded on both sides of the rail.
- 4. Ladders to be 18 inches wide.
- 5. Ladders that terminate at platforms or landings must extend a minimum of 48 inches beyond the platform elevations.
- 6. Include ladder safety systems on all ladders as specified in Section 10 40 13 "Fall Prevention and Safety Systems."
- 7. Provide self-closing safety gate on at least one side or as shown on the Drawings to protect floor openings for ladder access per OSHA 1910 and as specified in Section 10 40 13 "Fall Prevention and Safety Systems."
- 8. Galvanized steel ladders within the pedestal and access tube may be delivered in segments and bolted together. Hardware must be galvanized, and the bolts must be properly sized with approximately two threads extending past the nut. Bolts cannot be trimmed in the field. Hardware location cannot obstruct the climber per OSHA 1910.

D. Tank Openings:

1. Wet Riser Manhole:

- a. Tank manufacturer must design and install 36-inch I.D. manhole approximately 3-feet above the base of the wet riser in accordance with AWWA D100, as specified and indicated on the Drawings.
- b. Manhole cover must be davited or hinged.
- c. Manhole hardware must be galvanized steel. Provide washers on both sides of flange to avoid damage to coatings during installation. The location will be as indicated on the Drawings and approved by the Engineer.
- d. All gaskets be reinforced with cloth or annular rings and NSF/ANSI 61 certified.
- e. Refer to Section 10 40 13 "Fall Prevention and Safety Systems" for confined space entry signage requirements.

| Hatch Location           | Qty. | Clear Opening Size |
|--------------------------|------|--------------------|
| Tank Interior Roof Hatch | 1    | 36" x 42"          |

f. General:

- 1) Hatches must be installed on a minimum 4-inch curb. Hatch lid must have a minimum 2-inch overhang. Hatch must be equipped with a neoprene gasket between steel curb and hatch.
- 2) An EPDM rubber gasket must be used to make a positive seal when the hatch is closed.
- 3) Aluminum must have a clear anodic finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- 4) Installation must be in accordance with the manufacturer's written instructions.
- 5) Hatches must open to a 90-degree angle.
- 6) Refer to Section 10 40 13 "Fall Prevention and Safety Systems" for confined space entry signage requirements.
- 7) Manufacturer must provide a lifetime guarantee against defects in materials and workmanship.

g. Tank Interior Roof Hatch:

- 1) Hatch must be single leaf and constructed of aluminum with 316 stainless steel hardware. Hatch must be rated for a minimum live load of 150 psf.
- 2) Hatch must be equipped with stainless steel pressure locks on the exterior of hatch, three each minimum and an exterior padlock staple.
- 3) The door must have stainless steel gas shocks or springs to assist in opening the door and reducing the force during closing.
- 4) A 316 stainless steel or aluminum hold open arm with push/pull handle must automatically keep the cover in its upright, open position.
- 5) Approved Manufacturers:
  - a) Halliday Products – F1R.
  - b) Approved equal.

E. Rigging Access and Rails:

1. Provide one circular continuous galvanized and epoxy coated interior access rails suitable for use with a beam trolley. Rails must be configured and designed to safely support a horizontal scaffolding system that will provide access to all interior surfaces for coatings and maintenance. Rails must be mounted to the underside of the roof such that a minimum of 6-inch clearance is provided from the top flange to the roof plate. Bottom of rails must be a minimum of 6-inches above the overflow elevation. All hangers and connections must be fully seal welded plate steel.

F. Roof Guardrail:

1. Provide a 42-inch roof guardrail with top-rail, mid-rail(s), and toe plates in accordance with OSHA requirements and as shown on the Drawings. The circular guardrail must extend at least 3 feet beyond the outside of any roof appurtenances, including cathodic protection hand holes, if included.

2. Guardrail must be a structurally designed for loading per OSHA 1910 and any antennas, lights or other loading specified herein and as shown on the Drawings. Provide design calculations, design assumptions and design for guardrail with tank Shop Drawings.

G. Piping:

1. Materials:

- a. Ductile Iron Pipe in accordance with Section 33 05 01.02 "Ductile Iron Pipe and Fittings."
- b. Stainless steel pipe and fittings must be Type 304L/316L stainless steel fabricated from material meeting the requirements of ASTM A240 as indicated. Fabrication, inspection, testing, marking and certification of pipe and fittings must be in accordance with ASTM A778 and A774 respectively. Backing flanges, retaining rings and related hardware must be 304L/316L stainless steel to match adjacent piping and drilled to ANSI B16.5 Class 150. Pipe, fittings and welds must be cleaned and passivated.
- c. Carbon steel pipe and fittings must be in accordance with AWWA C200 and ASTM A-53. Fabrication, inspection, testing, marking and certification of pipe and fittings must be in accordance with AWWA C208. Backing flanges, retaining rings and related hardware must match adjacent piping and drilled to ANSI B16.5 Class 150.
- d. All carbon steel piping must have shop applied epoxy lining in accordance with AWWA C210. All linings are to be applied after welding and fabrication that may damage the interior lining.
- e. Wet riser must be at least 48-inch diameter or as required to accommodate wet riser ladder while meeting OSHA 1910 clearances and as required to accommodate 36-inch diameter manhole at ground level.
- f. Route the overflow pipe on the exterior of the tank and down tank support column, where the pipe must terminate with a flap valve. Pipe material to be carbon steel with minimum wall thickness of 1/4-inch.
- g. Flap Valve:
  - 1) Flap valve must consist of a cast iron frame, cover (flap) and adjustable hinge blocks.
  - 2) Assembly bolts, hinge pins and keepers must be 304 stainless steel.
  - 3) Hinge bushing must be bronze.
  - 4) Valve must assure positive closing with less than a 1/16-inch gap.
  - 5) Valve frame must be able to connect to a flanged connection. Mating flange and flap valve flange must be 125-lb. standard drilling. The number of bolt holes in the valve flange must match the mating flange and be able to rotate the valve sufficiently to mount it horizontal or vertical to the ground.
  - 6) If mounted in a horizontal position, provide a counterweight as required to operate the valve and maintain a positive closure while not in use.
  - 7) Seat faces must have a resilient seat, neoprene rubber or equal.

8) Valve will be prepared and coated as specified. Shop applied primers must be confirmed by the manufacturer to be compatible with specified coating system.

9) Approved Manufacturers:

a) Waterman Industries – Model F-55.

b) Approved equal.

2. Tank Drain: A 6-inch diameter nozzle must be installed as low as possible on the wet riser. Provide a 6-inch gate valve and blind flange.

#### H. Tank Ventilation:

1. Tank vent must be as indicated on the Drawings. The tank manufacturer to size roof ventilator to pass air so that the maximum fill/draw rate must not develop pressure within the tank per the design parameters provided and a broken pipe analysis assuming a broken pipe immediately outside of the tank's foundation. Broken pipe analysis must be based on largest diameter inlet/outlet pipe with a break 5 feet beyond the pedestal wall.

2. Vent must be constructed of Aluminum with #16 316 stainless steel insect screen, minimum diameter is 36 inches, meeting current AWWA and NCDEQ standards.

3. Vent must be securely fastened using 316 stainless steel hardware.

4. Vent must be provided with a pressure-vacuum relief mechanism that will operate in the event that the vent fails. The mechanism must be designed to return automatically to its original position after operation. The pressure/vacuum relief mechanism must be located on the tank roof above the maximum weir crest elevation, and incorporated in the vent assembly.

5. Contractor must include detailed calculations of vent sizing and broken pipe analysis with design calculations and Shop Drawings.

6. #16 vent screen condition must be observable without removing the vent's hood.

7. Approved Manufacturer(s):

a. AST Model Vent by Advance Tank and Construction Co.

b. Approved equal.

#### I. Level Monitoring and Sampling:

1. Provide 1-inch Schedule 80 steel threaded couplings or thread-o-lets welded to inlet/outlet pipe(s) or on wet riser a maximum of 5 feet above grade with isolation bronze ball valves. Piping to be galvanized steel.

a. Provide one coupling for pressure gauge and pressure transmitter as shown on the Drawings. Provide pressure gauge(s) as shown on the Drawings.

b. Provide one coupling for sampling port with ball valve and ball valve type hose bid. Label sampling port with vinyl decal.

2. Provide additional monitoring and sampling lines within the access tube as indicated on the Drawings.



3. Instrumentation Roof Nozzles: Provide one 4-inch and one 6-inch standard weight steel pipe nozzles welded to the roof with 125-lb. blind flanges to allow mounting of instrumentation and/or cathodic protection system.
- J. Cathodic Protection Openings: Provide welded steel couplings and penetrations as required by the approved cathodic protection design.
- K. Lightning Protection: Provide a lightning protection system for the elevated tank as indicated in Section 26 41 13 "Lightning Protection for Structures."
- L. Communications Equipment:
  1. Install antenna mounts on tank as required by Division 26 and as specified herein.
  2. The Owner's antenna mounts must be provided at the top of the tank. Two antenna locations must be provided. The location of the mount on top of the tank must be coordinated with the Owner.
  3. Cellular antennas may be installed in the future and attached to the tank's guardrail systems. The tank manufacturer must design the guardrail for loading per OSHA 1910, and any antennas, lights or other loading specified herein and as shown on the Drawings.
    - a. Nine future cellular antennas to be mounted on the exterior of the guardrail just above the guardrail height, weighing at least 100 pounds each with approximate dimensions of 36 inches high by 24 inches wide by 12 inches deep.
    - b. Nine future radios/miscellaneous antenna support equipment to be mounted on the interior of the guardrail at the same locations as the antennas. The support equipment is to be assumed to weigh 50 pounds each with approximate dimensions of 24 inches high by 24 inches wide by 12 inches deep.
    - c. The guardrail must be able to support a grouping of three antennas and support equipment anywhere on the guardrail.
    - d. Install carbon steel 2-inch angle iron, 24 inches wide at each guardrail post to mount conduits. Install stainless steel Unistrut with stainless steel hardware to the angle iron. Angle iron is to be seal welded on both sides at the attachment to the posts.
  4. Provide angle iron brackets at 10-foot intervals on the exterior of a tank column. Length of conduit hangers will be as required to provide adequate spacing between the quantity of conduits required for the Project, 24 inches minimum.

## 2.04 ELECTRICAL AND LIGHTING

- A. All Work must be performed and all materials must be provided in accordance with National Electric Code and the governing electrical, safety and inspection codes, regulations and ordinances. Refer to Division 26 for additional requirements.

## 2.05 STEEL TANK PAINTING

- A. Refer to Section 09 95 00 "Coatings for Water Storage Tanks."

## 2.06 SOURCE QUALITY CONTROL

- A. Tests: Review mill test certifications of all steel plate, structural components and reinforcement to ensure compliance with specification requirements.
- B. Inspections: Provide inspection of shop fabricated components in accordance with AWWA D100.

## 3.00 EXECUTION

### 3.01 EXAMINATION

- A. Foundation Excavation: The foundation bearing surface and excavation must be inspected by a representative of the tank manufacturer's geotechnical engineer prior to foundation construction. Verification of the applicable design and construction recommendations is required in a letter signed and sealed by the geotechnical engineer and submitted to the Engineer. The geotechnical engineer must be retained by the tank manufacturer.
- B. Environmental Conditions: Prior to performing any Work, verify the expected temperature, humidity and weather conditions are within the specified limitations for executing the Work.
- C. Elevated Tank Components: After completion of each major component and prior to proceeding with the next stage of construction, verify that tolerance inspections and material quality control tests conform to the requirements as specified in this Section.

### 3.02 REINFORCED CONCRETE CONSTRUCTION

- A. Reinforcement: Fabrication, placement, development and splicing of reinforcement must be in accordance with ACI 318 and ACI 117.
- B. Formwork:
  - 1. Formwork design, installation and removal must comply with the minimum requirements of ACI 318 and ACI 117 and with the applicable recommendations of ACI 347.
  - 2. Forming systems must be designed with the provision of ties and bracing such that concrete components conform to the correct dimensions, shape, alignment and elevation without leakage of mortar. Formwork systems must be designed to safely support all loading conditions. Embedded items must be properly positioned and secured. Form surfaces must be cleaned of foreign materials and coated with a release agent prior to placing reinforcement.
- C. Concrete: Concrete proportioning, production, placement, quality control and curing procedures must comply with ACI 318 and ACI 117. Concrete must satisfy the specific structural, durability and architectural requirements of the completed components.
  - 1. Proportioning: The proportions of materials for concrete must be established to provide adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without excessive segregation or bleeding. Unless otherwise specified, concrete without high range water reducer must be proportioned to produce concrete slumps at the point of placement between 2 and 4 inches. If high range water reducer is used, concrete slump prior to addition must be 3

to 4 inches. The slump, after addition of high range water reducer, must be a maximum of 8 inches. Air must be entrained to provide concrete with 3.0 to 6.0 percent air content.

2. Production: Concrete that arrives at the Project with slump below that suitable for placing, may have water added within the limits of the maximum permissible water-cement ratio. Maximum slump must not be exceeded. The water must be incorporated by additional mixing equal to at least half of the total mixing time required. For concrete with site-administered high range water reducer, the pre-plasticized minimum slump requirement must be attained as permissible by addition of water and mixing prior to the addition of the water reducer.
  - a. Placement: Prior to concrete placement, all snow, ice, water or other foreign material must be removed from the spaces that the concrete will occupy. Concrete must be deposited in its final position in accordance with ACI 318. These must be moved at short intervals to prevent stacking of concrete.
  - b. All concrete must be consolidated by vibration while fresh concrete is still plastic so that the concrete is thoroughly worked into the corners of forms and around the reinforcement and embedded items to eliminate all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators must be the largest practical size that can be used in the Work and must be operated by competent workmen.

D. Weather:

1. Concrete must not be placed during precipitation or extreme temperatures unless protection is provided.
2. During cold weather the recommendations of ACI 306.1 must be followed.
3. During hot weather the recommendations of ACI 305.1 must be followed.

### 3.03 FOUNDATION

A. Excavation: After verification of the foundation-bearing surface, provide a 2-inch thick concrete working slab within the lower excavation limits. Grade the Site to prevent runoff from entering the excavation.

B. Concrete Construction:

1. For shallow foundations, reinforcement placed adjacent to a concrete working slab must have a 2-inch minimum cover and reinforcing steel must be supported by precast concrete block, metal or plastic bar supports.
2. The sides of foundations must be formed using any suitable system conforming to ACI 318. Earth cuts must not be used as forms for vertical surfaces. Forms must be provided on top sloping surfaces steeper than 2.5 horizontal to 1 vertical. Straight form panels may be used to form circular foundation shapes. The minimum design radius must be maintained at all sections.

C. Finish:

1. Formed surfaces must have a smooth form finish when exposed and a rough form finish when not exposed.

2. Unformed surfaces must have a troweled finish when exposed and floated finish when not exposed.
3. The top of the concrete pier for each of the tank legs must be 6 inches above finished grade.

### 3.04 STEEL TANK

#### A. Welding:

1. Welding procedures and general welding requirements must be in accordance with AWWA D100.
2. No structural welding is permitted to any steel embedded in hardened concrete, unless a weld procedure is utilized that will preclude damage to the concrete.

#### B. Fabrication: Layout, cutting, forming, edge preparation and workmanship for steel tank components and fabrications must be in accordance with AWWA D100.

#### C. Tank Erection: Steel tank erection procedures and general requirements must be in accordance with AWWA D100.

#### D. All weld slag, spatter, rough welds and other sharp or rough areas must be removed to a profile conforming to NACE SP0178, Profile 'D'.

#### E. Inspection of shop and field welds must be in accordance with AWWA D100, Section 11, Inspection and Testing. All inspection must be performed before interior and exterior painting.

### 3.05 TANK PAINTING

#### A. Refer to Section 09 95 00 "Coatings for Water Storage Tanks."

#### B. Painting of the tank's exterior shell and cone, including logos if included, must be completed on the ground and prior to hoisting.

#### C. Galvanized steel must be repaired after welding or if damaged with zinc-based solder in accordance with ASTM A780.

### 3.06 FIELD QUALITY CONTROL

#### A. All cost of testing required for the construction of the tank will be borne by the Contractor. The results of all tests must be submitted to the Owner within 7 calendar days of the test being completed.

#### B. Soil and compaction testing for foundation and backfill will be provided by the Contractor.

#### C. Concrete Testing and Inspection:

1. The evaluation and acceptance of concrete must be in accordance with Section 5.6 of ACI 318 and ACI 117, except as modified in this Section.
2. The first sample for concrete that is pumped must be taken at the point of placement after the concrete has been pumped. After the first sample has been tested and certified to be within the specifications, subsequent samples may be taken from the truck.

3. Four cylinders must be made from each sample required. Two cylinders should be tested at 28 days for the strength test. One cylinder should be tested at 7 days to supplement the 28-day tests. The fourth cylinder is a spare to replace or supplement other cylinders.
  4. Slump, air and compressive cylinder testing must be performed by an independent laboratory. The tank manufacturer will retain the independent laboratory and provide the Owner with copies of all test results within 7 days of completing the test.
- D. Steel Tank Testing and Inspection:
1. All costs of tests required for the construction of the tank will be borne by the Contractor. The results of all tests must be submitted to the Owner within 7 calendar days of the test being completed.
  2. Inspection procedures for the steel tank must be as required by AWWA D100. Radiographic inspection of full penetration butt-welded joints must be made by an independent inspection company retained by the tank manufacturer. Contractor must submit name of company completing the tests for the Engineer's approval prior to construction.
- E. Provide leak testing per AWWA D100.
- F. Conduct settlement testing by providing four survey points on each column foundation and at the wet riser. Record elevations and submit survey data prior to filling and upon completion of filling. Settlement must be within the tolerances of AWWA D100. Larger settlements will not be accepted unless sealed by the tank manufacturer's engineer as being acceptable and as approved by the Owner.
- G. Piping Test Inspection: Refer to Section 01 40 00 "Quality Management."
- H. Tank Painting Inspection and Testing: Refer to Section 09 95 00 "Coatings for Water Storage Facilities."

### 3.07 CLEAN AND ADJUST

- A. The Site must be kept in a clean and safe condition at all times. The tank manufacturer must remove all construction equipment and debris at Project completion.
- B. Tank Disinfection:
1. Water and sufficient pressure for flushing, cleaning, initial testing and disinfection will be supplied by the Owner at no cost to the tank manufacturer. Tank manufacturer is responsible for coordination with the Owner and all materials required to test and disinfect tank. Tank disinfection must be in accordance with AWWA C652, Chlorination Method No. 2 or 3.
  2. After disinfection, the tank manufacturer must arrange for bacteriological testing of water samples from the tank. Failed tests will be supplemented by the tank manufacturer. The tank must not be placed in service until bacteriological tests pass.
  3. Disinfection of piping must be performed per Section 33 10 13 "Disinfecting of Water Utility Distribution."

### 3.08 WARRANTY INSPECTION

- A. The Owner and Contractor will observe all surfaces of the reservoir within 11 to 23 months after the reservoir Work has been accepted for Substantial Completion and placed in service to establish if remedial work is required. If the water utility is not able to remove the tank from service for the inspection or for any repair work, due to adverse weather conditions, drought or system limitations, the inspection or repair work may be delayed by the Owner for up to 16 months at no additional cost. All repair work must be conducted within a schedule approved by the Owner.
- B. The Owner will isolate the reservoir from the distribution system and drain the reservoir. Contractor must open, clean out, high-pressure water wash, and rinse the tank prior to the anniversary observation. After observation of the tank is complete and repair work accepted by Owner, the Contractor must follow disinfection procedures specified.
- C. Contractor must provide suitable and adequate equipment including, lighting, ventilation, rigging, cable climbers, mirrors, inspection equipment, and sufficient manpower to clean, disinfect and move equipment and tools around the reservoir, etc., as may be necessary to facilitate complete observation of all interior surfaces. Contractor will bear all costs of the anniversary observation and must incorporate such costs into bid.
- D. The Owner will document the inspection in accordance with AWWA D100.
- E. Provide coating inspection per Section 09 95 00 "Coatings for Water Storage Tanks."

### END OF SECTION

**DIVISION 40**  
**PROCESS INTEGRATION**

## **40 05 43 MISCELLANEOUS VALVES**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install miscellaneous valves complete and ready for operation as shown on the Drawings and specified herein.
- B. The equipment shall include, but not be limited to, the following; however, not all items specified herein may be included in this Project.
  - 1. General Requirements.
  - 2. Thermoplastic Valves:
    - a. Air Relief Valves – PVC-CPVC.
    - b. Ball Valves – PVC/CPVC.
    - c. Ball Valves – PVC with Electric Motor Operator.
    - d. Ball Valves – PVC/CPVC for Sodium Hypochlorite Service.
    - e. Butterfly Valves – PVC/CPVC.
    - f. Butterfly Valves – PTFE for Sodium Hypochlorite Service.
    - g. Check Valves – Ball (Spring Return).
    - h. Check Valves – Ball (Non-spring Return).
    - i. Check Valves – Foot.
    - j. Diaphragm Valves – PVC/CPVC.
    - k. Diaphragm Valves – PVC for Sodium Hypochlorite Service.
    - l. Degassing Valves for Sodium Hypochlorite Feed Only.
    - m. Pressure Relief Valves – PVC/CPVC.
    - n. Three-way Valves with Electric Motor Operator.
    - o. Vacuum Breaker (Self-Closing).
  - 3. Stainless Steel Ball Valves.
  - 4. Corporation Stops.
  - 5. Yard Hydrants.
  - 6. Globe Valves.
  - 7. Mud Valves.
  - 8. Shear Gates.
  - 9. Flap Valves.
  - 10. Pressure Reducing Valves.
  - 11. Telescoping Valves.



12. Backflow Preventers.
13. Dual Disc Check Valves.
14. Duckbill Check Valves.
15. Solenoid Valves.

#### 1.02 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  1. Shop Drawings.
  2. Operation and maintenance manuals.

#### 1.03 GUARANTEE AND WARRANTY

- A. Manufacturer shall warrant the equipment and materials furnished under this Section against defects in materials and workmanship and operational failure for a period of 1 year from the date of Owner acceptance.
- B. In the event of failure of any part or parts of the equipment during the first year of service, provided that the equipment has been operated and maintained in accordance with good practice, the manufacturer shall furnish and deliver a replacement for the defective part or parts at the manufacturer's own expense. Manufacturer is also responsible for equipment freight.

#### 1.04 REFERENCE STANDARDS

- A. ASTM International (ASTM):
  1. ASTM A36 - Standard Specification for Carbon Structural Steel
  2. ASTM A48 - Standard Specification for Gray Iron Castings
  3. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
  4. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
  5. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes
  6. ASTM A380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
  7. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings
  8. ASTM A536 - Standard Specification for Ductile Iron Castings
  9. ASTM B30 - Standard Specification for Copper-Base Alloys in Ingot Form
  10. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings
  11. ASTM B98 - Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes

12. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications
  13. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
  14. ASTM F1970 - Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems
- B. American Water Works Association (AWWA):
1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  2. AWWA C511 - Reduced-Pressure Principle Backflow-Prevention Assembly
  3. AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
  4. AWWA C800 - Underground Service Line Valves and Fittings
- C. American National Standards Institute (ANSI):
1. ANSI ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers
  2. ANSI B1.20.1 - Specifications, Dimensions, Gauging for Taper and Straight Pipe Threads (except dry seals)
  3. ANSI B16.1/B16.5 - Pipe Flanges and Fittings Package
  4. ANSI B16.10 - Face-to-Face and End-to-End Dimensions of Valves
- D. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):
1. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges, and Unions
  2. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Services
  3. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

#### 1.05 QUALITY ASSURANCE

- A. Experience Requirements: Manufacturer shall have had successful experience in manufacturing valves for this type of service in the sizes indicated. Manufacturer shall have at least 10 years of experience in the manufacture of the valves.
- B. Uniformity Requirements: Units of the same type shall be the product of one manufacturer.
- C. Inspection of units may also be made by the Engineer or other representative of the Owner after delivery. Equipment shall be subject to rejection at any time due to failure to meet any of specified requirements, even though submittal data may have been accepted previously. Equipment rejected after delivery shall be marked for identification and shall be removed from the Site at once.

## **2.00 PRODUCTS**

### **2.01 GENERAL**

- A. Valves and appurtenances shall be of size shown on the Drawings or as noted.
- B. Valves and appurtenances shall have name of maker, nominal size, flow directional arrows, working pressure for which they are designed and standard referenced, cast in raised letters or via riveted stainless steel nameplate upon some appropriate part of the body.
- C. Unless otherwise noted, all valves and fittings shall have a minimum working pressure of 150 psi or shall be rated for the test pressures associated with the pipe they connect to, whichever is higher.
- D. Joints, size and material - unless otherwise noted or required by the Engineer:
  - 1. Except where noted, joints referred to herein shall be of same type, nominal diameter, material and with a minimum rating equal to pipe or fittings they are connected to.
  - 2. Valves and appurtenances shall be of same nominal diameter as pipe or fittings they are connected to.
- E. Despite any of these specified requirements, coatings and lubricants in contact with potable water shall be NSF61 certified as acceptable for use with that fluid.
- F. Unless otherwise noted, interior ferrous surfaces of valves shall be given a shop finish of an epoxy conforming to AWWA C550 with a minimum thickness of 6 mils.
- G. Exterior surface of various parts of valves, operators, floor stands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease or other foreign matter; and thereafter, one shop coat of an approved rust-inhibitive primer shall be applied in accordance with Division 9.
- H. Special tools and the manufacturer's standard spare parts, if required for normal operation and maintenance, shall be supplied with the equipment. Tools shall be packaged, clearly and permanently marked on the exterior to indicate equipment for which tools are intended.
- I. Provide special adaptors as required to ensure compatibility between valves, appurtenances, and adjacent pipe.
- J. Where valve handwheels are installed with a centerline higher than 6 feet, the valve shall be installed in an orientation and equipped with a chainwheel to allow for operation from standing at grade. Chain and accessories shall be stainless steel. Chain wheels shall be:
  - 1. Ductile iron coated per Section 09 95 00 "Coatings for Water Storage Tanks" or Section 09 97 16 "Pipeline Coatings and Linings", as applicable; or
  - 2. Stainless steel.

## 2.02 THERMOPLASTIC VALVES

### A. Air Relief Valves (Chemical Feed Systems Only):

1. Materials:
  - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
    - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
    - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
  - b. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
3. Valve shall be automatic float operated valves designed to release accumulated air from a piping system while the system is in operation and under pressure.
4. End Connection: NPT.
5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Plast-O-Matic Series ARV; or
  - b. Engineer approved equivalent.

### B. Ball Valves - PVC/CPVC:

1. Materials:
  - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
    - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
    - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
  - b. Seats shall be Teflon Polytetrafluoroethylene (PTFE) with elastomeric backing O-ring cushions to provide smooth even stem torque and to compensate for wear.
  - c. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
3. All valve stems shall be equipped with a double O-ring.
4. The valve shall be capable of blocking in two directions (upstream and downstream), leaving full pressure on the opposite end of the valve.
5. End Connection:
  - a. 2-1/2 Inches and Smaller: True Union.
  - b. 3 Inches and Larger: Flanged.

6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASAHI-America Type 21/21A;
  - b. Georg Fischer Type 546;
  - c. Hayward TB Series; or
  - d. IPEX USA LLC VXE/VKD Series.
- C. Ball Valves - Vented PVC/CPVC for Sodium Hypochlorite Service:
  1. Materials:
    - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
      - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
      - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
    - b. Seats shall be Teflon Polytetrafluoroethylene (PTFE) with Viton Fluorocarbon rubber (FPM/FKM) elastomeric backing O-ring cushions to provide smooth even stem torque and to compensate for wear.
    - c. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM).
  2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
  3. All valve stems shall be equipped with a double O-ring.
  4. The valve shall be capable of blocking in two directions (upstream and downstream), leaving full pressure on the opposite end of the valve.
  5. The addition of a 1/8-inch diameter vent hole shall be drilled and deburred by the manufacturer. The valve shall be installed with this vent hole on the upstream side of the system to keep the liquid in the cavity of the ball fluid.
  6. End Connection:
    - a. 2-1/2 Inches and Smaller: True Union.
    - b. 3 Inches and Larger: Flanged.
  7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASAHI-America Type 21/21A;
    - b. Georg Fischer Type 546;
    - c. Hayward TBZ Series; or
    - d. IPEX USA LLC VXE/VKD Series.

D. Butterfly Valves - PVC/CPVC:

1. Materials:

- a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
    - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
    - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
  - b. Seats shall be Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
  - c. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
  3. All valve stems shall be equipped with a double o-ring.
  4. The valve shall be capable of blocking in two directions (upstream and downstream), leaving full pressure on the opposite end of the valve.
  5. End Connection:
    - a. 2-1/2 Inches and Smaller: True Union.
    - b. 3 Inches and Larger: Flanged.
  6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASAHI-America Type 57; or
    - b. Georg Fischer Type 567.

E. Butterfly Valves – PTFE for Sodium Hypochlorite Service:

1. Valve shall be rated for 150 psi continuous service and have a temperature rating of -60 to +250 deg. F. Valves must be bubble tight in the closed position.
2. Valve Body:
  - a. Body shall be manufactured from vinyl ester and fiberglass composite. The valve body shall be full face flange wafer or lug style for end the of line service. Valve body shall be capable of direct threading for lug style and threads shall have nominal pullout strength of 250 ft-lb.
  - b. Valve body composite shall have a nominal tensile strength of 50,000 psi as per ASTM D256.
  - c. Valve body composite shall have a nominal notched Izod impact strength of 30 ft-lb. per inch of 1760 J/M.
  - d. Valve shall be equipped with operator mounting flange that is compliant to ISO 5211 and flange fasteners shall not be pressure retaining.

3. Valve Seat Energizer:
    - a. Valve seat shall be molded and machined PTFE with a nominal wall thickness of 0.125 inches capable of full vacuum at maximum temperature rating.
    - b. Valve sealing face of seat shall be recessed into valve body to eliminate liner cold flow (creep). Wetted elastomers shall not be allowed.
    - c. Valve seat non-wetted energizer shall be Silicone and shall be one piece permanently attached to valve seat.
  4. Valve Disc and Stem:
    - a. Disc and stem shall be one-piece blowout resistant type and stem shall be double "D" machined where operator is attached. Two-piece stem and disc and exposed fasteners on disc shall not be allowed.
    - b. Disc shall be lined. Lined discs shall be encapsulated with PFA and have a nominal liner thickness of 0.125 inches.
    - c. Stem shall have machined locking barbs at both ends of disc to provide torturous no leak path with valve seat.
  5. Valve Triple Stem Seals:
    - a. Valve shall have matching radii molded seat and disc (ball and socket).
    - b. Valve shall have tight compression around stem maintained by resilient energizer against valve seat.
    - c. Valve shall have live loaded stainless steel tapered rings on both ends of disc that compresses energized valve seat onto locking barbs on stem to provide sealing.
  6. Valve Fasteners:
    - a. Valve body fasteners shall be hex head cap screws.
    - b. Fasteners shall be PTFE coated B7 A193 standard material.
  7. Valve Testing:
    - a. Valve seat shall exceed testing criteria of API-598. Valve shall be hydrostatically tested at 165 psi and maintain bubble tight when the disc is in the closed position and valve stems tested to 225 psi. All valves shall be tagged per MSS-SP25 for identification and shall have a unique serial number.
  8. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. PureFlex – Series 800.
- F. Check Valves - Ball (Spring Return):
1. Materials:
    - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
      - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.

- 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
    - b. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
    - c. The spring shall be PTFE coating and be suitable for the intended chemical service.
  2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
  3. Spring return ball check valves may be installed in vertical or horizontal applications.
  4. Materials for construction compatible with the chemical being pumped.
  5. End Connection:
    - a. 2-1/2 Inches and Smaller: True Union.
    - b. 3 Inches and Larger: Flanged.
  6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Asahi-America;
    - b. Georg Fischer Type 562; or
    - c. Plast-O-Matic Series CKS.
- G. Check Valves - Ball (Non-Spring Return):
1. Materials:
    - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
      - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
      - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
    - b. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
  2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
  3. Non-spring return ball check valves may be installed in vertical applications only.
  4. Materials for construction compatible with the chemical being pumped.
  5. End Connection:
    - a. 2-1/2 Inches and Smaller: True Union.
    - b. 3 Inches and Larger: Flanged.
  6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Asahi-America; or
    - b. Georg Fischer Type 561.



#### H. Check Valves - Foot:

##### 1. Materials:

- a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:

- 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
- 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.

- b. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.

- 2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings. The screen shall be the same construction as the valve body.

- 3. Materials for construction compatible with the chemical being pumped.

##### 4. End Connection:

- a. 2-1/2 Inches and Smaller: True Union.
- b. 3 Inches and Larger: Flanged.

- 5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Asahi-America; or
- b. Engineer approved equivalent.

#### I. Diaphragm Valves - PVC/CPVC:

##### 1. Materials:

- a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:

- 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
- 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.

- b. Diaphragm shall be Teflon Polytetrafluoroethylene (PTFE) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.

- c. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.

- 2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.

- 3. All valve stems shall be equipped with a double O-ring.

- 4. The valve shall be capable of blocking in two directions (upstream and downstream), leaving full pressure on the opposite end of the valve.

5. End Connection:
    - a. 2-1/2 Inches and Smaller: True Union.
    - b. 3 Inches and Larger: Flanged.
  6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASAHI-America Type 14 or Type 15;
    - b. Hayward DAB Series; or
    - c. IPEX USA LLC DV Series.
- J. Diaphragm Valves - PVC for Sodium Hypochlorite Service:
1. Materials:
    - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
      - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
      - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
    - b. A three-layer diaphragm shall be provided:
      - 1). Diaphragm (wetted layer) shall be Teflon Polytetrafluoroethylene (PTFE) or as required for chemical compatibility.
      - 2). The gas barrier shall be polyvinylidene fluoride (PVDF) and shall prevent the migration of gas to the PTFE (wetted layer).
      - 3). The backing cushion shall be ethylene propylene diene terpolymer rubber (EPDM).
    - c. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
  2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
  3. All valve stems shall be equipped with a double O-ring.
  4. The valve shall be capable of blocking in two directions (upstream and downstream), leaving full pressure on the opposite end of the valve.
  5. End Connection:
    - a. 2-1/2 Inches and Smaller: True Union.
    - b. 3 Inches and Larger: Flanged.
  6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASAHI-America Type 14 or Type 15; or
    - b. Hayward DAB Series.

K. Degassing Valves for Sodium Hypochlorite Feed Only:

1. Materials:

- a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:

- 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
- 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.

- b. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.

2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.

3. Materials for construction compatible with the chemical being pumped.

4. End Connection: NPT.

5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Plast-O-Matic Series DGV; or
- b. Engineer approved equivalent.

L. Pressure Relief Valves - PVC/CPVC:

1. Materials:

- a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:

- 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
- 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.

- b. Diaphragm shall be Teflon Polytetrafluoroethylene (PTFE).

2. The anti-siphon / back-pressure valves shall be the same size as the connecting piping. Connection reducers are not acceptable.

3. Set point shall be field adjustable and initially set by the Contractor and noted on the installation certificate.

4. The valve shall be of the spring opposed diaphragm type with threaded adjustment knob and locknut. Plunger or piston type pressure relief valves are not acceptable.

5. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.

6. End Connection:

- a. 2-1/2 Inches and Smaller: True Union.
- b. 3 Inches and Larger: Flanged.

7. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. TOP VALVE Back Pressure / Anti-Siphon Valve by Primary Fluid Systems, Inc.; or
  - b. Plast-O-Mastic RVDT (in-line) or RVTX (angle-pattern).

M. Three-Way Valves with Electric Motor Operator:

1. Materials:
  - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
    - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
    - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.
  - b. Seats shall be Teflon Polytetrafluoroethylene (PTFE) with elastomeric backing o-ring cushions to provide smooth even stem torque and to compensate for wear.
  - c. Seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
2. The three-way ball valve shall be the double drilled L-port configuration capable of diverting fluids through either the left or right branch with a 90-degree handle rotation. This drill pattern allows one port to always be open so that there is not "all off" position.
3. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
4. All valve stems shall be equipped with a double o-ring.
5. The valve shall be a T-port configuration.
6. End Connection:
  - a. 2-1/2 Inches and Smaller: True Union.
  - b. 3 Inches and Larger: Flanged.
7. The valve shall be equipped with an electric motor actuator to be controlled from a remote panel. The actuator shall be powered by 120 VAC, single phase.
8. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASAHI-America Type 23 with Series 92 actuator; or
  - b. Plast-O-Matic Type EBVA.

N. Vacuum Breaker (Self-Closing):

1. Materials:
  - a. Body: Valves shall be manufactured to ASTM F1970 and constructed from one of the following:
    - 1). PVC Type 1, ASTM D1784 Cell Classification 12454-A.
    - 2). CPVC Type IV, ASTM D1784 Cell Classification 23447-B or 23567-A.

- b. Diaphragms or seals shall be made of Viton Fluorocarbon Rubber (FPM/FKM) or ethylene propylene diene terpolymer rubber (EPDM), as required for chemical compatibility.
  - c. Compression spring shall be Type 316 stainless steel.
- 2. Valves shall be PVC or CPVC construction to match adjacent piping unless specifically noted or called out on the Drawings.
- 3. Normally-closed design.
- 4. End Connection: NPT.
- 5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Plast-O-Matic Series VB/VBS/VBM; or
  - b. Engineer approved equivalent.

## 2.03 STAINLESS STEEL BALL VALVES

### A. 1/2 to 2 Inches:

- 1. Three-piece body, full port, vented ball, blowout-proof stem, type 316 stainless steel trim, reinforced PTFE seat and seal, level operator, rated 1000 psi cold water pressure (CWP). Conforms to MSS SP-110.
- 2. End Connection: Threaded.
- 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. NIBCO Stainless Steel 3-Piece Ball Valve;
  - b. Cameron Series Navco S30;
  - c. Neles – Jamesbury Series 3A; or
  - d. Engineer approved equivalent.

### B. Larger Than 2 Inches:

- 1. Unibody design, blowout-proof stem, type 316 stainless steel trim, mounting pad, fire safe, vented ball, rated 275 cold water pressure (CWP). Conforms to MSS SP-72 and MSS SP-25.
- 2. End Connection: Class 150 ANSI flange.
- 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. NIBCO Stainless Steel Unibody Ball Valve;
  - b. Cameron Series WKM 320F;
  - c. Neles – Jamesbury Series 7000; or
  - d. Engineer approved equivalent.

## 2.04 CORPORATION STOPS

- A. Corporation Stops 3/4 inch through 2 inches shall be ball valve type, meeting AWWA C800, Section 4.2.3 (High Pressure), withstanding working pressures up to 300 psi. Body, ball, operating stem, T-head, and service line connector shall be manufactured from red brass and conform to ASTM B62 and/or ASTM B584, UNS No. C83600. Ball shall be fluorocarbon coated and shall float on two EPDM seats and be watertight in both directions. Operating stem and nut shall be one piece, held in place by a mating machined flange on stem and in body. Operating stem shall have an EPDM O-ring to provide a watertight seal against the body.
- B. Inlet threads shall be AWWA Taper, except where used with service clamps, where threads shall be IPS threads. Thread types and diameters shall conform to AWWA C800. Inlet threads will be integral to body. Waterway diameter shall be approximately equivalent to nominal size of stop, and shall accommodate maximum cutter size established by AWWA C800. Outlet shall be a compression connection meeting AWWA C800 Section 4.4.9.
- C. Where corporation stops are used with plastic pipe, a brass companion flange shall be provided on outlet of each corporation stop. Corporation stops shall be bronze with tapered plug and flat key operator.
- D. Subject to compliance with requirements, corporation stops shall be:
  - 1. The Ford Meter Box Company, Inc. FB Style Ballcorp; or
  - 2. Engineer approved equivalent.

## 2.05 YARD HYDRANT

- A. Yard Hydrant shall be automatically draining, backflow protected with standard 3/4-inch garden hose thread outlet and lever handle.
- B. Depth of bury shall be 4 feet.
- C. Yard hydrants shall be coated per Section 09 97 16 "Pipeline Coatings and Linings."
- D. Subject to compliance with requirements, yard hydrants shall be:
  - 1. Woodford Model Y2;
  - 2. Jay R. Smith Figure Number 5909;
  - 3. Zurn Z1395; or
  - 4. Engineer approved equivalent.

## 2.06 GLOBE VALVES

- A. Globe valves 3 inches in diameter and smaller shall be pressure Class 200 or better.
- B. Materials:
  - 1. Body: Bronze.
  - 2. Disc: Stainless steel.
  - 3. Seat Ring: Stainless steel.
  - 4. Stem: Silicon bronze.

- C. End Connection: Threaded. Model numbers referenced below are for threaded ends; flanged ends shall be provided where shown on the Drawings and shall be equal construction with appropriate end connections.
- D. Globe valves shall be coated per Section 09 97 16 "Pipeline Coatings and Linings."
- E. Subject to compliance with requirements, globe valves shall be:
  - 1. Walworth Co. Figure 3245P;
  - 2. Jenkins Figure 592J;
  - 3. Stockham Figure B-62;
  - 4. Lunkenheimer Figure 73-PS;
  - 5. Fairbanks Figure 0505; or
  - 6. Engineer approved equivalent.

## 2.07 MUD (DRAIN) VALVES

- A. General:
  - 1. Mud (drain) valves shall be designed to allow for draining fluid and sludge from a tank.
  - 2. Stems shall be of the non-rising type.
  - 3. Base flange shall be drilled per ANSI Class 125 and shall be machined to provide a smooth seating surface.
  - 4. Fasteners shall be 316 stainless steel.
  - 5. Mud valves shall be provided with stem guides. The stem guide shall be of the adjustable design for plumb alignment. The adjusting bolt and washer shall be type 316 stainless. Stem guides shall be spaced so that the unsupported length between extension stems shall not exceed 7 feet.
  - 6. Mud valves shall be outfitted with stem extensions, where necessary to reach the floor stand or operating nut.
- B. Where floor stands are not scheduled, the operating nut shall be outfitted with a position indicator and incidentals as necessary. Position indicators should be outfitted with a housing adapter or wall bracket depending on the application. Position indicator and incidentals shall be by Trumbull Industries, Inc.
- C. Cast Iron Body Mud Valves (MV1):
  - 1. Base flange, yoke, and gate shall be ASTM A126 cast iron.
  - 2. Stem, stem nut, seats and stem extensions shall be ASTM B62 bronze.
  - 3. Stem Guides shall be constructed of ductile iron or stainless steel. Stem guides shall include a bronze bushing.
  - 4. Indicating floor stands shall be ASTM A126 cast iron, outfitted with a handwheel, and indicate the position of the valve.
  - 5. Cast iron mud valves shall be coated per Section 09 95 00 "Coatings for Water Storage Tanks."

6. Subject to compliance with requirements, cast iron body mud valves shall be:
  - a. Trumbull Industries, Inc., Iron Mud Valve;
  - b. Clow Valve, F-3075-T;
  - c. M&H Valve , 140-02;
  - d. Troy Valve, Model A2500; or
  - e. Engineer approved equivalent.
- D. Stainless Steel Mud Valves (MV2): The body flange, yoke, guides and gate shall be cast 316 stainless steel. After machining, all castings shall be passivated in accordance with ASTM A380.
- E. The stem shall either be cast stainless steel with a permanently bonded coating or rolled to prevent galling. If coated, the coating shall be safe for potable water use and capable of enduring a minimum of 15,000 open-close cycles without galling or excessive wear.
  1. Stem Guides shall be constructed of cast 316 stainless steel. Stem guides shall include a bronze bushing with an inside diameter 1/16 inch larger than the outside diameter of the extension stem and shall be retained with two stainless steel screws.
  2. Indicating floor stands shall be 316 stainless steel, outfitted with a 316 stainless steel handwheel, and indicate the position of the valve.
- F. Subject to compliance with requirements, stainless steel mud valves shall be:
  - a. Troy Valve Model MV-X;
  - b. Trumbull Industries, Inc., Stainless Mud Valve; or
  - c. Engineer approved equivalent.
- G. Schedule: The required valves and certain pertinent data is given below. This list is given to facilitate description of the various valves and as an aid to plan take off and is not guaranteed to be complete.

## 2.08 SHEAR GATES

- A. Shear gates shall be double wedge type. Wedges shall be bolted to the shear gate frame. Gates shall be furnished with a pull rod, lifting handle, and catch.
- B. Materials:
  1. Body, gate and wedged: cast iron manufactured to ASTM A126, Class B.
  2. Seat rings: bronze manufactured to ASTM B62.
- C. All valve stems shall be equipped with a lift handle, length as scheduled.
- D. End Connection: 125# ANSI flange.
- E. Shear valves shall be coated per Section 09 97 16 "Pipeline Coatings and Linings."
- F. Subject to compliance with requirements, shear gates shall be:
  1. M&H style 44-02;
  2. Troy Valve Model A2520; or



3. Engineer approved equivalent.

G. Schedule: The required valves and certain pertinent data is given below. This list is given to facilitate description of the various valves and as an aid to plan take off and is not guaranteed to be complete.

## 2.09 FLAP VALVES

A. Flap valves shall be circular flange framed, with machined back flange for attachment to a flanged wall thimble. Hinge arms shall have two pivot points, an adjustable lower pivot with limited rotation and a threaded upper hinge post to adjust flap valve sensitivity. A lubrication fitting shall be supplied for each pivot.

B. Materials:

1. Body and Flap: Cast iron manufactured to ASTM A126, Class B.
2. Seat: Neoprene or Buna-N bonded in a groove machined in the body.
3. Hinge Arms: High-tensile bronze, ASTM B584-C865
4. Hinge Pins: Silicon bronze, ASTM B98-C655 or Type 304 stainless steel.

C. End Connection: 125# ANSI flange.

D. Flap valve shall be designed to open when differential head across the flap is 0.3 feet or less.

E. Valve must assure positive closing with less than a 1/16" gap.

F. Valve frame must be able to connect to a flanged connection. Mating flange and flap valve flange must be 125 lb. standard drilling. The number of bolt holes in the valve flange must match the mating flange and be able to rotate the valve sufficiently to mount it horizontal or vertical to the ground.

G. If mounted in a horizontal position, provide a counterweight as required to operate the valve and maintain a positive closure while not in use.

H. Flap valves shall be coated per Section 09 95 00 "Coatings for Water Storage Tanks."

I. Subject to compliance with requirements, flap valves shall be:

1. M&H Style 47-02;
2. Rodney Hunt Series FV-AC;
3. Troy Valve A25406; or
4. Approved equal.

J. Schedule: The required valves and certain pertinent data is given below. This list is given to facilitate description of the various valves and as an aid to plan take off and is not guaranteed to be complete.

## 2.10 HYDROSTATIC PRESSURE RELIEF VALVE – FLOOR TYPE

A. Floor type pressure relief valves shall consist of three parts. A cover, a body and a grate. Valves shall be designed so that neither the cover nor grate can become separated from the body of the valve, due to ground water pressure around the tank. However, when necessary,

both may be easily removed by turning them to right or left to free them from locking lugs cast integrally on the inside of the body.

B. Cast Iron Body Hydrostatic Pressure Relief Valves – Floor Type (HPRV1):

1. Materials:

- a. Body, Cover and Grate: cast iron manufactured to ASTM A126, Class B.
- b. Seat: Machined bronze in a machined groove.
- c. Seal: Neoprene or Buna-N.

2. Valves shall be coated per Section 09 95 00 “Coatings for Water Storage Tanks.”

3. Subject to compliance with requirements, Cast Iron Body Hydrostatic Pressure Relief Valves – Floor Type (HPRV1) shall be:

- a. M&H Style F-1493;
- b. Troy Valve A2550; or
- c. Engineer approved equivalent.

C. Stainless Steel Hydrostatic Pressure Relief Valves – Floor Type (HPRV2):

1. Materials:

- a. Body, Cover and Grate: 316 stainless steel.
- b. Seal: Neoprene or Buna-N.

2. Subject to compliance with requirements, Stainless Steel Hydrostatic Pressure Relief Valves – Floor Type (HPRV2) shall be:

- a. Troy Valve Series A2550RSN;
- b. Trumbull Industries, Inc. Series 367; or
- c. Engineer approved equivalent.

D. Schedule: The required valves and certain pertinent data is given below. This list is given to facilitate description of the various valves and as an aid to plan take off and is not guaranteed to be complete.

2.11 PRESSURE RELIEF VALVES – WALL TYPE

A. Wall type pressure relief valves shall be suitable for wall installation and relieve pressure due to ground water around the tank. When the pressure is relieved, the valve will close to prevent seepage of liquid out of the tank.

B. Materials:

- 1. Body and flap gate: cast iron manufactured to ASTM A126, Class B.
- 2. Seat ring and hinge pin: Machined bronze.
- 3. Seal: Neoprene or Buna-N mechanically retained.

C. End Connection: 125# ANSI FLANGE.

D. Valves shall be coated per Section 09 95 00 “Coatings for Water Storage Tanks.”

- E. Subject to compliance with requirements, wall type pressure relief valve shall be:
  - 1. M&H Style F-1494-T;
  - 2. Troy Valve A2580; or
  - 3. Engineer approved equivalent.
- F. Schedule: The required valves and certain pertinent data is given below. This list is given to facilitate description of the various valves and as an aid to plan take off and is not guaranteed to be complete.

## 2.12 PRESSURE REDUCING VALVES

- A. The pressure reducing valves shall be pilot-operated, differential piston actuated pressure reducing valves reduce a higher, fluctuating inlet pressure to a lower, steady downstream pressure regardless of variations in demand.
- B. Valve shall come complete with two glycerin filled pressure gauges with snubber fittings, one to monitor upstream pressure in psi, and one to monitor downstream pressure in psi.
- C. Materials:
  - 1. Body: Cast iron manufactured to ASTM A126, Class B.
  - 2. Cover: Steel manufactured to ASTM A36.
  - 3. Trim: Lead-free bronze.
  - 4. Seat: BUNA-N.
  - 5. Fasteners: 316 stainless steel.
- D. Cast materials shall be coated per Section 09 97 16 "Pipeline Coatings and Linings."
- E. Subject to compliance with requirements, pressure reducing valves shall be:
  - 1. GA Industries Model 4500-D; or
  - 2. Engineer approved equivalent.
- F. Schedule: The required valves and certain pertinent data is given below. This list is given to facilitate description of the various valves and as an aid to plan take off and is not guaranteed to be complete.

## 2.13 TELESCOPING VALVES

- A. Telescoping valves shall be designed for sludge removal or liquid level control in a basin.
- B. Telescopic valves shall consist of a seamless slip tube with a v-notch which is raised and lowered by a rack and pinion (non-rising stem) assembly or rising screw (rising stem) assembly through a packing element attached to a standard pipe flange. Telescopic valves shall be provided with floor stand and sized to be flanged to piping as shown on the Drawings.
- C. Materials:
  - 1. Slip Tube: 304 stainless steel.
  - 2. Seal: BUNA-N.

3. Stem Assembly: 304 stainless steel.
4. Stem Cover: PVC.
5. Floor Stand: Cast or ductile iron.
- D. End Connection: ANSI Class 125.
- E. Cast materials shall be coated per Section 09 95 00 "Coatings for Water Storage Tanks."
- F. Subject to compliance with requirements, telescoping valves shall be by:
  1. Troy Valve;
  2. Trumbull Manufacturing, Inc.; or
  3. Engineer approved equivalent.
- G. Schedule: The required valves and certain pertinent data is given below. This list is given to facilitate description of the various valves and as an aid to plan take off and is not guaranteed to be complete.

#### 2.14 BACKFLOW PREVENTERS

- A. Reduced pressure backflow preventers shall be designed to provide cross-connection protection of potable water supply.
- B. Provide reduced pressure principle backflow preventers meeting requirements of ANSI/ASSE 1013, compliant with AWWA C511, and approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.
- C. Valves shall be coated per Section 09 97 16 "Pipeline Coatings and Linings."
- D. Units 2-1/2 Inches and Larger:
  1. Units shall consist of two independently acting check valves together with an automatically operating pressure relief valve, two gate valves, and four test cocks, epoxy lined bronze or iron body with stainless steel internal parts.
  2. Subject to compliance with requirements, provide products by one of the following:
    - a. Watts, LF909;
    - b. Zurn, 375; or
    - c. Febco, LF860.
- E. Units 2 Inches and Smaller:
  1. Units shall consist of two independently acting check valves together with an automatically operating pressure relief valve, two ball valves, strainer, and four test cocks, epoxy lined bronze or iron body with bronze internal parts.
  2. Subject to compliance with requirements, provide products by one of the following, acceptable manufacturers and models are:
    - a. Watts, LF009;
    - b. Zurn, 975XL2; or
    - c. Febco, LF825Y.

- F. Provide test kit consisting of gauge test valves, hoses, adaptors, securing strap, instruction guide and lightweight case. Acceptable manufacturers and models are:

1. Watts, TK-9A;
2. Zurn, TG-5; or
3. Febco, TK-1.

#### 2.15 DUAL DISC CHECK VALVES

- A. Dual disc check valves shall be designed to cause the doors to open during forward flow, and the spring shall shut the doors prior to flow reversal.
- B. Dual disc check valves shall be of the dual disc type with vertical pivot pin and spring action closing to assure non-slam closing.
- C. Materials:
  1. Body: ASTM A536 ductile iron.
  2. Discs: 316 stainless steel.
  3. Hinge: 316 stainless steel.
  4. Pin Stop: 316 stainless steel.
  5. Spring: 316 stainless steel.
  6. Seat: BUNA-N.
- D. End Connection: Valves shall be wafer style manufactured for inserting between standard ANSI Class 125 pipe flanges
- E. Cast materials shall be coated per Section 09 97 16 "Pipeline Coatings and Linings."
- F. Subject to compliance with requirements, dual disc check valves shall be:
  1. Crane Duo-Chek;
  2. APCO/Dezurik Double Door Check Valves (CDD) Series 9000; or
  3. Val-Matic Dual Disc Series 8800.

#### 2.16 SOLENOID VALVES

- A. Solenoid valves shall be packless piston type, direct acting for sizes less than 2-inch and internal pilot operated for sizes 2 inches and larger; 2-way or 3-way valves. All solenoids shall be NEMA 4X rated and shall be ASCO Valve; Red Hat by Automatic Switch Co.; similar by Circle Seal Controls-Atkomatic Valve Co., for air and water service.
- B. Valves shall be energized to open, except for valves on water seal lines to pumps, which shall be energized to close.
- C. Valves shall be Type 316 stainless steel bodies, NPT end connections of connected piping, Type 304 stainless steel internal parts, and Buna-N or Ethylene Propylene valve seats. Valves shall have a minimum 150-psig safe working pressure and zero minimum operating pressure differential. Connections shall be threaded.

- D. Solenoid valves size 3 inches and larger shall be full bore bronze body, Type 430 stainless steel plunger, copper coil Class A encapsulated, Type 302 stainless steel spring, wash-down safe, equal to Type A as manufactured by Magnatrol Valve Corp., Hawthorne, NJ, or equal.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Carefully handle and install valves in a manner that prevents damage to any part of the valves. Install valves in accordance with the manufacturer's instructions.

#### **3.02 FIELD QUALITY CONTROL**

- A. Upon completion of installation of the equipment, conduct an acceptance test to verify the satisfactory operation of each unit. The test shall be conducted in a manner approved by and in the presence of the Engineer and/or Owner. The unit shall be checked for general operation and leakage. The unit must perform in a manner acceptable to the Engineer before final acceptance will be made by the Owner.

**END OF SECTION**

## **40 05 61 GATE VALVES**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment, and incidentals necessary to install gate valves and appurtenances, including valve boxes, operators, bolts, nuts, and gaskets.

#### **1.02 QUALITY ASSURANCE**

- A. The intent of these specifications is to purchase a quality product of the manufacturer's latest design, meeting the minimum standards set forth.
- B. The services of the manufacturer's technical representative shall be provided for pre-startup installation checks, startup assistance, training of Owner's operating personnel, troubleshooting and other services as required in Section 01 75 00 "Starting and Adjusting."
- C. Experience Requirements: The manufacturer shall have at least 10 years of experience in the manufacture of valves used in the water and wastewater treatment environment. References and installation list shall be provided on request.
- D. Acceptable Manufacturers:
  - 1. American Flow Control.
  - 2. M&H.
  - 3. Mueller.
  - 4. Clow.
  - 5. U.S. Pipe.
  - 6. Kennedy Valve.

#### **1.03 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Shop Drawings.
  - 2. Operation and Maintenance Manuals.

#### **1.04 STANDARDS**

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
  - 1. American Society of Mechanical Engineers (ASME) Standards:
 

|            |                                                                       |
|------------|-----------------------------------------------------------------------|
| ASME B16.1 | Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 |
|------------|-----------------------------------------------------------------------|
  - 2. ASTM International (ASTM) Standards:

|           |                                                                                      |
|-----------|--------------------------------------------------------------------------------------|
| ASTM A126 | Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings |
| ASTM A536 | Standard Specification for Ductile Iron Castings                                     |

3. American Water Works Association (AWWA) Standards:

|                  |                                                                     |
|------------------|---------------------------------------------------------------------|
| AWWA C111/A21.11 | Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings    |
| AWWA C500        | Metal-Seated Gate Valves for Water Supply Service                   |
| AWWA C509        | Resilient Seated Gate Valves for Water Supply Service               |
| AWWA C515        | Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service |
| AWWA C550        | Protective Interior Coatings for Valves and Hydrants                |

1.05 GUARANTEE AND WARRANTY

- A. Manufacturer shall warrant the equipment and materials furnished under this Section against defects in materials and workmanship and operational failure for a period of 2 years from the date of Owner acceptance.
- B. In the event of failure of any part or parts of the equipment during the first 2 years of service, provided that the equipment has been operated and maintained in accordance with good practice, the manufacturer shall furnish, deliver, and install a replacement for the defective part or parts at the manufacturer's own expense. Manufacturer is also responsible for equipment removal, reinstallation, and freight.

**2.00 PRODUCTS**

2.01 GATE VALVES

- A. General:
  - 1. Gate valves 3 inches through 36 inches shall be resilient wedge type with non-rising stem in strict accordance with AWWA C509/C515.
  - 2. Gate valves smaller than 3 inches shall be stainless steel, non-rising stem with wedge disc and screwed ends for 300-psi W.O.G. working pressure.
- B. Gate: Gate for resilient seated valves shall be ductile iron with rubber-seat compound bonded to the valve gate.
- C. Manual Operators: Operators shall turn counterclockwise to open the valve. Exposed valves shall have handwheel operators unless otherwise designated. A directional arrow and the word "open" shall be cast on the handwheel. Valves for buried service shall have a 2-inch square nut operator and shall be installed with extension stems where required to extend operating nut to within 12 inches of the finished grade. Provide a cast iron valve box to enclose the operating stem. Valve box shall be three-piece extension type equal to Mueller No. 10380 or Clow F2450.
- D. Stem and Seal: The non-rising stem shall be bronze or stainless steel with inside screw. Shaft seal shall employ O-rings or V-type packing.



- E. Bell Ends: Where designated, valves shall be mechanical joint or rubber gasketed push on joints in accordance with the applicable requirements of AWWA C111/A21.11.

## **2.02 PROTECTIVE COATINGS AND LININGS**

- A. The exterior surfaces of all exposed valves shall be furnished with a factory applied rust-inhibitive primer. Primer shall be coordinated with field painting to ensure compatibility.
- B. The valve manufacturer's standard paint will be acceptable provided it is functionally equivalent to the specified paint and is in accordance with the field painting specified in Section 09 97 16 "Pipeline Coatings and Linings."
- C. Provide factory coatings and linings per AWWA C550.

## **3.00 EXECUTION**

### **3.01 INSTALLATION**

- A. Carefully handle and lower buried valves into position to prevent damage to any part of the valves. Place the valve in the proper position with stem truly vertical and securely hold until connections have been made. Furnish bolts, nuts, and gaskets. Contractor shall be responsible for adjusting the valve boxes to the proper length to conform with the ground surface.

### **3.02 FIELD QUALITY CONTROL**

- A. Upon completion of installation of the equipment, an acceptance test to verify the satisfactory operation of each unit shall be conducted. The test shall be conducted in a manner approved by and in the presence of the Engineer. The unit shall be checked for general operation and leakage. The unit must perform in a manner acceptable to the Engineer before final acceptance will be made by the Owner.

**END OF SECTION**

**40 05 78      AIR VALVES****1.00      GENERAL****1.01      WORK INCLUDED**

- A. Furnish labor, materials, equipment, and incidentals necessary to install air release and combination air valves of the sizes and types indicated. Furnish the necessary isolating valves and piping.

**1.02      SUBMITTALS**

- A. Contractor shall submit Shop Drawings, Certificate of Adequacy of Design, and operation and maintenance manuals for the material included in this Section. Copies of those submittals will be provided to the Owner.
- B. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
1. Product Catalog Data.
  2. Shop Drawings.
  3. Certificate of Adequacy of Design and Affidavit of Compliance with AWWA C512.
  4. Operation and maintenance manuals.
  5. Test Data.

**1.03      STANDARDS**

- A. The applicable provisions of the following standards apply as if written here in their entirety:
1. American National Standards Institute (ANSI) / NSF International:

|             |                                                   |
|-------------|---------------------------------------------------|
| ANSI/NSF 61 | Drinking Water System Components – Health Effects |
|-------------|---------------------------------------------------|

2. American Society of Mechanical Engineers (ASME):

|            |                                                                                 |
|------------|---------------------------------------------------------------------------------|
| ASME B16.5 | Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard |
|------------|---------------------------------------------------------------------------------|

3. American Water Works Associations (AWWA):

|           |                                                                                                             |
|-----------|-------------------------------------------------------------------------------------------------------------|
| AWWA C228 | Stainless-Steel Pipe Flanges for Water Service (2-Inch Through 72-Inch)                                     |
| AWWA C512 | Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service                                  |
| AWWA C514 | Air Valve and Vent Inflow Preventer Assemblies for Potable Water Distribution System and Storage Facilities |
| AWWA M14  | Backflow Prevention and Cross-Connection Control: Recommended Practices                                     |
| AWWA M51  | Air Valves: Air-Release, Air/Vacuum, and Combination                                                        |

**1.04      DELIVERY**

- A. Marking: Each valve shall be marked by body markings or a corrosion-resistant nameplate that clearly indicate the manufacturer's name or trademark, size of the valve, size of the orifices if different from the valve size, and the designation of the maximum and minimum operating pressure (or 20 psi if none is stated) rating of the valve.
- B. Preparation for Shipment: Valves shall be complete in all details when shipped. Cavities shall be drained of water to protect from freezing. The openings shall be covered to prevent entry of foreign material, and the threads shall be protected. The manufacturer shall carefully prepare the valves for shipment. Valves shall be fully packaged or attached to pallets at the manufacturer's option.
- C. Cover and store valves to prevent corrosion or damage to any valve components.

## **2.00 PRODUCTS**

### **2.01 MANUFACTURED PRODUCTS (WATER)**

- A. General:
  - 1. Air valves shall meet AWWA C512 standards. Valves in potable water applications must adhere to NSF 61 requirements.
  - 2. Each air valve shall have a 316 stainless steel body, and 316 stainless steel trim. Float shall be dimensioned or baffled to prevent air from blowing valve closed until air is exhausted. Elastomers shall be EPDM.
  - 3. Valve body, float, and assembly shall be designed for the pipeline's overall maximum working pressure and shall seat at the minimum pressure shown in the valve schedule, Paragraph 3.03. The minimum operating pressure shown is under steady state conditions and does not include minimum surge pressure.
  - 4. Contractor shall coordinate the threaded connection or flange drilling patterns between pipe and valves.
  - 5. Valve outlet shall be threaded or flanged for connection to vent piping for treated water systems. Valve outlet shall be fitted with a cover and screen for raw water systems.
  - 6. Valve inlet shall be NPT for 2-inch and smaller valves. Valve inlet shall be ANSI Class 150 for 3-inch and larger valves. For valves with working pressure class at 300 psig, valve inlet shall be ANSI Class 300, or AWWA C228 Class F/SF, flange for 3-inch and larger valves. Valve and flange rating shall equal or exceed the maximum working pressure.
  - 7. Valves 1 inch and larger shall have an outlet at the bottom of the valve housing. The outlet shall be fitted with a 1/2-inch gate valve as shown on the Drawings.
  - 8. Isolation valves on the inlet side of the air valve shall match the inlet diameter of the air valve and shall be gate valves.
  - 9. Interior components should be stainless steel. Interior components that are not stainless steel shall be painted with System No. 1 in accordance with Section 09 97 16 "Pipeline Coatings and Linings."
- B. Air Release Valves (AR): Air release valves shall be designed to automatically release accumulated air pockets within the pipeline while the pipeline is in operation and under pressure.

- C. Air and Vacuum Valves (AV): Air and vacuum valves shall be designed to allow large volumes of air to escape through the valve orifice when filling a pipeline and to close watertight once the air has been expelled. Air and vacuum valves shall also permit large volumes of air to enter through the valve orifice when the pipeline is being drained, to break the vacuum.
- D. Combination Air Valves (CAV):
  - 1. Combination air valves shall be designed to exhaust large volumes of air as the pipeline is being filled; permit large volumes of air to enter the pipeline during pipeline drainage; release accumulated pockets of air while the pipeline is in operation and under pressure; and dampen surge pressures caused by water column separation or rapid air discharge.
  - 2. Combination air valves shall be heavy-duty, single-chamber air and vacuum valves with disc floats. Floats shall include discs drilled with the small and large orifices, and an anti-surge float. Internal clearances around the floats shall be equal to the inlet/outlet area. The anti-surge float should be normally opened and have drilled orifices to throttle water flow.
  - 3. Combination air valve inlet/outlet cross-sectional area shall be equal to the nominal size of the valve. CAV outlet for raw water use shall be fitted with a cover or with a vent pipe where indicated on the Drawings. Combination air valves outlets for treated water use shall be connected to piping to vent air out of the manhole. The vent piping shall extend to 4 feet above the ground or as indicated on the Drawings.
  - 4. Manufacturers shall be one of the following:
    - a. Vent-O-Mat: RBX Series.
    - b. Vent-Tech: Model WTR.
- E. Combination Air and Vacuum Valves for Pump Discharge (PAV): Pump combination air valves shall be designed to allow large volumes of air to escape through the valve orifice during pump startup. An air discharge throttling device, a surge check valve, or a slow-closing device must be used to protect the air valve from water hammer effects. The combination air valve must close watertight once the air has been expelled. Pump combination air valves shall also permit large volumes of air to enter through the valve orifice when a pump stops to break the vacuum. PAVs shall be on the pump discharge and sized for the minimum duration pump ramp up time. The PAV shall not breach the OSHA or Owner standard for hearing protection, whichever is more stringent.
  - 1. Manufacturers shall be one of the following:
    - a. Vent-O-Mat: RBX Series.
    - b. Vent-Tech: Model WTR.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION AND TESTING**

- A. Carefully handle and install valves vertically in such a manner as to prevent damage to any part of the valves. Installation shall be in accordance with the manufacturer's instructions.

Provide nuts, bolts, and gaskets where applicable with materials of construction in accordance with service type and process flow as required by AWWA C512.

- B. Air valve and accompanying isolation valve [and drain valve if present] shall be braced adequately to withstand normal pipeline operation pressures and avoid undue stresses on the pipe.
- C. Valves shall be installed in such a manner as to provide adequate access and room for valve operation, maintenance, and removal.
- D. The exterior of atmospherically exposed metal surfaces shall be coated with System No. 2 in accordance with Section 09 97 16 "Pipeline Coatings and Linings."
- E. Conduct testing described in Section 4 and Section 5 of AWWA C512. Provide test results to the Owner or Owner's representative. Tests shall include:
  - 1. Holiday testing to verify interior/exterior coated surfaces are holiday free.
  - 2. Shell hydrostatic test equal to 150 percent of the design pressure. Test shall be at least 1 minute for 8-inch and smaller valves and 3 minutes for 10- through 20-inch valves.
  - 3. Air valve seat leakage test, including hydrostatic and operational testing. Provide testing at 20 psi or the minimum design pressure, whichever is less and demonstrate no leakage. Test duration is to be a minimum of 30 seconds. Outlet of the valve shall be open to the atmosphere.

### 3.02 TAGGING

- A. Valves shall be permanently tagged with a brass tag indicating the model number, working pressure rating, and station location.

### 3.03 SCHEDULES

- A. The required valves and certain pertinent data are included to facilitate description of the various valves and as an aid to plan take-off. Contractor is responsible for verifying size, type, and number of valves required.

| No. Req. | Valve Size (in) | Pipe Diameter (in) | Valve Type <sup>1</sup> | Min. Pressure (psi) | Max. Pressure (psi) | Installation Location <sup>2</sup> | Valve Service <sup>3</sup> |
|----------|-----------------|--------------------|-------------------------|---------------------|---------------------|------------------------------------|----------------------------|
| 1        | 2               | 4                  | PAV                     | 0                   | 100                 | Exposed; Above Grade               | Non-Potable Water          |
| 1        | 2               | 4                  | AR                      | 0                   | 100                 | Exposed; Above Grade               | Non-Potable Water          |
| 5        | 1               | 12                 | CAV                     | 10                  | 250                 | In-Vault                           | Non-Potable Water          |

<sup>1</sup>Air release (AR), air/vacuum (AV), combination (CAV), pump discharge air valve (PAV)

<sup>2</sup>Underground (direct bury), in-plant (indoors), in-vault, outdoor (exposed above grade).

<sup>3</sup>Potable water, non-potable water, raw water, wastewater

## END OF SECTION

## **40 72 76      LEVEL SWITCHES**

### **1.00      GENERAL**

#### **1.01      SUMMARY**

- A. Section includes:
  - 1. General requirements for providing level switches.
- B. Related Section:
  - 1. Section 01 23 10 "Alternates and Allowances.
  - 2. Section 01 33 00 "Document Management"
  - 3. Section 01 33 02 "Shop Drawings"
  - 4. Section 01 33 03 "Product Data"
  - 5. Section 01 33 04 "Operation and Maintenance Data"
  - 6. Section 01 75 00 "Starting and Adjusting"
  - 7. Section 40 90 01 "Instrumentation"

#### **1.02      WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install all equipment for complete instrumentation and controls. Contractor's work shall include but not be limited to the following:
  - 1. Installation of equipment furnished under this contract.
  - 2. Interconnections between equipment furnished under this contract.
  - 3. Interconnection between equipment furnished under this contract and the existing instrumentation and control equipment or that furnished and installed under other contracts.
- B. The Contractor's attention is directed to the fact that instrumentation is an integrated system and as such shall be furnished by one vendor or system integrator who shall provide all the equipment and appurtenances, regardless of manufacture, and be responsible to the Contractor for satisfactory operation of the entire system.
- C. Supervision, labor, tools, and materials necessary for installation of the instrumentation equipment and material furnished herein and their interconnection shall be provided by the Contractor. Installation work shall conform to applicable city, state, and national building and electrical codes.
- D. Coordinate the work of the system manufacturer's service personnel during construction, testing, calibration and acceptance of the instruments.

#### **1.03      QUALITY ASSURANCE**

- A. General: Equipment shall be the Manufacturer's latest and proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering

into the design of the instrumentation system. The completed system shall be compatible with the functions required and the equipment furnished by the Contractor.

- B. Operating Voltage: Electrical components of the system shall operate on 120-V, single-phase, 60-Hz, except as otherwise noted in the specifications.
- C. Power Supplies: The drawings and specifications indicate the energy sources that will be provided. Any other devices or power supplies necessary to obtain proper operation of the instrument system from these energy sources shall be furnished with the instrumentation.
- D. Protection:
  - 1. The instrumentation system supplier shall provide input-output isolation of all incoming and outgoing signals.
  - 2. Each 4-20 mA DC process measurement current loop installed on this contract which extends outside the combination motor starter enclosure shall be protected by insertion of a 1/16-amp fuse, Buss Type MKB. Fuses shall be installed in standard fuse blocks behind the combination motor starter enclosure door.
  - 3. The necessary fuses or switches required by the Instrumentation Manufacturer shall be provided with the equipment. The instruments requiring an internal power supply shall have an internal ON-OFF switch.
- E. Input/Output:
  - 1. In general, and unless specifically stated otherwise, inputs and outputs involving instrumentation systems shown shall be 4-20 mA DC process measurement signals. Current loop isolators, current repeaters, or other signal isolators shall be furnished and installed as required to meet instrument specifications and to make the instrumentation system fully operational.

#### 1.04 SUBMITTALS

- A. Submittals shall be in accordance with Division 01 and shall include:
  - 1. Shop Drawings:
    - a. Shop drawings shall be submitted to the Engineer for approval before fabrication or shipment to the job. Equipment shall not be fabricated or shipped to the job before receipt of approved shop drawings from the Engineer. Submittals for approval shall include component manufacturing data sheet indicating pertinent data and identifying each component by item number and nomenclature.
    - b. The submittal shall be organized with a cover sheet listing each instrument being provided. Each instrument shall be listed with the associated tag name, model number, and specified options.
    - c. Separated by tabbed sections, each section shall include the product cut sheets from the manufacturer.
    - d. Component drawing showing: dimensions, mounting, external connection details.
    - e. Wiring schematic.
    - f. Full description of operation.

- g. Complete schematic diagram.
  - h. The manufacturer shall be responsible for preparation of the required sets of these drawings for distribution as indicated in Division 0 and Division 1 specifications.
  - i. Shop drawings submitted for all equipment furnished under this section of the specifications shall be submitted at the same time in the same package. Partial submittals will not be reviewed. Sales bulletins and other general publications are not acceptable as submittals for approval.
2. Equipment installation Report:
- a. Contractor shall provide an Equipment Installation Report for each instrument (flow meter, level transmitter, etc.) to the Engineer for approval. The equipment installation report shall include documentation stating that the instrument was installed and properly calibrated per the manufacturer's recommendations by an Authorized representative of the instrument manufacturer. All parameters required for programming of the instrument shall be provided in a hard copy format as part of the equipment installation report. Documentation stating that the person performing the calibration and start-up is an authorized representative shall be provided as well.
3. Operation and Maintenance Manuals:
- a. Operating instructions shall incorporate a functional description of the entire system including the system schematics which reflect "as-built" modifications.
  - b. Wiring diagrams shall clearly show terminal numbers and wire numbers as they are in the instrumentation system.
  - c. Instrument panel wiring shall be such that each wire installed has its own number designation at each end and such that no number is repeated.
  - d. Setup parameters: O&M shall include an ISA datasheet with each instrument. The ISA form shall be filled out with ordering information, setup parameters, ranges, and approximate location.
  - e. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.

#### 1.05 JOB CONDITIONS

##### A. SPARE PARTS:

- 1. Furnish all standard recommended spare parts as indicated in the Manufacturer's instruction manuals, for each component in the system.

- B. SPECIAL TOOLS: Furnish a kit which contains special size wrenches and other types of tools, not normally available, which are necessary for assembling, disassembling, aligning, and calibrating each piece of equipment. In addition, any piece of equipment (meter, test set, etc.) required by the Manufacturer to align, adjust, or otherwise calibrate any item under this section of the specification shall be furnished.

#### 2.00 PRODUCTS



## 2.01 FLOAT SWITCHES

### A. General:

1. Provide a mechanical switch with form C contact and mounting hardware as required.
2. Float switch shall be installed in accordance with the manufacturer's recommendations.

### B. Manufacturer:

1. SJE-Rhombus.

### C. Model:

1. SJE MilliAmpMaster WPS.
2. Pre-approved equal.

### D. Functional requirements:

1. Power: 1A max/0.160mA min at 125 VAC, 0.1A max/0.160mA min at 30 VDC, 1mA min at 5 VDC.
2. The float switch and piping shall be submersible.
3. Maximum Water Depth: 30 feet.
4. Activate/deactivate height: 1.5" above and below horizontal.

### E. Physical requirements:

1. Float diameter: 2.74" diameter.
2. Float length: 4.83" length.
3. Tether length: 3.5" length.
4. Housing material: High-impact, corrosion resistant Polypropylene.
5. Cable: Flexible 16-gauge, 3 conductor SJOW, water-resistant.

### F. Mounting:

1. Each set of float switches within an enclosed ground storage tank shall mount to a 1/4-inch 316 stainless steel cable with a weighted anchor attached to the end. Locate cable in an obstructed location within storage tank. Contractor must provide all NSF-certified mounting hardware to suspend cable from tank lid or cable support rack, if a support rack is available.
2. Provide stainless steel mounting clip for cable mount.

### G. The manufacturer supplied cable must be sufficient length to reach termination cabinet without splicing.

## 3.00 EXECUTION

### 3.01 INSTALLATION

- ### A.
- Wire each device requiring power so that when wires are removed from any one device, power is not be disrupted to any other device. Ground the case of each device either by mounting directly on a steel frame or by a third wire.

### 3.02 FIELD QUALITY CONTROL

- A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided during construction to assist the Contractor in the location of sleeves; methods of installing conduit and special cable; mounting, piping, and wiring one of each type of device, and the methods of protecting all the equipment prior to placing it into service. Upon completion of the installation, the services of the above service engineer shall be provided for calibration and start-up of the equipment and for instructing the operating personnel. The Manufacturer shall provide sufficient service to place the system in satisfactory operation.
- B. Upon completion of installation of sample pumps, an acceptance test to verify the satisfactory operation of each unit shall be conducted. The test shall be conducted in a manner approved by and in the presence of the Engineer. The unit shall be checked for excessive noise, vibration, alignment, general operation, etc. The unit must perform in a manner acceptable to the Engineer before final acceptance will be made by the Owner.
- C. Check out and calibrate the system upon completion of the installation.
- D. Prior to the Owner turning on any form of energy to the system, the Contractor shall provide the Engineer with a certified statement of approval of the installation including his supplier's authorization for turning on energy to the system.

### END OF SECTION

## **40 73 13      PRESSURE GAUGES**

### **1.00      GENERAL**

#### **1.01      WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install pressure gauges and cocks. Dial gauges shall indicate pressure or vacuum on a graduated dial by means of a pointer utilizing an elastic element (Bourdon tube or coil), and actuating linkage as necessary for indicating pressure or vacuum.

#### **1.02      QUALITY ASSURANCE**

- A. Acceptable Manufacturers:
  - 1. Ametek.
  - 2. Ashcroft.
  - 3. Marshalltown Instruments.
  - 4. Weksler.
  - 5. Approved equal.

#### **1.03      SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
  - 1. Product data including product data sheets and catalog information. Clearly indicate on data sheets which option(s) are selected.

### **2.00      PRODUCTS**

#### **2.01      MANUFACTURED PRODUCTS**

- A. Pressure Gauges:
  - 1. The gauges shall be the manufacturer's standard industrial product. The gauges shall be new and shall embody the design characteristics stated for the respective size, type, etc. scheduled herein.
  - 2. Pressure gauges shall be equipped with white faces, black numerals, and black pointers.
  - 3. Gauge cases shall be stainless steel.
  - 4. Gauges shall be liquid filled.
  - 5. Bourdon tube, socket, and connecting tube shall be 316 stainless steel.
  - 6. Gauge accuracy should be 1 percent of its full range.
  - 7. Gauge suitable for ambient and process temperatures from 20 to 150 deg. F.
  - 8. Select gauge range so that:
    - a. The normal operating value is in the middle third of the dial.

- b. Maximum operating pressure does not exceed 75 percent of the full-scale range.
9. Unless otherwise required by codes, provide stem mounted or flush mounted, as required, with dial diameter as follows:

| Pipe Size          | Dial Size    | Gauge Connection |
|--------------------|--------------|------------------|
| 1-1/2" or less     | 3-1/2"       | 1/4" NPT         |
| Larger than 1-1/2" | 4" or 4-1/2" | 1/4" NPT         |

**B. Gauge Accessories:**

1. All accessories are to be stainless steel materials.
2. Provide accessories at each gauge unless noted otherwise.
3. Pulsation Dampeners:
  - a. Furnish and install a pulsation dampener, Mid-West Model 150, Vari-Damp Pulsation Dampener, or approved equal.
4. Gauge Cocks: Gauge cocks for insulating standard product gauges shall be heavy duty brass with tee handle and bottom threaded connections with male and female ends.
5. Block and Bleed Manifold: Furnish and install two-valve block and bleed manifold.

### **3.00 EXECUTION**

#### **3.01 INSTALLATION**

- A. Provide tap and connection piping to install the pressure gauges. Connection shall comprise of brass or bronze nipples, fittings, gauge cock, diaphragm seal and pulsation dampener. Install the gauge and protect the gauge until project acceptance by the Owner.
- B. Calibrate gauges at job site for pressure and temperature in accordance with manufacturer's instructions.
- C. Vent liquid filled gauges with scale range of 300 psi or less as recommended by manufacturer.
- D. Gauge tapping position to be clear of equipment functions and movements, and protected from maintenance and operation of equipment.
- E. Gauge to be readable from an accessible standing position.

#### **3.02 SCHEDULES**

- A. The pressure gauges to be furnished are listed on the schedule included on the following page. The list does not include the gauges to be furnished as part of the equipment. The list has been prepared to facilitate takeoff and may or may not include all pressure gauges necessary, which is the responsibility of the Contractor.

| Facility        | Gauge Location       | Unit | Range   |
|-----------------|----------------------|------|---------|
| Summerfield EST | Water Well Discharge | psi  | 0 - 150 |

**END OF SECTION**

## **40 90 01 INSTRUMENTATION**

### **1.00 GENERAL**

#### **1.01 WORK INCLUDED**

- A. Furnish labor, materials, equipment and incidentals necessary to install all equipment for complete instrumentation and controls. Contractor's work shall include but not be limited to the following:
  - 1. Installation of equipment furnished under this contract.
  - 2. Interconnections between equipment furnished under this contract.
- B. The Contractor's attention is directed to the fact that instrumentation is an integrated system and as such shall be furnished by one vendor who shall provide all the equipment and appurtenances, regardless of manufacture, and be responsible to the Contractor for satisfactory operation of the entire system.
- C. Supervision, labor, tools, and materials necessary for installation of the instrumentation equipment and material furnished herein and their interconnection shall be provided by the Contractor. Installation work shall conform to applicable city, state, and national building and electrical codes.
- D. Coordinate the work of the system manufacturer's service personnel during construction, testing, calibration and acceptance of the instruments.

#### **1.02 QUALITY ASSURANCE**

- A. GENERAL: Equipment shall be the Manufacturer's latest and proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering into the design of the instrumentation system. The completed system shall be compatible with the functions required and the equipment furnished by the Contractor.
- B. OPERATING VOLTAGE: Electrical components of the system shall operate on 120 volt, single-phase, 60 Hertz, except as otherwise noted in the specifications.
- C. POWER SUPPLIES: The drawings and specifications indicate the energy sources that will be provided. Any other devices or power supplies necessary to obtain proper operation of the instrument system from these energy sources shall be furnished with the instrumentation.
- D. PROTECTION
  - 1. The instrumentation system supplier shall provide input-output isolation of all incoming and outgoing signals.
  - 2. Each 4-20 mA DC process measurement current loop installed on this contract which extends outside the RTU enclosure shall be protected by insertion of a 1/16 amp fuse, Buss Type MKB. Fuses shall be installed in standard fuse blocks behind the RTU enclosure door.
  - 3. The necessary fuses or switches required by the Instrumentation Manufacturer shall be provided with the equipment. The instruments requiring an internal power supply shall have an internal ON-OFF switch.

## E. INPUT/OUTPUT

1. In general and unless specifically stated otherwise, inputs and outputs involving instrumentation systems shown shall be 4-20 mA DC process measurement signals. Current loop isolators, current repeaters, or other signal isolators shall be furnished and installed as required to meet instrument specifications and to make instrumentation system fully operational.

## 1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00, Document Management and shall include:

### 1. Shop Drawings

- a. Shop drawings shall be submitted to the Engineer for approval before fabrication or shipment to the job. Equipment shall not be fabricated or shipped to the job before receipt of approved shop drawings from the Engineer. Submittals for approval shall include component manufacturing data sheet indicating pertinent data and identifying each component by item number and nomenclature:
- b. The submittal shall be organized with a cover sheet listing each instrument being provided. Each instrument shall be listed with the associated tag name, model number, and specified options.
- c. Separated by tabbed sections, each section shall include the product cut sheets from the manufacturer.
- d. Wiring schematic.
- e. Full description of operation.
- f. Complete schematic diagram.
- g. Each piece of electrical and electronic equipment including electrical valves and tolerances for each component.
- h. Component identification on the schematic.
- i. The manufacturer shall be responsible for preparation of the required sets of these drawings for distribution as indicated in Division 0 and Division 1 specifications.
- j. Shop drawings submitted for all equipment furnished under this section of the specifications, shall be submitted at the same time in the same package. Partial submittals will not be reviewed. Sales bulletins and other general publications are not acceptable as submittals for approval.

### 2. Equipment installation Report.

- a. Contractor shall provide an Equipment Installation Report for each instrument (flow meter, level transmitter, etc.) to the Engineer for approval. The equipment installation report shall include documentation stating that the instrument was installed and properly calibrated per the manufacturer's recommendations by an Authorized representative of the instrument manufacturer. All parameters required for programming of the instrument shall be provided in a hard copy format as part of the equipment installation report. Documentation stating that the person

performing the calibration and start-up is an authorized representative shall be provided as well.

### 3. Operation and Maintenance Manuals

- a. Operating instructions shall incorporate a functional description of the entire system including the system schematics which reflect "as-built" modifications.
- b. Wiring diagrams shall clearly show terminal numbers and wire numbers as they actually are in the instrumentation system.
- c. Setup parameters: O&M shall include an ISA datasheet with each instrument. The ISA form shall be filled out with ordering information, setup parameters, ranges, and approximate location. All information shall indicate final adjusted parameters.
- d. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.

## 1.04 STANDARDS

A. The applicable provisions of the following standards shall apply as if written here in their entirety:

1. ASTM A-126 Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
2. ASTM B-61 Specification for Steam and Valve Bronze Castings

## 1.05 JOB CONDITIONS

### A. SPARE PARTS

1. Furnish all standard recommended spare parts as indicated in the Manufacturer's instruction manuals, for each component in the system.
2. Furnish the following non-standard spare parts:
  - a. One (1) box of each different type and size of fuses.

B. SPECIAL TOOLS: Furnish a kit which contains special size wrenches and other types of tools, not normally available, which are necessary for assembling, disassembling, aligning, and calibrating each piece of equipment. In addition, any piece of equipment (meter, test set, etc.) required by the Manufacturer to align, adjust, or otherwise calibrate any item under this section of the specification shall be furnished.

## 2.00 PRODUCTS

### 2.01 REMOTE EQUIPMENT

A. Controls for remote electrically operated or motor driven equipment shall be complete, including the necessary auxiliary relays so as to require only wiring and connections to the equipment control circuit. Contacts for control of remote motor operated or electrically operated equipment shall be rated not less than 10 amperes at 120 volts unless otherwise specified herein.

- B. Remote motor operated or electrically operated equipment shall have a separate 120 volt control circuit which operates through the dry contacts provided by the instrumentation system.

## 2.02 ENCLOSURES/PANELS

Enclosures and panels as indicated on the plans and in this specification shall be furnished, installed, and wired. Enclosures shall be NEMA 4X 304 stainless steel for outdoor environments and NEMA 1 enclosures for indoor environments, unless specifically stated otherwise.

## 3.00 EXECUTION

### 3.01 INSTALLATION

- A. Wire each device requiring power so that when wires are removed from any one device, power is not be disrupted to any other device. Ground the case of each device either by mounting directly on a steel frame or by a third wire.

### 3.02 FIELD QUALITY CONTROL

- A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided during construction to assist the Contractor in the location of sleeves; methods of installing conduit and special cable; mounting, piping, and wiring one of each type of device, and the methods of protecting all of the equipment prior to placing it into service. Upon completion of the installation, the services of the above service engineer shall be provided for calibration and start-up of the equipment and for instructing the operating personnel. The Manufacturer shall provide sufficient service to place the system in satisfactory operation.
- B. Upon completion of installation of sample pumps, an acceptance test to verify the satisfactory operation of each unit shall be conducted. The test shall be conducted in a manner approved by and in the presence of the Engineer. The unit shall be checked for excessive noise, vibration, alignment, general operation, etc. The unit must perform in a manner acceptable to the Engineer before final acceptance will be made by the Owner.
- C. Check out and calibrate the system upon completion of the installation.
- D. Prior to the Owner turning on any form of energy to the system, the Contractor shall provide the Engineer with a certified statement of approval of the installation including his supplier's authorization for turning on energy to the system.

## END OF SECTION